Labour Market Concentration Since the British Industrial Revolution*

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Abstract

This paper highlights an economic history perspective on labour share dynamics during the second phase of the British Industrial Revolution. It addresses two broad questions: 1) Did market concentration increase between 1851 and 1911? 2) If so, did the labour share decline, as suggested by ongoing debates? I use census data from 1851 to 1911 to answer these questions, focusing on local labour markets. Employing different specifications of market concentration, I found a surprising doubling in market concentration during this period, as measured by both the Herfindahl-Hirschman Index and Concentration Ratio approaches. However, local labour market concentration decreased as the labour market expanded. I further explore this by providing a counterfactual analysis, showing that a one standard deviation increase in creative destruction leads to a 50% rise in new

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entrants. Consequently, I offer two explanations for the presented results. The first is that local labour market concentration is more suitable for analysing labour share, making it a more practical and data-driven approach. The second explanation is that the decline and rise of labour share trigger uneven growth through redistribution and creative destruction. This explanation is more theoretical but still supports my results. In the future, a greater focus on the first stage of the British Industrial Revolution could lead to the developing of a more grounded theory.

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1 Introduction

Since the British Industrial Revolution, the labour share of national income has increased over time.[1] Between 1770 and 1850, compensations for labour increased by over 12 per cent, and since 1850, it has continually risen, featuring values above 0.75, where 1 represents all value added.[2] However, many economists have noted a recent decline in the labour share across countries, starting in the 1970s.[3]

The rise of concentration is the most accepted explanation for the declining labour share, featuring the expansion of capital-intensive firms, *superstar firms*, and the increase of their market power.[4] Other theories emphasise automation as a factor in the decline in employment based on substituting labour for capital and different consequences of -biased technological change.[5]

1. Gregory Clark, "The Industrial Revolution," *Handbook of Economic Growth* 2 (2014): 217–262, ISSN: 15740684, https://doi.org/10.1016/B978-0-444-53538-2.00005-8; Robert C Allen, "Engels' pause: Technical change, capital accumulation, and inequality in the british industrial revolution," *Explorations in Economic History*, 2009, https://doi.org/10.1016/j.eeh.2009.04.004.

2. Clark, "The Industrial Revolution."

3. David Autor et al., "The Fall of the Labor Share and the Rise of Superstar Firms," *The Quarterly Journal of Economics* 135 (2 2020): 645–709, ISSN: 0033-5533, https://doi.org/10.1093/QJE/QJAA004; Simcha Barkai, "Declining Labor and Capital Shares," *The Journal of Finance* 75 (5 2020): 2421–2463, ISSN: 1540-6261, https://doi.org/10.1111/JOFI.12909; Loukas Karabarbounis and Brent Neiman, "The global decline of the labor share," *Quarterly Journal of Economics* 129, no. 1 (2013): 61–103.

4. Autor et al., "The Fall of the Labor Share and the Rise of Superstar Firms"; Jan De Loecker, Jan Eeckhout, and Gabriel Unger, "The Rise of Market Power and the Macroeconomic Implications," *The Quarterly Journal of Economics* 135, no. 2 (May 2020): 561–644, https://doi.org/10.1093/qje/qjz041; Dan Andrews, Chiara Criscuolo, and Peter N. Gal, *The global productivity slowdown, technology divergence and public policy: A firm level perspective*, Hutchins Center Working Paper 24 (Brookings Institution, 2016).

5. Daron Acemoglu, "Technical Change, Inequality, and the Labor Market," *Journal of Economic Literature* 40 (March 2002): 7–72; David Card and John E. DiNardo, "Skill-

However, the labour share increased over the long run, even after the British Industrial Revolution, despite the most drastic capital deepening on a large scale.

How has the overall rise of labour share since the British Industrial Revolution coexisted with the recent observations of its decline? In this dissertation, I argue that a decline and rise in labour share tend to increase concentration via different channels. The booms in labour share trigger uneven growth, rooted in the uprising of market entrants and their less capital-intensive enterprises compared to incumbents.[6] The new entrants spur incumbents' capital growth. The busts in labour share are caused by redistribution via exits, accounting for different ages of new market entrants and incumbents. The new entrants more frequently leave, and incumbents grab their labour while raising fixed costs. It became possible in the model with different menus of technologies for entrants and incumbents based on Hopenhayn's model.[7] In other words, I explain that concentration could increase in both cases: declining and rising labour share.

First, I present stylised facts about labour and capital dynamics in England since the 1760s. I illustrate that labour share has increased over time, and historical long-run data has not confirmed high labour and capital com-

Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles," *Journal of Labor Economics* 20, no. 4 (2002): 733–783; Hugo Reichardt, *Scale-Biased Technical Change and Inequality*, Job Market Paper (LSE, July 2024).

6. Note: I use the terms 'workforce,' 'entrepreneurs,' and 'firms' as synonyms unless otherwise explicitly stated.

7. Hugo A. Hopenhayn, "Entry, exit, and firm dynamics in long run equilibrium," *Econometrica: Journal of the Econometric Society* 60, no. 5 (1992): 1127–1150.

pensations substitution in value-added as postulated by neoclassical growth models.[8] Instead, a steady rise of capital costs, measuring capital interest, coexists with a less stable but rising labour share. This puzzle makes it reasonable to question neoclassical capital accumulation models and Kaldor's facts, not only due to the decline in labour share facts but also from the perspective of an economy where labour and capital compete for tasks.[9] The rise in concentration because of differences in competition for labour and capital-intensive tasks could simultaneously lead to increased capital deepening and labour share, as could be drawn from the Schumpeterian framework.[10] Hence, I propose to resolve these theoretical disparities between the co-growth of labour share and capital costs by shifting toward Schumpeterian and task-based frameworks.

Second, to formalise my approach, I concentrate only on labour share dynamics and draw attention to mechanisms of how both decline and growth raise market concentration. I use a simple framework to describe the distribution of labour across entrepreneurs below. At the core of these explana-

8. See Philippe Aghion and Peter W. Howitt, *The Economics of Growth* (MIT Press, 2008) as the best reference on neoclassical and AK models.

9. Daron Acemoglu, *Capital and Wages*, Working Paper 32190 (National Bureau of Economic Research, March 2024); Daron Acemoglu and Pascual Restrepo, "Robots and Jobs: Evidence from US Labor Markets," *Journal of Political Economy* 128, no. 6 (2020): 2188–2244.

10. Ufuk Akcigit and S. T. Ates, "What Happened to US Business Dynamism?," *Journal of Political Economy* 131, no. 8 (2023): 2059–2124; Philippe Aghion et al., "A Theory of Falling Growth and Rising Rents," *Review of Economic Studies* 90, no. 6 (2023): 2675–2702; Joachim Hubmer and Pascual Restrepo, *Not a Typical Firm: Capital-Labor Substitution and Firms' Labor Shares*, Working Paper (Penn Institute for Economic Research, Department of Economics, University of Pennsylvania, 2023).

tions, the distribution of labour across entrepreneurs (firm size) drives the labour share dynamics, which vary in both declining and rising labour share in value added. The product (markups) and labour (labour concentration) markets depict the market concentration resulting from uneven distribution. As product and labour market concentrations are proportional, I will focus on labour market concentration further.[11] Therefore, the market concentration dynamic results from different configurations of labour share, as labour concentration depicts a heterogeneity in labour distribution.

Third, I highlight the historical environment for market concentration research between 1851 and 1911 for England, Wales, and Scotland. The second phase of the British Industrial Revolution (1840 – 1900) received considerable attention regarding the start of equal output and wage growth, known from Robert Allen's paper on Engels' pause.[12] In this dissertation, I research how the growth during the second stage of the British Industrial Revolution was distributed geographically, sectorally, and occupationally rather than focusing on output and wage dynamics. For these purposes, I utilise the census data from England, Wales, and Scotland, starting from 1851. I work with a shorter edition of the census data from the British Business Census of Entrepreneurs, covering only entrepreneurs, and discuss the limitation of this

11. I draw this conclusion from the empirical literature, for instance, David Autor, Christina Patterson, and John Van Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation," 2023, Kevin Rinz, "Labor Market Concentration, Earnings, and Inequality," *Journal of Human Resources* 57, no. S (2022): S251–S283.

12. Robert C Allen, "Engels' pause: Technical change, capital accumulation, and inequality in the british industrial revolution."

approach in the Discussion and Limitations section. While the convenient explanation that the second stage of the British Industrial Revolution was relatively equal in workers' compensation and business dynamism, I provide evidence of the rise of market concentration, even though output and wages were synchronised.

Fourth, to generalise market concentration and business dynamism as forces of the British Industrial Revolution, I trace the incumbents and new entrants back to 1851, during the second phase of the British Industrial Revolution. I link census data between 1851 and 1911 to observing natural experiments, analysing how different behaviours of incumbents affected the pace of growth and to what extent the centres of the British Industrial Revolution were more dynamic. I quantify the effect of creative distraction on the number of new entrants using a counterfactual scenario of increasing number of exited incumbents by one standard deviation. In this part, I test insights from business dynamism research to uncover the British Industrial Revolution dynamic through market concentration and between-firms dynamics. Consequently, I am explaining how business dynamism, particularly creative destruction, explains this historical period. Along with this analysis, I outline future work and possible sources in the Conclusion to approach to extend the period back to the 17th century, explaining not only the forces of the ongoing British Industrial Revolution but also why it began.

The labour share declined between 1851 and 1871 and began rising in 1871. While the workforce's size constantly rose, more in centres of the

British Industrial Revolution, the nationwide market concentration also grew. The local labour markets, which experienced the rise of the concentration above the median in 1851, had more negligible growth in concentration afterwards, suggesting a catch-up dynamic in sizing workforces. Moreover, the market concentration in 1851 of cities below the median is a significant predictor of increasing concentration in 1861 across local labour markets.

Market concentration doubled between 1851 and 1881, showing steady growth at the national level. The rise in market concentration between 1851 and 1861 happened because of a rise within occupational concentration; less entrepreneurs entered concentrated markets. The rise in concentration between 1861 and 1871 occurred due to an increasing employment share in sectors experiencing rising market concentration. The rise in concentration and increased employment of those occupations suggest that the sizing of workforces led to more significant concentration. The changes in concentration between 1871 and 1881 are mostly explained by the covariance effect, indicating that the rise in concentration occurred within occupations through redistribution rather than only an increase in the employment share of those occupations.

To sum up, labour concentration over the period changed significantly. The decline in concentration was primarily due to redistribution. In contrast, the rise in concentration could result from increasing the employment share of certain occupations and redistribution to larger workforces.

The first contribution of my dissertation is to the literature on business

history and entrepreneurial activity. Several authors work with the long-form census data between 1851 and 1911 provided by the I-CeM project, linking them with the effects of automation and technological change.[13] Robert Bennett and Cambridge Population Group shorted I-CeM project data for entrepreneurs and contributed several times to summarising this data.[14] However, regarding workforce size, the Cambridge Population Group stops at describing absolute numbers of growth without exploring the heterogeneity of this growth beyond geographical and occupational structure. I estimate the heterogeneity effect of rising workforce size through market concentration.

Additionally, I run further tests on the British Business Census of Entrepreneurs, as concerns about the quality of this data have been mentioned in the literature by the authors themselves.[15] Chebyshev's and Markov's inequalities allow me to use confidence intervals for the previous absolute estimates of workforce size, proposing the upper boundaries of this growth. Using bootstrap methods, I also demonstrate that the estimates are more likely to be downward biased rather than overly confident. To access the

13. Benjamin Schneider and Hillary Vipond, *The Past and Future of Work: How History Can Inform the Age of Automation*, Working Paper 10766, Available at SSRN: https://ssrn.com/abstract=4643947 or http://dx.doi.org/10.2139/ssrn.4643947 (CESifo, 2023).

14. Robert Bennett et al., *British Business Census of Entrepreneurs, 1851-1911 [data collection]*, SN: 8600, 2020; Robert Bennett et al., *The Age of Entrepreneurship: Business Proprietors, Self-Employment and Corporations since 1851* (Routledge, 2019); Robert J. Bennett et al., *BBCE: Atlas of Entrepreneurship*, https://www.bbce.uk/atlas/, Accessed on [27.08.2024], 2020.

15. Robert J. Bennett and Leslie Hannah, "British Employer Census Returns in New Digital Records 1851–81; Consistency, Non-response, and Truncation–What This Means for Analysis," *Historical Methods: A Journal of Quantitative and Interdisciplinary History* 55, no. 2 (2022): 61–77.

quality of prior results, I calculate the mean using Fisher's scoring computational algorithm within the maximum likelihood estimation method. These tests develop previous inferences from the British Business Census of Entrepreneurs, making the estimations bounded rather than absolute.

Leslie Hannah and other business historians argue that the merging movement in the late 19th century caused rising market concentration afterwards.[16] I demonstrate that the market concentration dynamic was already evolving before the merger movement, and there is no evidence that the mergers or lack of antitrust practices facilitated the rise of large companies in the first place. I expand my argument by analysing the size of the top 1% of the top 10% of entrepreneurs between 1851 and 1881, which shows a steady growth in their share during this period. Moreover, the top 10% also grew from 58.7% to 62.6%, accounting for two-thirds of the entire labour force. As a result, technological change, rather than mergers, appears as the primary driving force behind concentration dynamics. My research, instead, aligns closely with the literature on automation and inequality, demonstrating how technological change enhances concentration.[17]

The second contribution is to the literature on the British Industrial Rev-

16. Leslie Hannah and John A. Kay, *Concentration in Modern Industry: Theory, Measurement and the UK Experience* (Springer, 1977); Peter L. Payne, "The Emergence of the Large-Scale Company in Great Britain, 1870-1914," *The Economic History Review* 20, no. 3 (1967): 519–542.

17. Reichardt, *Scale-Biased Technical Change and Inequality*; Benjamin Moll, Lukasz Rachel, and Pascual Restrepo, "Uneven Growth: Automation's Impact on Income and Wealth Inequality," *Econometrica* 90, no. 6 (2022): 2645–2683; Maarten De Ridder, "Market Power and Innovation in the Intangible Economy," *American Economic Review* 114, no. 1 (2024): 199–251.

olution. I show that the second phase of the British Industrial Revolution, as depicted by Robert Allen in Engel's pause, was unequal, as I paid attention to microdata and local labour markets. While several authors discuss Engel's pause and early modern growth in terms of monopsony power, my research emphasises the role of business dynamism and the unequal distribution of growth.[18] Moreover, I contribute to the literature on the causes and distributional effects of the British Industrial Revolution, particularly emphasising Joel Mokyr's theory of entrepreneurs as driving forces.[19] I highlight the consequences of creative destruction and business dynamism from production rather than focusing on entrepreneurs as part of upper-tail human capital formation. In their recent paper, Kelly, Mokyr, and Ó Gráda show a drastic difference between North and South regarding rising wages during 1760-1830.[20] I highlight the non-wage-related differences in entry and exit patterns of later business dynamism. Lastly, I test intuitions from Nicholas Craft's papers, where he inquiries about reconsidering the British Industrial Revolution through a new growth theory lens.[21]

18. Vincent Delabastita and Max Rubens, *Monopsony and Industrialization*, SSRN, 2022; Michael M. Paker, Judy Z. Stephenson, and Patrick Wallis, "Nominal Wage Patterns, Monopsony, and Labour Market Power in Early Modern England," *The Economic History Review*, 2024,

19. Joel Mokyr, *The British Industrial Revolution: An Economic Perspective* (Routledge, 2018); Joel Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress* (Oxford University Press, 1992).

20. Morgan Kelly, Joel Mokyr, and Cormac Ó Gráda, "The Mechanics of the Industrial Revolution," *Journal of Political Economy* 131, no. 1 (2023): 59–94.

21. Nicholas F. R. Crafts, "Exogenous or Endogenous Growth? The Industrial Revolution Reconsidered," *The Journal of Economic History* 55, no. 4 (1995): 745–772, ISSN: 1471-6372, https://doi.org/10.1017/S0022050700042145.

My third contribution is to the empirical macroeconomics literature on market concentration, firm size, and labour share dynamics.[22] As Gregory Clark famously summarised historical labour share dynamics for England, I link this dynamic to local labour market concentration, as explained in Autor, Patterson, and Van Reenen's paper.[23] Consequently, I estimate the market concentration trends at different levels across historical settings to compare with the literature. As my analysis focuses on England, Wales, and Scotland between 1851 and 1911, I obtain results proportional to the estimations by Autor, Patterson, and Van Reenen at the country level for 1992-2017 US, as they measure local labour market concentration between 31 and 36 points. My results fall between 35 and 75 for nationwide market concentration, and between 26 and 36 for local concentration. Kwon, Ma, and Zimmerman estimated trends in corporate market concentration in the US over nearly 100 years, starting from 1918.[24] They observe the rise of

22. Matias Covarrubias, Germán Gutiérrez, and Thomas Philippon, "From Good to Bad Concentration? US Industries over the Past 30 Years," *NBER Macroeconomics Annual* 34, no. 1 (2020): 1–46; Germán Gutiérrez and Thomas Philippon, "Fading Stars," in *AEA Papers and Proceedings*, vol. 109 (Nashville, TN: American Economic Association, 2019), 312–316; Chad Syverson, "Macroeconomics and Market Power: Context, Implications, and Open Questions," *Journal of Economic Perspectives* 33, no. 3 (2019): 23–43; Jan De Loecker, Jan Eeckhout, and Simon Mongey, *Quantifying Market Power and Business Dynamism in the Macroeconomy*, Working Paper, NBER Working Paper Series w28761 (National Bureau of Economic Research, 2021); Hugo Hopenhayn, Julian Neira, and Rish Singhania, "From Population Growth to Firm Demographics: Implications for Concentration, Entrepreneurship and the Labor Share," *Econometrica* 90, no. 4 (2022): 1879–1914; José Azar, Ioana Marinescu, and Marshall Steinbaum, "Labor Market Concentration," *Journal of Human Resources* 57, no. S (2022): S167–S199; Barkai, "Declining Labor and Capital Shares"; Karabarbounis and Neiman, "The global decline of the labor share."

23. Autor, Patterson, and Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation."

24. Soyoung Y. Kwon, Yueran Ma, and Karsten Zimmermann, "100 Years of Rising

corporate concentration without a corresponding decline in the labour share and do not discuss this matter further due to the different focus of their research.[25] I address this gap by explaining why concentration growth can coexist with a stable or rising labour share. Finally, I analyse the firm size distribution patterns, which follow a Pareto distribution, and confirm that the distribution holds Zipf's law, as widely emphasised in the literature on firm size based on modern data.[26]

The remainder of the paper is organised as follows. Section 2 provides the historical context for the second phase of the British Industrial Revolution, mainly focusing on narrative evidence, and explains why cities were considered the main labour markets of that time. Section 3 lays out the literature review. Section 4 describes the methodology related to data construction and identification strategy issues as well as the limitations of my research. Section 5 summarises the main results in three parts. The first part reports additional estimations on average firm size growth. The second part consists of market concentration estimations between 1851 and 1881. The third part accesses business dynamism, entry and exits, and consequences of creative destruction between 1881 and 1911. Section 6 concludes and outlines goals for further research.

Corporate Concentration," *American Economic Review* 114, no. 7 (2024): 2111–2140.

25. Kwon, Ma, and Zimmermann, "100 Years of Rising Corporate Concentration," p. 2135.

26. Robert L. Axtell, "Zipf Distribution of US Firm Sizes," *Science* 293, no. 5536 (2001): 1818–1820; Xavier Gabaix, "The Granular Origins of Aggregate Fluctuations," *Econometrica* 79 (3 2011): 733–772, ISSN: 1468-0262, https://doi.org/10.3982/ECTA8769.

The appendices are organised into a single part. Appendix A presents robustness checks.

2 Historical Context

2.1 The British Industrial Revolution

The British Industrial Revolution, spanning the mid-18th to the beginning of the 20th century, was marked by a cascade of inventions and their adoptions, accomplishing modern economic growth.[27] Occurring in the North of England, it is famously known for many great industrial inventions, particularly the steam engine, cotton gin, spinning jenny and many other notable inventions.[28] They facilitated the rapid growth of Yorkshire, Liverpool, and other industrialising cities, boosting trade within Britain by expanding railroads and fostering international trade via growing markets.[29]

The macro dimension of changes is described widely in the literature, starting from Maddison's project guesstimations.[30] It illustrates the dramatic

27. Clark, "The Industrial Revolution"; Robert C. Allen, "The British industrial revolution in global perspective," *The British Industrial Revolution in Global Perspective*, January 2012, 1–331, https://doi.org/10.1017/CBO9780511816680; Mokyr, *The British Industrial Revolution: An Economic Perspective*.

28. Mokyr, *The British Industrial Revolution: An Economic Perspective*.

29. Friedrich Engels, *The Condition of the Working Class in England* (London: Panther Edition, 1969); Dan Bogart, "Turnpike trusts and the transportation revolution in 18th century England," *Explorations in Economic History* 42, no. 4 (2005): 479–508; Peter Temin, "Two views of the British industrial revolution," *The Journal of Economic History* 57, no. 1 (1997): 63–82; Ronald Findlay and Kevin H. O'Rourke, *Power and Plenty: Trade, War, and the World Economy in the Second Millennium*, Power and Plenty (Princeton, NJ: Princeton University Press, 2009).

30. The latest summary is Jutta Bolt and Jan Luiten van Zanden, "Maddison style

changes in production and population, as shown by the famous hockey stick graph of GDP per capita, which skyrocketed after the middle of the mid-18th century.[31] Nevertheless, there is no widely accepted explanation of the causes of the Industrial Revolution in the economic history literature. Moreover, macroeconomics pays little attention to the British Industrial Revolution as a primary event in researching long-term economic growth.[32] Hence, the questions of why the Industrial Revolution happened and why it occurred in Britain remain open to debate from many perspectives.

Another critical remark is the timing. I use a definition by Robert Allen, which divides the Industrial Revolution into two phases.[33] The first phase occurred between the mid-18th and mid-19th centuries, characterised by stagnant real wages and a contrasting rising output. The second phase, from the mid-19th century to the early 20th century, was marked by the synchronisation of gross output with real wage growth. While there are many classifications of the timing, I rely on this one because it provides a better macro perspective on growth, starting with unequal benefits for workers in

estimates of the evolution of the world economy: A new 2023 update," *Journal of Economic Surveys*, 2024, 1–41.

31. Clark, "The Industrial Revolution," p. 218.

32. However, there are three papers that provide a fresh perspective on the Industrial Revolution from a macroeconomic standpoint: Pierre Bouscasse, Emi Nakamura, and Jón Steinsson, *When Did Growth Begin? New Estimates of Productivity Growth in England from 1250 to 1870*, Working Paper w28623 (National Bureau of Economic Research, 2021); Robert E. Lucas, "What was the industrial revolution?," *Journal of Human Capital* 12, no. 2 (2018): 182–203; David De la Croix, Matthias Doepke, and Joel Mokyr, "Clans, guilds, and markets: Apprenticeship institutions and growth in the preindustrial economy," *The Quarterly Journal of Economics* 133, no. 1 (2018): 1–70.

33. Robert C Allen, "Engels' pause: Technical change, capital accumulation, and inequality in the british industrial revolution."

terms of real wages and later becoming more well-distributed.

As discussed above, the current literature on the British Industrial Revolution is puzzling in many ways, particularly when the authors attempt to intersect macroeconomics with economic history. On the one hand, macroeconomics debates of what drives economic growth from a long-run perspective are scarcely related to the Industrial Revolution, and the forces besides demography and endowment factors have not unfolded. On the other hand, the accepted economic history theories are very wide-ranged and devoted primarily to supply-side and demand-side causes, while the supply-side reasons were mainly associated with three pillows of curriculum literature: Robert Allen's picture of high wages and low coal prices; Acemoglu et al. concept of skill-biased and endogenous growth from technological shocks; and the unified growth theory by Oded Galor.[34] Demand-related theories put in place the upper-tail human capital formation, technological creativity, and political institutions as drivers of technological change, emphasising the question of who and why act.[35] Both sides are searching for quantitative evidence of why the Industrial Revolution was British and what caused its sustainability

34. Acemoglu, "Technical Change, Inequality, and the Labor Market"; Robert C. Allen, "The British industrial revolution in global perspective"; Oded Galor, "The journey of humanity : and the keys to human progress": 286.

35. Mara P. Squicciarini and Nico Voigtländer, "Human Capital and Industrialization: Evidence from the Age of Enlightenment," *The Quarterly Journal of Economics* 130 (4 2015): 1825–1883, ISSN: 0033-5533, https://doi.org/10.1093/QJE/QJV025; Mokyr, *The Lever of Riches: Technological Creativity and Economic Progress*; Douglass C. North and Barry R. Weingast, "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England," *The Journal of Economic History* 49, no. 4 (1989): 803–832, https://doi.org/10.1017/S0022050700009451.

over the long run.

To begin with, the macro dynamics of these theories are perplexing in many ways. Broadberry and Wallis (2017) show the decline in the frequency of fluctuations between pre-industrial and industrial times, arguing that the periods of economic growth were counterbalanced by shrinking.[36] The authors frame the reasons for this decline through the nature of the pre-industrial economy with dependency on agriculture and demographic forces. However, it uncovers another part of the dynamic: the growth before the Industrial Revolution, which is not necessarily new.

British historian Samuel Lilley (1973) rebuttals the classic story of the Industrial Revolution as a golden age of technological creativity.[37] He shows the continuity of technologies from the Middle Ages, emphasising the broader pre-requisite processes of a patenting boom on the eve of the Industrial Revolution. For instance, he cites religious leaders of the 13th and 14th centuries who have already written about the unprecedented change in the speed of discovering something new across Europe. The acceleration of progress in many ways was the product of not only the technological creativity of the population itself but also a new way of adopting ideas from abroad. He points out the general-purpose technologies that Europeans invented not as a first,

36. Stephen Broadberry and John Joseph Wallis, "Growing, Shrinking, and Long Run Economic Performance: Historical Perspectives on Economic Development," *NBER Working Papers*, 2017,

37. Samuel Lilley, "Technological Progress and the Industrial Revolution 1700-1914," in *The Industrial Revolution*, ed. Carlo M. Cipolla (London; Glasgow: Collins/Fontana, 1973), 624.

such as the windmill invented by Persia, the spinning wheel from China, and the compass extensively used in Arabic. Lilley generally accounts for a large gap between the idea of technological creativity, which depends on population size and profit-seeking innovators, and how it historically evolved.

Oded Galor (2022) strengthens the role of the pre-modern Malthusian economy with constrained population by living standards, arguing that the Industrial Revolution was a crucial part of the transition to modern fertility and mortality regimes.[38] In his book, Galor combines diverse ideas such as quality-quantity tradeoffs in parenting, fertility decline as a reaction to living standards, and historical development roots. From this perspective, the Industrial Revolution caused the escaping from the Malthusian economy, leading to a new demographic regime. Even though it seems theoretically meaningful, this theory fails to capture the historical data and the historical dimension itself.[39] To rebuttal the main point of Galor's theory, historical data shows the lack of consistent links between fertility decline and living standards.[40] The demographic transitions across Europe are not associated with the living standards, while the first fertility decline occurred in France before 1800. England's transition was observed only in the 1890s when the output rose steadily with wages for a long time. Even not accounting for other

38. Galor, "The journey of humanity : and the keys to human progress."

39. Neil Cummins, "The micro-evidence for the Malthusian system. France, 1670–1840," *European Economic Review* 129 (October 2020): 103544, ISSN: 0014-2921, https://doi.org/10.1016/J.EUROECOREV.2020.103544.

40. Ansley J. Coale, *The Decline of Fertility in Europe*, vol. 5138 (Princeton, NJ: Princeton University Press, 1986), ISBN: 9781400886692.

pieces of Galor's theory, it misinterprets historical data on a large scale.

The core problem at the intersections of economic history and macroeconomics in explaining the British Industrial Revolution is that historical data often contradict theoretical models. To emphasise this with stylised facts, I will use the labour share and costs of capital data from the Bank of England database, *A Millenium of Macroeconomic Data*.[41] I extract labour share from Gregory Clark's estimations of wage share in the national income for England before 1860, and I use standard labour share calculated by the Office for National Statistics between 1860 and 2016. Accounting for debates on difficulties in calculating capital share, I compose only the costs of capital as a sum of the rate of returns from long-term yields on perpetual annuities/consols and the nominal value of capital stocks between 1760 and 2016.[42]

The labour share has grown over time, and the Industrial Revolution did not depress the labour share in the long term. Figure 1 shows the dynamic of labour share starting from 1770. The first stage of the British Industrial Revolution between the 1770s and 1860s includes the relative stagnation of labour income, heading below 0.60 points in the 1800s, and the boom between the next stagnation point in the 1860s. The boom, which Robert Allen's high wages equilibrium predicts, led to the opposite outcomes, suppressing

41. R Thomas and N Dimsdale, *A Millennium of UK Data*, Bank of England OBRA dataset, Accessed: 24.06.2024, 2017.

42. I rely on the paper by Barkai, "Declining Labor and Capital Shares" and estimate only the capital cost term in the capital share equation.

the wage income relative to national income. The decline of the labour share occurred with the parallel growth of output and wages in the second stage. Moreover, HP-filtered data captures many high-wage equilibriums, which suit the requirements, although they did not lead to extensive technological changes over time. Consequently, Allen's theory partly fails to capture why the short-run fluctuations of labour share, both decline and rise, led to wage and output synchronisation, raising concerns about how capital accumulation and compensations to workers should be linked.

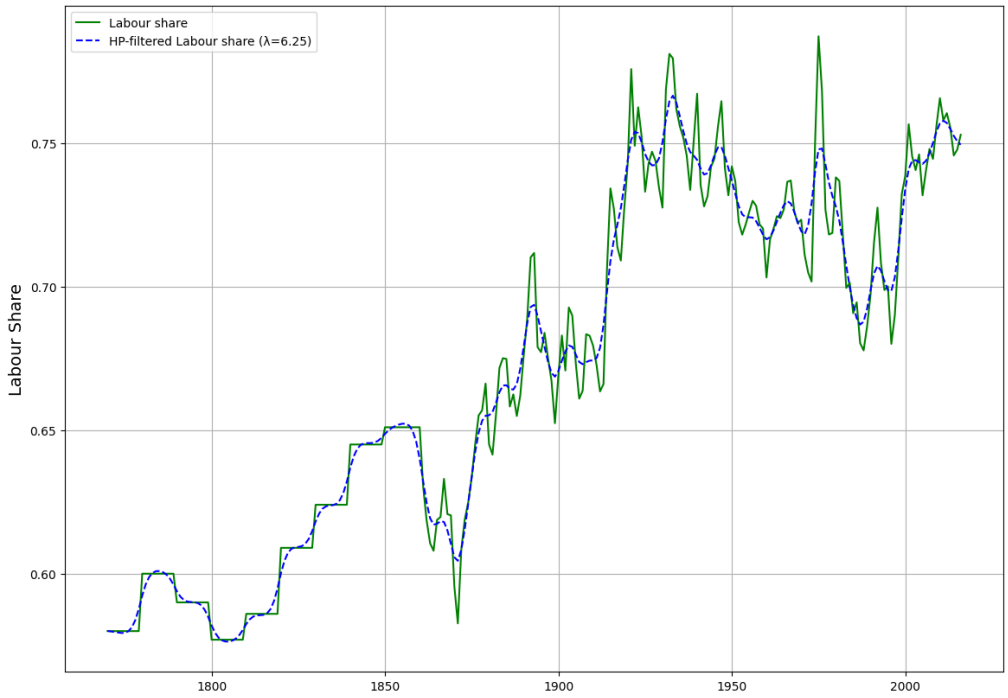


Figure 1: Labour Share in the UK, 1770-2016.

Note: The data source is A Millennium of Macroeconomic Data, A56 list.

The capital interest was unstable, with significant growth beginning only

in the mid-19th century. Figure 2 depicts the costs of capital before 1900. It stresses the long-run expectations of returns from capital. Consequently, the high costs reflect high expectations from capital investments and an increase in firm sizes in terms of fixed cost growth. Acemoglu's skill-biased technological change theory predicts that the British Industrial Revolution was biased toward unskilled labour. The entrepreneurs substituted low-skilled workers with relatively high wages for capital, causing technological unemployment. This theory finds support in different fields of literature, including the evidence indicating who and with which fear or interests participated in the Captain Swing movement.[43] However, capital costs are another aspect of this theory. Figure 2 shows how capital interests declined between the 1820s and 1860s, possibly reacting to early 19th-century resistance, proceeded by rising capital costs. It questions the assumptions of fixed return from the capital in the skill-biased model and of stable elasticity of substitution between unskilled labour and capital in different stages of the Industrial Revolution.

To sum up, the existing theories of the British Industrial Revolution failed to incorporate the macro dynamics, as is evident from the Robert Allen prices and wages tradeoff. The Malthusian models are scarce in historical justification, and Oded Galor's theory does not engage in this critique. The technological change literature over-ambitions in their assumptions, assuming the

43. Bruno Caprettini and Hans-Joachim Voth, "Rage against the Machines: Labor-Saving Technology and Unrest in Industrializing England," *American Economic Review: Insights* 2, no. 3 (2020): 305–320, https://doi.org/10.1257/aeri.20190356; Eric Hobsbawm and George Rudé, *Captain Swing* (London, UK: Verso Books, 2014), ISBN: 9781781680279.

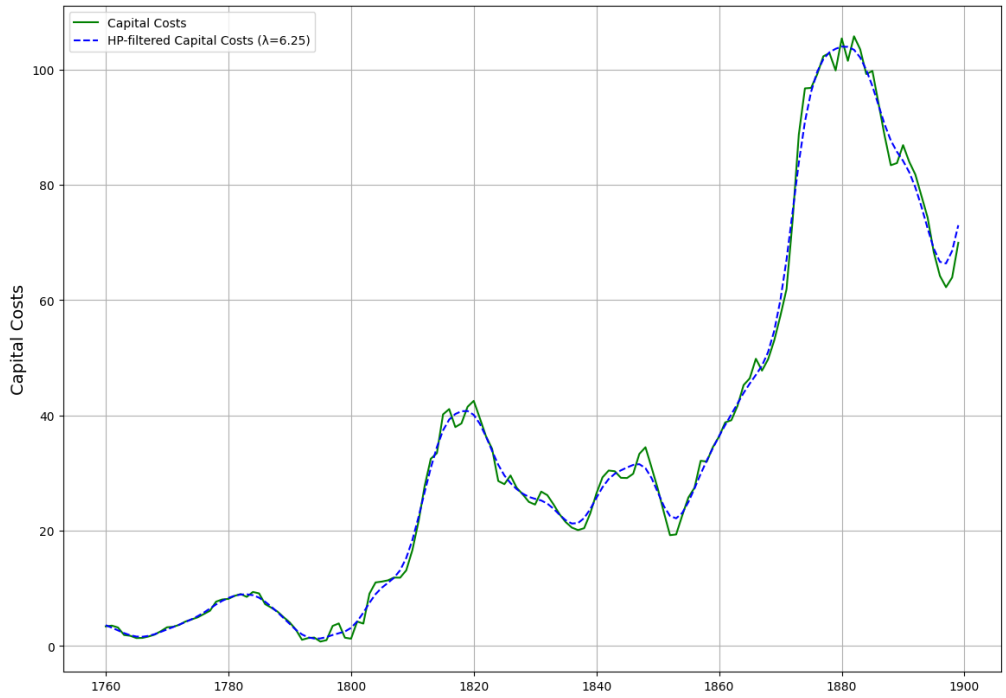


Figure 2: Capital Costs in the UK, 1760-1900.

Note: Capital costs are calculated as the product of the rate of return and the nominal value of the capital stock. For the rate of return, I use the yield on perpetual annuities/consols (A31 list), and for the nominal value of capital stock, I use the values of non-dwellings stocks from A55 list.

constant elasticity of substitution of capital over labour. Also, the literature provides relatively theoretical models which do not engage with historical granular data. I believe that the search for empirical identification of forces behind the macro dynamic of the British Industrial Revolution is worthwhile in this context of the nature of long-run economic growth.

One way to address the disparities in these stylised facts is by engaging with the ideas of the endogenous growth theory, particularly the Schum-

peterian models. The endogenous growth theory provides a new perspective on the macro dynamics of the Industrial Revolution, emphasising business dynamism and market concentration in explaining technological change.

An example of this is Nicholas Crafts's paper Exogenous or Endogenous Growth. The Industrial Revolution Reconsidered (1995), in which he considered the opportunity to revise the British Industrial Revolution within the Schumpeterian framework.[44] In this paper, he uses the classical Rebelo AK model to engage with the endogenous growth literature, considering this model appropriate to explain the slow TFP growth on the eve of the Industrial Revolution but not its timing. However, he motivates future attempts to think about the applications of the endogenous theory of growth positively, writing as follows:

> "Finally, given the importance of the appropriation of rents as an inducement to innovative activities, it would be helpful to see more research on market power and strategies for extracting rents other than the use of patents, which appears to have a disproportionate amount of attention."

Another example of pointing out the relevance of Schumpeterian models is Joel Mokyr's attention to Nicholas Crafts's engagement with the modern for the 1990s neoclassical theories of economic growth, as discussed in The British Industrial Revolution: An Economic Perspective:

44. Crafts, "Exogenous or Endogenous Growth? The Industrial Revolution Reconsidered," p.768.

> "Thus far, it remains very much an open question if the insights of the 'new growth theory' can be applied to the Industrial Revolution (Crafts, 1996)."[45]

However, there has been little support for a comprehensive Schumpeterian growth theory from the business dynamism side in economic history. One exception is Joel Mokyr's entrepreneurship theory as a driving force of the British Industrial Revolution and his other engagements with the new growth theory. The difference between Mokyr's theory and my argument is that I focus solely on the dynamics between entrepreneurs, as I believe that competition and dynamism are the main pillars of the British Industrial Revolution rather than human capital. Therefore, I intend to approach the question from a different perspective, exploring the business dynamism among entrepreneurs more profoundly as a driving force of the British Industrial Revolution rather than focusing solely on entrepreneurs themselves.

To illustrate the core predictions of Schumpeterian models, the Schumpeterian Growth Paradigm by Aghion, Akcigit, and Howitt (2015) is a programme paper which draws the perspectives of understanding growth via business dynamism. The authors develop the Schumpeterian idea of creative distraction, drawing a bridge between competition and growth. They argue that competition is positively associated with innovations, paying attention to the dynamic between incumbent firms, market structures, and different

45. Note: There is a mistake in the initial citation Mokyr, *The British Industrial Revolution: An Economic Perspective*, p.27, as Crafts' paper, from which the citation originated, was written in 1995, not in 1996 as Mokyr stated.

outcomes of that to innovations. The theory emphasises the importance of relationships between firms and market structures, making two predictions that could lead to a different understanding of the British Industrial Revolution. *The first prediction* is that firms are right-tailed and skewed by their size. Their *second claim* is that the reallocation of output leads to productivity growth, especially between incumbents and newcomers. Both theoretical predictions could be sources of macro dynamics, which have limited discussion in the existing theories of the British Industrial Revolution.

The perspective of the endogenous theory of growth enhances the discussion of business dynamism as a source of long-run economic growth, combining, on the one hand, the importance of large firms and their behaviour and, on the other hand, the role of the distribution of growth between incumbents and entry firms. Moreover, the authors stress the role of market power as a shaping force of innovations, which could be in favour of firms, monopolistic power, or in favour of labour or consumers, monopsony power.[46]

While the concentration of market power leads to outcomes in terms of bargaining power in prices and wages, it also shapes the product and labour markets itself. The concentrated markets provide another set of barriers for entry firms and different initiatives to adopt innovations.[47] In the context

46. As a classic reference, Joan Robinson, *The Economics of Imperfect Competition* (London, UK: Macmillan Company, 1969), ISBN: 9780333047013, and as a contemporary review of current monopsony literature, David Card, "Who Set Your Wage?," *American Economic Review* 112, no. 4 (2022): 1075–1090, https://doi.org/10.1257/aer.20200798.

47. Philippe Aghion et al., "Competition and Innovation: An Inverted-U Relationship," *The Quarterly Journal of Economics* 120, no. 2 (2005): 701–728, https://doi.org/10.1093/qje/120.2.701.

of the Industrial Revolution, market concentration could act as an agent for spreading innovations in the local markets, leading, for instance, to a boom in patenting. Hence, a variation of skewed firms and distribution of growth, in theory, could prolifically improve the current understanding of the British Industrial Revolution.

Furthermore, my research redefines the stylised facts about labour share and capital costs, which seems puzzling from the current perspective. The decline in labour share and capital costs between the 1850s and 1860s hypothetically lies in declining of the speed of growing market concentration. More firms began to substitute low-skill labour with capital through production networks between already industrialised regions and those that were not. The rise of labour share and capital costs after the 1860s relates to the rising market concentration in local markets more extensively, which is associated with the increasing potential of grabbing market competition. It also suggests a potential explanation for the rising firm size in terms of labour and capital, leading not to the substitution effect but to the accumulation of both within firms.

In conclusion, the intersection between theories of the British Industrial Revolution and the stylised facts I presented above provides a foundation for offering a new explanation of the business dynamism during the Industrial Revolution as a driving force. In the next section, I will present narrative evidence highlighting the importance of market concentration and business dynamism, particularly in the mid-19th century. In the Literature Review

section, I will discuss the Schumpeterian Growth Paradigm in greater detail than I have previewed above.

2.2 Market Concentration

Ego documents and 19th-century political commentaries suggest a rise in capital concentration and a shift in attitudes toward capital and labour. Moreover, the historical context of studying concentration and labour markets is closely associated with the political movements related to Marxism. Hence, this section highlights some of the Marxist literature's intuitions, justifying my dissertation's historical objectives.

In *The Condition of Working Class in England*, Friedrich Engels points out the negative impact of industrialisation on living standards in Manchester, Stockport, and Salford between 1844 and 1845.[48] Even though his thoughts and narrative evidence of worsening living standards are more pronounced later in Marxian literature and in Marx itself, he stresses the concentration and market power, as follows:

> "The largest manufacturers, formerly the leaders of the war against the working class, were now the foremost to preach peace and harmony. And for a very good reason, The fact is, that all these concessions to justice and philanthropy were nothing else but means to accelerate the concentration of capital in the hands of the few,

48. Engels, *The Condition of the Working Class in England*.

> for whom the niggardly extra extortions of former years had lost all importance and had become actual nuisances; and to crush all the quicker and all the safer their smaller competitors who could not make both ends meet without such perquisites."[49]

Leon Trotsky highlights the same concentration process regarding entry barriers for new entrepreneurs in his analysis of the Russian economy before the revolution.[50] He interestingly associates the size of the industry and its productivity in the early 20th century, approaching the fact that the most growing industries by their size should keep larger labour productivity. Trotsky also finds concentrated industries as an outcome of bourgeois-driven industrialisation, emphasising the roles of international capital and trade to facilitate the rise of entity size in the manufacturing sector. He matches the growth of industrial production with rising fixed costs, extending this analysis to the political dimension of controlling markets by a few capitalists. Trotsky compliments Engels's narrative evidence from England, emphasising how industries and their entities become sizable to control markets, quoting:

> "The bourgeoisie became economically more powerful, but as we have seen its power rested on a higher concentration of industry and an increased predominance of foreign capital."[51]

49. Engels, *The Condition of the Working Class in England*, p.3.
50. Leon Trotsky, "Peculiarities of Russia's Development," in *The History of the Russian Revolution*, vol. 3 (London: V. Gollancz, 1932).
51. Trotsky, chapter 1.

Nicholai Bukharin, a soviet party leader between the 1920s and the 1930s, deconstructs the early idea of determinants of the wealth of nations.[52] He asks a narrower question of what determines the capital accumulation within a country, suggesting that the rise of concentration led to extensive cooperation and legislative reforms, not vice versa. More importantly, he proposes the bottom-up approach to evaluating the increase in competition, arguing that the largest firms, which he calls international trusts, emerged from vertical hierarchal competition. In this process, competition among small firms leads to the rise of middle-sized firms, and after several iterations, it results in a few dominant firms in the product markets. Bukharin also distinguishes the concentration inside IO, referring to it as centralisation, and the concentration between firms, as follows:

> "A great concentration of capital accelerates the absorption of small-scale enterprises by large-scale ones; conversely, centralisation aids the increase of individual capital units and so accelerates the process of concentration."[53]

Another context I aim to emphasise is the market discipline of the time. Paul Johnson claims that the Victorian England markets were legally and ideologically biased toward owning capital.[54] He develops the idea of the non-neutrality of markets at the time rather than their Smithian nature. The legal

52. Nikolai Bukharin and Evgenii Preobrazhensky, "Chapter 3: Communism and the Dictatorship of the Proletariat," in *The ABC of Communism* (University of Michigan Press, 1966), 69–92.

53. Bukharin and Preobrazhensky, chapter 10.

54. Paul Johnson, "Market Disciplines in Victorian Britain," 2005,

reasons for the biased market discipline are mostly related to the Master and Servant Law. The law was commonly enforced between the 1850s and 1870s, providing the right to make criminal claims against workers who breached their contracts. Many contractors falsely claimed or threatened to claim that labourers breached their contracts, while the positive shocks to output increased the reinforcing of this law. This effect holds across contractors and geographical distribution, with industrialised regions invoking the Master and Servant Law more frequently. The ideological factors behind Victorian markets, as formulated by John Stuart Mill's Principles of Political Economy, highlight higher state dependency in overcoming market failures. Both the legal and ideological boundaries made markets biased toward capital instead of labour in Victorian England.

Suresh Naidu and Noam Yuchtman found that the iron, textile, and coal industries more extensively used the Master and Servant Law, while the higher marginal revenue of labour led to a higher rate of prosecutions.[55] They show that the more industrialised regions of England and Wells more frequently used coercive practices to respond to positive demand shock, suppressing wages. Naidu and Yuchtman identify that after the abolition of this law in 1875, wages in regions with higher past prosecutions started to react positively to the corresponding demand shocks. By doing this, they highlight the tightness of the Victorian labour market, arguably a mechanism of bias

55. Suresh Naidu and Noam Yuchtman, "Coercive Contract Enforcement: Law and the Labor Market in Nineteenth Century Industrial Britain," *American Economic Review* 103 (1 2013): 107–44, ISSN: 0002-8282, https://doi.org/10.1257/AER.103.1.107.

toward capital holders. This paper emphasises the legal reasons for market non-neutrality in Victorian times, showing the extensive market power of capital holders in relatively industrialised regions.

The resistance toward capital holders and their dominance in the labour market is also a context of the time. The rise of concentration and bias toward the capital in the late 19th century led to resistance via trade unionisation. Sidney and Beatrice Webb in Industrial Democracy describe this unionisation as a method of collective bargaining.[56] They are going further, contesting capital and labour and discussing the context of the time when the attitudes toward labour have changed dramatically. They write about these changes in juridical practice as follows:

> "But the changes in the law effected by Parliament during the past four years are of less importance to Trade Unionism than those made by the judges, notably by the House of Lords in its judicial capacity. By a series of unexpected decisions, beginning with Allen v. Flood, on the 14th of December 1897, and ending, for the moment, with Quinn v. Leathern, on the 5th of August 1901, the highest court of appeal has entirely changed the legal position of Trade Unions."[57]

19th-century England experienced rapid changes in attitudes toward labour and capital. On the one hand, many left-wing writers of this period stressed

56. Sidney Webb and Beatrice Webb, *Industrial Democracy*, vol. 2 (London and New York: Longmans, Green & Co., 1897).

57. Webb and Webb, p. xxiii, Introduction.

the growth in the concentration of capital in various contexts, highlighting it as a negative phenomenon. The boundaries of Victorian markets indeed facilitated the concentration growth, protecting the interests of capital holders. On the other hand, labour received unprecedented attention in the late 19th century through collective bargaining and legal changes. From the described historical context, it is not clear whether these two stories contradict or if they complement each other. Before testing these intuitions empirically, it is necessary to describe the agents of change that amplify the capital and labour dynamic.

Thus far, this chapter justifies the market concentration and business dynamism as sources behind the British Industrial Revolution. Based on the existing theories, I have highlighted the labour share dynamics and the costs of capital and provided straightforward critiques, such as issues with timing. By proposing the Schumpeterian growth models framework and providing a theoretical justification for how it could resolve the disparities between macroeconomic theories and historical data, I have moved on to highlight narrative evidence from contemporary political thinkers and other Marxist philosophers. As a result, the historical context of rising capital concentration, worsening labour conditions, market bias toward capital holders, and the labour share dynamics makes it reasonable to view the British Industrial Revolution through the lenses of the Schumpeterian growth paradigm and, more broadly, business dynamism.

3 Literature Review

3.1 Labour Share and Market Concentration

Besides the literature on the British Industrial Revolution already discussed, I categorise the remaining related literature into three fields of study: labour share dynamics and causes of market concentration; measurement issues related to estimating labour market concentration and intersecting aggregate and local moments; and the business history debates what causes of rising market concentration historically. While I already pointed out my contribution to the literature in the Introduction, the empirics on measuring market concentration and interpreting labour share dynamics play a significant role in how I construct the empirical parts of the dissertation. Additionally, I revisit the considerable debates in business history between renowned economic historians Leslie Hannah and Peter Hart, along with their coauthors, during the 1970s and 1980s.[58] These debates focused on the rise of large companies and their relationships with market concentration.

Regarding labour share, the starting point mentioned in the literature is the critique of Kaldor's facts of economic dynamic, which assumes that factor incomes are stable over time.[59] Kaldor's facts, considered by many

58. P. E. Hart and S. J. Prais, "The Analysis of Business Concentration: A Statistical Approach," *Journal of the Royal Statistical Society. Series A (General)* 119, no. 2 (1956): 150–191; Leslie Hannah and John A. Kay, "The Contribution of Mergers to Concentration Growth: A Reply to Professor Hart," *The Journal of Industrial Economics* 29, no. 3 (1981): 305–313.

59. Nicholas Kaldor, "Capital Accumulation and Economic Growth," in *The Theory of Capital: Proceedings of a Conference Held by the International Economic Association*,

generations of economists concerning growth models, have been questioned recently by a large body of literature studying market power and business dynamism.[60] Karabarbounis and Neiman's paper shows the decline in global labour share starting in 1975.[61] The decrease is more dramatic for the United States, Japan, Germany, and other countries, while the labour share in Great Britain remains stable during this time frame. Mining and transport experienced the most significant decline in labour share, and the authors observed the decline of regional labour shares in the United States. Many authors confirmed these results, and there are a few distinctive explanations for the declining labour share starting in the 1970s.

Three core explanations exist for why the labour share declined from the 1970s. These are the rise of market power, sluggish labour force growth, and increased investment in intangible assets with rising fixed costs.[62]

Autor et al. suggest that the decline in labour share is related to growing markups of the most productive firms, named superstar firms, with the lowest variable costs.[63] The increasing market power of these firms enables them to

ed. F.A. Lutz and D.C. Hague (London: Palgrave Macmillan UK, 1961), 177–222, ISBN: 9781349590425; Autor et al., "The Fall of the Labor Share and the Rise of Superstar Firms."

60. Note: the starting point of the popularisation of this literature is Autor et al., "The Fall of the Labor Share and the Rise of Superstar Firms."

61. Karabarbounis and Neiman, "The global decline of the labor share."

62. Note: There is literature on intangible investments De Ridder, "Market Power and Innovation in the Intangible Economy," labor forces and population dynamics Hopenhayn, Neira, and Singhania, "From Population Growth to Firm Demographics: Implications for Concentration, Entrepreneurship and the Labor Share," and the rise of superstar firms and their market power Autor et al., "The Fall of the Labor Share and the Rise of Superstar Firms."

63. Autor et al.

raise markups, and these firms maintain lower labour shares in added value, which, in turn, influences the aggregate labour share. The advantages of superstar firms' substantial market share impact markups and innovative activity, with the increase in concentration occurring in the sectors with the highest number of patents. As a result, Autor et al. demonstrate that market concentration appears to be linked with inter-firm dynamics, where sales and overall value-added increasingly move toward the superstar firms rather than with the labour share decline of the average firm.

While the market power literature mainly describes trends after the 1970s and regards declining labour share but not growing, it offers valuable measurements and methodological insights for disentangling market power, competition, and observed market concentration. In the literature, market power typically refers to the differences between prices and marginal costs in the output market, known as *markups*. Chad Syverson argues that markups are challenging to measure directly, and the most used approximation for this is market concentration.[64] Although many attempts have been made to measure markups directly using supply and demand estimators, market concentration is still the most common measure in empirical research. Moreover, the literature considers two types of market concentration: labour market concentration and sales concentration. Ultimately, both show market shares in input markets as a proxy for market power.

64. Syverson, "Macroeconomics and Market Power: Context, Implications, and Open Questions."

Many empirical studies have found that labour and sales concentration are considered proportional. Azar et al. directly measure the labour market concentration across US labour markets, finding that labour markets highly concentrate on average.[65] Moreover, the increase in market concentration associated with suppressing posted wages by 17% moved the market from the 75 percentile to the 25 percentile in their data. They use the Herfindahl-Hirschman Index and show that labour market power is as essential a measure of market power as sales concentration. Autor et al. suggest a similar dynamic, but they emphasise that labour market concentration at the national level could decline while the sales concentration rises.[66] Furthermore, the differences between sales and labour concentration in pace and direction are measured differently: by markups for product market power and wages for labour market power, or monopsony power, respectively. However, a few recent studies have identified a moment when product and labour market powers are highly correlated, such as local labour market concentration, which I am considering as the focus of my dissertation.[67]

Back to Chad Syverson's paper, the local labour market is a specific market definition when firms are operating.[68] In the literature, they are usually

65. Azar, Marinescu, and Steinbaum, "Labor Market Concentration."
66. Autor, Patterson, and Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation."
67. Rinz, "Labor Market Concentration, Earnings, and Inequality"; Autor, Patterson, and Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation."
68. Syverson, "Macroeconomics and Market Power: Context, Implications, and Open Questions."

commuting zones, and it found support in many recent papers across fields. Additionally, local labour markets show the strongest correlation between sales and labour concentration across the studies, highlighting the flexibility of defining commuting zones as a reasonable territory for labour supply. Consequently, the current literature suggests that local labour market concentration could reasonably approximate the market concentration dynamic as a measure of market power. In this empirical context, the labour market concentration captures labour and product market power.

Theoretically, monopsony will be the most popular framework for explaining the market power in the labour market.[69] However, I advocate for an alternative approach, arguing that the local labour market concentration could also capture the market power in product markets and reflect inequality between firms. For instance, Moll et al. study the distributional effect of automation, showing that technological change can depress wages at the bottom of distribution and raise inequality.[70] Their model captures the return of technological advancements on wealth, particularly business incomes, accounting for the return gap between different investment assets. On top of that, there is a growing body of literature explaining the market concentration in terms of rising fixed costs for top firms compared with higher variable

69. There is a growing body of literature on monopsony in relation to market concentration, for example, Samuel Dodini et al., "Monopsony, Job Tasks and Labour Market Concentration," *The Economic Journal* 134, no. 661 (2024): 1914–1949, https://doi.org/10.1093/ej/uead042.

70. Moll, Rachel, and Restrepo, "Uneven Growth: Automation's Impact on Income and Wealth Inequality."

costs for smaller firms, as well as different directions of automation on firm size. In sum, while the standard explanation is that monopsony power lowers wages in the first place, a growing body of literature explores inequality between large and small firms regarding fixed and variable costs, technological adoption, and the direction of technological change.

In addition, Jarosch et al.'s recent paper uses the tradition of labour search models to show how frictions in the labour market affect market power.[71] They intentionally try to build a model outside the monopsony framework, focusing on market structure and random search in the labour market. This approach provides a natural framework for understanding market power as the restriction of outside options, where the single firm in the market entirely prevents separations. Also, they expand on the mechanism by which firms in the concentrated markets lower wages, emphasising the weaker bargaining position of workers with large firms. Consequently, the labour-searching models could also help understand market power, as they provide more intuitive mechanisms of how market concentration affects workers.

I intend to highlight the final approach to market concentration, which involves market power and competition, as illustrated by Schumpeterian growth models. Aghion, Akcigit, and Howitt formulated the main predictions of Schumpeterian growth models regarding business dynamism.[72] They

71. Gregor Jarosch, Johannes S. Nimczik, and Isaac Sorkin, "Granular Search, Market Structure, and Wages," *Review of Economic Studies*, 2024, https://doi.org/10.1093/restud/rdae004.

72. Philippe Aghion et al., "The Schumpeterian Growth Paradigm," *Annual Review of*

highlight five key facts: the firm size distribution is skewed; small firms exit more frequently; both incumbents and entrants innovate; and reallocation among incumbents and to new entrants is the source of growth. Competition positively influences frontier firms but may block the innovations of non-incumbents.[73] The U-shaped competition curve formalizes the idea that high competition increases inequality between incumbents and other firms, demonstrating that competition and technological change may favor incumbents and support their innovations.[74] On the other hand, creative destruction is another source of growth.

Thus far, I have emphasised empirical evidence and various theoretical perspectives on the relationships between labour share and market concentration. While the market concentration in the labour market and markups in the product markets are the most straightforward and robust measures of market power, they are proportional in the context of local labour markets, as empirical studies have shown. Therefore, local labour market concentration aims to reflect the average effect of market power in both product and labour markets, as evidenced by the inequality literature and adopted labour search models. This approach differs from a theoretical perspective of monopsony power literature but aligns with the empirical research agenda, making it a

Economics 7 (1 2015): 557–575, ISSN: Econ - 1941-1383, https://doi.org/10.1146/ANNUREV-ECONOMICS-080614-115412.

73. Philippe Aghion, Ufuk Akcigit, and Peter Howitt, "What do we learn from Schumpeterian growth theory?," in *Handbook of Economic Growth*, ed. Philippe Aghion and Steven N. Durlauf, vol. 2 (Elsevier, 2014), 515–563.

74. Philippe Aghion et al., "Competition and Innovation: An Inverted-U Relationship," *The Quarterly Journal of Economics* 120, no. 2 (2005): 701–728.

reasonable choice for an empirical strategy.

3.2 Local Labour Market Concentration

The concept of the local labour market has been used extensively in empirical studies, research on labour markets, both durable and non-durable product goods markets, extensions to trade, and various macroeconomics literature.[75]

Moreover, three empirical strategies exist for working with local labour markets. First, Autor et al. estimate the local labour market concentration in labour and sales and compare them with national trends in concentration.[76] Second, Azar et al. approximate labour market concentration using only employment and wages, restricting the regional markets by geography and occupations.[77] Third, Kevin Rinz employs the four-digit industrial classification, a popular strategy in the literature that utilises industrial statistics, to define the local labour markets as commuting zones restricted by produc-

75. David H. Autor, David Dorn, and Gordon H. Hanson, "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *American Economic Review* 103, no. 6 (2013): 2121–2168, https://doi.org/10.1257/aer.103.6.2121; Alan Manning and Barbara Petrongolo, "How Local Are Labor Markets? Evidence from a Spatial Job Search Model," *American Economic Review* 107, no. 10 (2017): 2877–2907, https://doi.org/10.1257/aer.20141307; Enrico Moretti, *Local Labor Markets*, Working Paper w15947 (National Bureau of Economic Research, 2010); Acemoglu and Restrepo, "Robots and Jobs: Evidence from US Labor Markets"; Azar, Marinescu, and Steinbaum, "Labor Market Concentration"; Autor, Patterson, and Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation"; Rinz, "Labor Market Concentration, Earnings, and Inequality."

76. Autor, Patterson, and Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation."

77. Azar, Marinescu, and Steinbaum, "Labor Market Concentration."

tion sectors.[78] Although these approaches depend more on data availability and research needs than theoretical preferences, they highlight the variations and context in which local labour markets can be defined.

Regarding the methods used in literature to address local labour market concentration, there are approaches like HHI restricted by geographical units, such as the local labour market, and sectoral or occupational restrictions depending on the data availability.[79] Moreover, authors usually observe the Concentration Ratio (CR) of the top 5 or top 10 firms and the top 1 or 0.1 per cent of firms over time when, for instance, the entire firm continuum is unavailable or available only by size bins.[80] While I use both approaches to measure market concentration, as permitted by the available data, I also draw attention to the applications of the Schumpeterian growth framework, mainly how creative distraction captures the competitiveness of the local labour market in response to the new entrants as an exogenous variation. This approach has been extensively used in economic history and macroeconomics to identify exogenous or idiosyncratic shocks to the largest firms in various market structures.[81]

78. Rinz, "Labor Market Concentration, Earnings, and Inequality."

79. Autor, Patterson, and Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation."

80. Kwon, Ma, and Zimmermann, "100 Years of Rising Corporate Concentration."

81. For example, Jeremiah Dittmar and Skipper Seabold, *New Media and Competition: Printing and Europe's Transformation after Gutenberg*, Working Paper (LSE, 2019) uses the deaths of printers as a source of exogenous variation. In macroeconomics: Gabaix, "The Granular Origins of Aggregate Fluctuations"; Xavier Gabaix and Ralph S. J. Koijen, "Granular Instrumental Variables," *https://doi.org/10.1086/728743*, July 2024, 000–000, ISSN: 0022-3808, https://doi.org/10.1086/728743.

The empirical literature on local labour market concentration provides three identification approaches, primarily as responses to challenges in data availability. As I will show in the Methodology, the data allows me to exercise all of them to estimate the dynamic better and test how incumbents' distraction in the local labour market affects entries, as it is theoretically consistent with the search labour models. Before explaining these approaches in the methodology section, it is necessary to summarise the business history debates on the factors driving market concentration in England between the mid-19th century and the early 20th century.

3.3 Business History

As a historical context, the development of ownership structures in the United Kingdom, beginning primarily with the 1855 Joint Stock Company Act, led to a boom in corporation ownership and mergers starting in the late 19th century.[82] Many authors have noted the spike in mergers in the late 19th century across the United Kingdom, particularly in regions with low industrial economic activity, such as Scotland.[83] At the same time, authors started to document the rise in market concentration in industrial production, which imposes two distinctive explanations of the causes of market concentration.

82. John Micklethwait and Adrian Wooldridge, *The Company: A Short History of a Revolutionary Idea* (Random House Publishing Group, 2005), 272; Payne, "The Emergence of the Large-Scale Company in Great Britain, 1870-1914."

83. Peter L. Payne, *The Early Scottish Limited Companies, 1856-1895: An Historical and Analytical Survey* (Edinburgh: Scottish Academic Press, 1980), pp. 136-151; Payne, "The Emergence of the Large-Scale Company in Great Britain, 1870-1914."

From one perspective, the extensive merger movement led to more significant industry market concentration and capital accumulation in the largest corporations.[84] As an example of 'bad concentration', authors argue that it lowers wages and has negative welfare costs. From another perspective, the British Industrial Revolution and technological change led to more extensive market concentration, as an example of 'winners take all'.[85] It is reasonable for large firms to innovate or expand their products to maintain the market share in both product and labour markets, as this exemplifies 'good concentration'. As a result, the business history provides two competing perspectives on the causes of market concentration.

This debate primarily centred between Leslie Hannah and his coauthors, who argue in favour of the role of mergers, and Peter Hart and his coauthors, who demonstrate that technological change significantly amplified market concentration. Their various articles and responses use arguments based on limited data on the largest corporations and their capital value or market valuation, primarily from Stock Exchange archives or the distribution of firms by size bins. However, Peter Hart's papers argue that the market concentration increased due to differences in survival rates between small and large firms. As small firms became highly profitable between 1939 and 1950,

84. Hannah and Kay, *Concentration in Modern Industry: Theory, Measurement and the UK Experience*; Hannah and Kay, "The Contribution of Mergers to Concentration Growth: A Reply to Professor Hart."

85. Hart and Prais, "The Analysis of Business Concentration: A Statistical Approach"; P. E. Hart, "On Bias and Concentration," *The Journal of Industrial Economics*, 1979, 211–226.

the concentration decreased compared to the mid-19th century. In contrast to Peter Hart, Leslie Hannah and other business historians highlight the merging nature of observing 20th-century market concentration, supporting a hypothesis that concentration rises because of legal and market structure causes. While the more extensive literature supports Leslie Hannah's hypothesis, I will introduce evidence supporting Peter Hart's view on market concentration in the following sections.

Thus far, I have outlined three pillars of the literature I build on. First, I explained how local labour market concentration reflects market power and discussed how the literature links market concentration with labour share. I identified a gap in the literature, pointing out that most studies focus only on modern observations of declining labour share and market concentration, with limited research on the role of technological change, particularly in the context of the United Kingdom. Second, I have explained various strategies for measuring local labour market concentration found in the literature, providing another empirical approach to estimate the tightness of labour markets in a condition of labour market concentration. Third, I emphasised the debate in business history regarding market concentration, revisiting arguments in favour of Peter Hart's papers, which are less cited in the literature than Leslie Hannah's contributions.

I am now turning to the empirical part, where I present the Methodology, including data, methods and limitations, and the Results.

4 Methodology

4.1 Data

As a primary source, I use The Integrated Census Microdata (I-CeM) between 1851 and 1911 for England Wells and between 1851 and 1901 for Scotland.[86] It is a project run by Cambridge Population Group, utilising census statistics from 1851 in a digital format. The history of British census records starts from 1841, primarily documented in census enumerators' books. The typical book consists of full name, age, sex, place of birth, household relations, and occupation information. Based on the enumerators' books, Cambridge Population Group digitised data from 1851 in the I-CeM. Figure 3 shows a granularity of data, using Liverpool as an example. They code all the parishes of this time and their corresponding dwellers.

In most cases, I use a less granular version of I-CeM, The British Business Census of Entrepreneurs (BBCE), which concentrates only on entrepreneurs' data. This dataset provides not all household-side data as I-CeM but records of entrepreneurs and corresponding statistics.[87] It fulfils my goals to show the local labour markets from the entrepreneurial side, concentrating on the consistency of labour markets rather than tracing individuals over time. Additionally, BBCE provides most of the data at the level of towns, which keeps

86. Kevin Schürer and Edward Higgs, *Integrated Census Microdata (I-CeM), 1851-1911 [data collection]*, SN: 7481, 2024, https://doi.org/10.5255/UKDA-SN-7481-3.

87. R. Bennett et al., *British Business Census of Entrepreneurs, 1851-1911 [data collection]*.

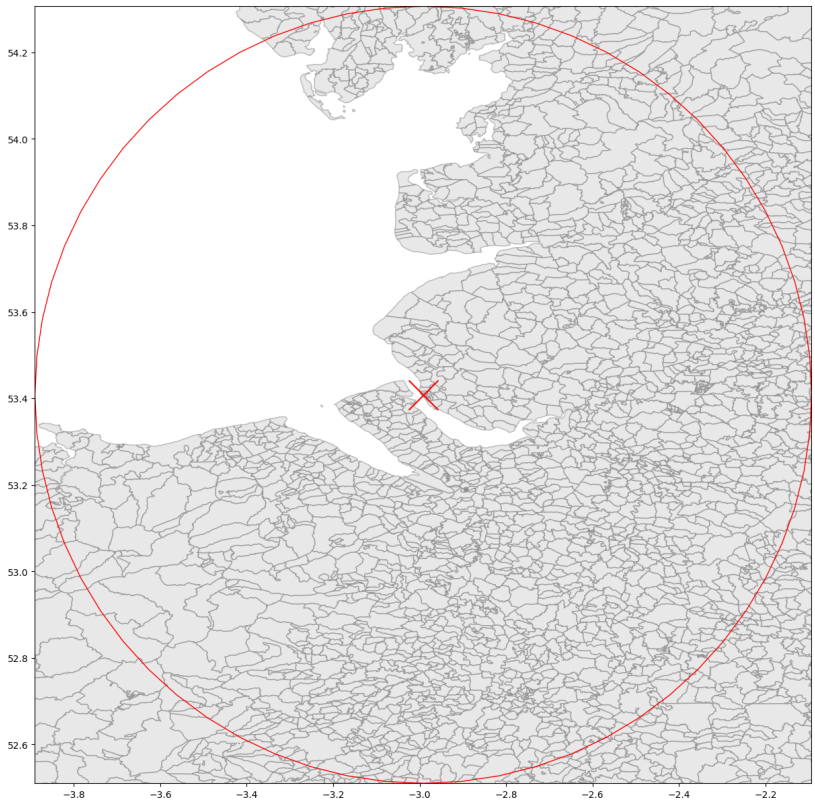


Figure 3: Parishes within 50 km of Liverpool & Birkenhead

my analysis of labour markets simple regarding data linkages; when I use data not at the level of cities, I primarily rely on the full version of I-CeM due to my purposes and the more extensive saturation of I-CeM at the parish levels.

Table 1 shows the main variables that BBCE extracted from I-CeM between 1851 and 1911. The dataset provides occupational and sectoral data for all time-frames, although the number of employers in the business entity

only for the 1851, 1861, 1871, and 1881 censuses. It limits my empirical analysis of firm size distribution, allowing me to trace firms by their employment size before the 1891 census. The BBCE provides the ID of each entrepreneur, and I use it to link entrepreneurs over censuses. Moreover, I will discuss how I overcome this drawback of the data in the Discussion and Limitations section.

Table 1: Main Variables from BBCE

Variables	1851	1861	1871	1881	1891	1901	1911
RecID	✓	✓	✓	✓	✓	✓	✓
Parish name	X	X	✓	X	X	X	X
Town Name	✓	✓	✓	✓	✓	✓	✓
Urban-rural code	✓	✓	✓	✓	✓	✓	✓
Emp. Status	✓	✓	✓	✓	✓	✓	✓
Employees total	✓	✓	✓	✓	X	X	X
Occupational code	✓	✓	✓	✓	✓	✓	✓
Sector codes	✓	✓	✓	✓	✓	✓	✓

I present the descriptive statistics of BBCE for 1851 years in Table 2. This table uncovers the data structure based on observations of the type of settlement, urban or rural area. Near half of the observations are concentrated in urban areas and vast cities, and the other half belong to different types of rural areas. Although many observations explain rural dynamism, I do not rely on the not-city data because of the sparse observations. Many parishes are empty or do not fully explain regions, and the parish as a unit does not represent labour markets. However, the data about cities are reliable and relatively complete. Even though the data provides limited information about workers, in BCCE, I only rely on entrepreneurial data and extract, if

Table 2: Urban Class and Employment Status

Category	**Freq.**	**Percent**	**Cum.**	**Cum. Freq.**
Urban	506,012	48.26%	48.26%	506,012
Transition type 1	28,710	2.74%	51.00%	534,722
Transition type 2	273,213	26.06%	77.05%	807,935
Rural	240,640	22.95%	100.00%	1,048,575
Total	1,048,575	100.00%		
Worker	281,576	26.85%	26.85%	281,576
Employer	293,246	27.97%	54.82%	574,822
Own account	473,751	45.18%	100.00%	1,048,575
Inactive or blank	2	0.00%	100.00%	1,048,577
Total	1,048,575	100.00%		

necessary, workers' data from I-CeM.

Table 3 shows the frequency of each employment status based on the area of living. Urban entrepreneurial statistics seem saturated, providing over half a million observations. These statistics are highly granular at the city level and simple to analyse and interpret.

Table 3: Frequency Table, Grouped by Urban Class and Employment Status

	Employment Status				
Urban Class	**Worker**	**Employer**	**Own acc.**	**Blank**	**Total**
Urban	152,188	110,394	243,428	2	506,012
Transition type 1	7,263	8,866	12,581	0	28,710
Transition type 2	65,047	81,337	126,829	0	273,213
Rural	57,078	92,649	90,913	0	240,640
Total	281,576	293,246	473,751	2	1,048,575

Note: Pearson $\chi^2(9) = 2.5 \times 10^4$, $p < 0.000$

To provide an example of the granularity of data at the city level, I show the ten largest cities as labour markets and their employment structure in Table 4. The saturation of labour markets by proportion of labour and firms allows me to assume different tightness of labour markets. Even though the statistics about child and women's labour are inconsistent, it also gives some understanding of the division of labour in various cities. I will discuss other limitations of this data in the Discussion and Limitations section.

Table 4: Employment Concentration in Cities (Top 10)

	Variable			
TOWN	**∑workers**	**∑firms**	**∑female**	**∑child**
LONDON	63571	8074	1659	0
BIRMINGHAM & SMETHWICK	25254	1976	260	48
NOTTINGHAM	16587	1013	2431	10
MANCHESTER & SALFORD	14557	1320	179	0
BRISTOL	9300	903	59	68
BOLTON	7941	255	71	15
LIVERPOOL & BIRKENHEAD	7909	1027	17	0
NORWICH	7098	530	158	0
WOLVERHAMPTON	6571	501	4	0
Total	712094	115506	5942	544

Furthermore, as a last strength of the source, the data shows the distribution of labour by sector and occupation at the city level. In Table 5, I provide an intuition of how significant this granularity is for London, emphasising using entrepreneurial data from BBCE with a possible combination with initial I-CeM.

As secondary sources, I rely on A Millennium of UK Data from the Bank

Table 5: Summary Statistics: London's Employment by Sectors

	Average Workers	**Total Workers**
Farming and fish.	8.496454	3594
Mining & quarr.	4.454545	49
Construction	11.29028	16608
Manufacturing	11.94146	22641
Dealers	6.312864	9766
Retail	5.625277	2537
Transport	7.394737	1124
Services (1)	7.3	219
Services (2)	4.100592	693
Agricultural prod.	7.027472	1279
Food retailing	2.660505	4318
Lodging	3.569231	232
Finance	11.325	453
Public service	4	4
Domestic service	4.153846	54

of England and additional datasets from Cambridge Population Group as secondary sources.[88] In addition, I use sources as robustness checks in Appendix A. They consist of different projects of the Cambridge Population Group and related business history papers, which estimate market concentration from other sources, such as Leslie Hannah's works.[89]

88. Thomas and Dimsdale, *A Millennium of UK Data*; R. J. Bennett et al., *BBCE: Atlas of Entrepreneurship*.

89. Hannah and Kay, "The Contribution of Mergers to Concentration Growth: A Reply to Professor Hart"; Leslie Hannah, "Mergers in British manufacturing industry, 1880–1918," *Oxford Economic Papers* 26, no. 1 (1974): 1–20.

4.2 Methods

Based on the structure of the primary source, I use the census data for *two purposes*. *First*, I utilise data from the 1851, 1861, 1871, and 1881 censuses to estimate local labour market concentration dynamics. *Second*, I draw on data from the 1851 to 1911 censuses to demonstrate business dynamism in the local labour market, assess the age of firms, entry and exits, and creative distraction consequences for labour markets.

4.2.1 Local Labour Market Concentration: 1851-1881

I define a local labour market as a zone where workers supply their labour. I use *three empirical specifications* of this definition. First, towns with their public provision, as justified by the historical context of industrial growth. Second, there is a historical analogue of commuting zones, assigning entrepreneurs to cities where they could commute using roads and railroads. Third, local labour markets are categorised by density, with more dense areas of entrepreneurial activity (centre) and a less dense threshold (periphery) around them. For the dissertation's sake, I use the first specification, allowing cities to be centres of industrial activity only, as it consists of historical evidence and has a more straightforward interpretation. I list the other two specifications in Appendix A.

I rely on Autor, Paterson and Van Reenen's working paper to estimate local labour market concentration. They use compositions of HHI indexes in the local labour market and country levels to provide evidence of the rise of

labour market concentration in the US between 1990 and 2020.[90] Following this logic, I construct two measures: local labour market concentration and national-level concentration. I build these measures as follows:

Local Labor Market Concentration:

$$HHI_{ct} = 100 \times \left(\sum_{i \in j,c} s_{icjt} \right)^2 \tag{1}$$

where s_{icjt} is the share of firm i in sector j within the geographical unit c at the city level at time t.

National Labor Market Concentration:

$$HHI_l = \sum_k W_{l,kt} \times W_{l,cjt} \times HHI_l \tag{2}$$

where $W_{l,kt}$ is the share of activity l in industry j in the group of industries k and city c in year t, and $W_{l,cjt}$ is the share of activity l in sector k in the city c.

Also, I use shift-share decomposition of the HHI index at the national level to divide it into three components: within effect, between effect, and covariance effect. Within effect holds the sectoral weights (share of employment) constant, changing only outcome (market concentration). The between effect holds outcomes constant and shows how changes are associated with shifts in sectoral weights. The covariance effect captures how simultaneous changes

90. Autor, Patterson, and Reenen, "Local and National Concentration Trends in Jobs and Sales: the Role of Structural Transformation."

in both weights and outcomes affect the total changes in the national HHI index. The formulas for national and local decomposition are as follows:

Shift-share decomposition of National Labour Market Concentration:

$$\Delta HHI_t^{EW} = \underbrace{\sum_k w_{k0}^l \Delta HHI_{kt}^{EW}}_{\text{within effect}} + \underbrace{\sum kHHI_{k0}^{EW} \Delta w_{kt}^l}_{\text{between effect}} + \underbrace{\sum k \Delta w_{kt}^l \Delta HHI_{kt}^{EW}}_{\text{covariance effect}} \tag{3}$$

Shift-share decomposition of Local Labor Market Concentration:

$$\Delta HHI_{cjt}^L = \underbrace{\sum_i w_{i0}^j \Delta HHI_{icjt}^L}_{\text{within effect}} + \underbrace{\sum_i HHI_{i0}^L \Delta w_{icjt}^j}_{\text{between effect}} + \underbrace{\sum_i \Delta w_{icjt}^j \Delta HHI_{icjt}^L}_{\text{covariance effect}} \tag{4}$$

Next, I use CR ratios to trace the labour concentration at the national level in two settings: top 1% in the top 10% and top 0.1%. I compare these results with the HHI estimations, and the CR formula is as follows:

$$CR_{1\%} = \frac{\text{Employment in top 1\% of firms}}{\text{Total employment in top 10\% of firms}} \tag{5}$$

$$CR_{0.1\%} = \frac{\text{Employment in top 0.1\% of firms}}{\text{Total national employment}} \tag{6}$$

Lastly, I quantify the effect of creative distraction in local labour markets based on the workforce size. I divide them into two groups: those who have experienced changes in incumbents and those who have not. Furthermore, I research data-driven differences in the size of workforces between markets

that experience these exogenous idiosyncratic shocks and those that do not. In other words, I use a variation of how market concentration evolved in response to changes in incumbents, as follows:

The impact of incumbent's distraction on employment:

$$P(E_t \mid D_{t-1} > 0) = f(D_{t-1}) \tag{7}$$

where **P** is the probability of new entries in the current year, if the incumbent destroyed in the previous year, and **F** is a function that quantifies the number of incumbents which died across local labour markets;

Incumbent did not change between periods:

$$P(E_t \mid S_{t-1} < 0) = g(S_{t-1}) \tag{8}$$

where **P** is the expected negative probability of new entries if the incumbent remains stable.

4.2.2 Business Dynamism, 1851-1911

In this part, I precisely quantify some measures of business dynamism, including entries, exits, age of firms beyond and above average size, and creative distraction. There are formal definitions of these measures as follows:

$$\text{Entry Rate} = \left(\frac{E_t^{\text{new}}}{E_t} \right) \times 100 \tag{9}$$

where **E** is the quantification of the number of businesses;

$$\text{Exit Rate} = \left(\frac{E_t^{\text{exit}}}{E_{t-1}} \right) \times 100 \tag{10}$$

where **E** is the quantification of the number of exits;

Age of a firm:

$$P(\text{Age at } t) = P(t_{\text{first}} \leq t \leq t_{\text{last}}) \tag{11}$$

where the first appearance in the census is considered the first year, and when the firm disappears, it is considered the last year;

Creative destruction:

$$P(\text{CD}) = P \left\{ \begin{array}{l} F_{i,j,c,t} > 0 \\ F_{i,j,c,t+1} = 0 \\ E_{i,t} > E_{k,t}, \ \forall \ k \neq i \text{ in the same market} \end{array} \right\} \tag{12}$$

where $\mathbf{F(t)}$ is the firm in the current year that is dominant in employment within its local labor market (the intersection of sector j and town c). $\mathbf{F(t+1) = 0}$ indicates that the firm exited the market by the next census. $E_{i,t} > E_{k,t}$ means that the incumbent has the largest employment in the local labor market within its sector.

Lastly, I quantify creative distraction conditionally to other measures of business dynamism, estimating the effects of changing incumbent to entries exits as follows:

Entries conditionally to creative destruction:

$$P(\text{Entries increase} \mid \text{Creative Destruction}) = P(E_t > E_{t-1} \mid F_{i,j,c,t+1} = 0) \tag{13}$$

where **E** is the number of entrants in this local labor market;

Exits conditionally to creative destruction:

$$P(\text{Exits increase} \mid \text{Creative Destruction}) = P(X_t > X_{t-1} \mid F_{i,j,c,t+1} = 0) \tag{14}$$

where **X** is the number of exits in this local labor market;

4.3 Discussion and Limitations

The presented primary source has two significant *limitations*. First, The British Business Census of Entrepreneurs has many empty parishes, and its coverage of entrepreneurs is incomplete. Second, census data is unsuitable for analysing firms because the types of entrepreneurs and their legal status are questionable. It will be hard to highlight if the firm has different entities across different cities.

To address issues with data coverage that could bias workforce size and market concentration estimations — potentially leading to Type 1 errors if coverage is biased toward small firms, and type 2 errors if coverage is biased toward large firms — I use Chebyshev's and Markov's inequalities to estimate confidence intervals. Both inequalities compare empirical moments

with theoretical ones, each in a different way, showing the expected and empirical upper-boundaries. It allows me to calculate upper boundaries of estimations using formulas as follows:

Chebyshev equation:

if X is any random variable, then for any b greater than 0:

$$P(|X - \mathbb{E}[X]| \geq b) \leq \frac{\mathrm{Var}(X)}{b^2}. \tag{15}$$

Markov equation:

if X is non-negative, then:

$$P(X \geq a) \leq \frac{\mathbb{E}[X]}{a}, \quad \text{for any } a > 0. \tag{16}$$

Moreover, as errors 1 and 2 could shift the distribution toward smaller or larger workforces because of coverage problems, I introduce the Weak Law of Large Numbers as an additional check on how different areas of coverage downward or upward the overall estimations, even though it will be not stable over time because the distribution is Pareto or log-normal, it would show to which part of distribution coverage is potentially biased. I use the formula as follows:

Weak Law of Large Numbers:

$$\begin{aligned} &\text{Let } X_1, X_2, \ldots, X_n \text{ be i.i.d. random variables with } \mathbb{E}[X_i] = \mu < \infty. \\ &\text{Then, for any } \epsilon > 0, \lim_{n \to \infty} P\left(\left|\overline{X} - \mu\right| \geq \epsilon\right) = 0. \end{aligned} \tag{17}$$

As a last check on the coverage of BBCE data, I use the maximum likelihood estimation (MLE) method to doublecheck how empirical and probability distributions suit each other. It also provides an additional estimation compared with Chebyshev's confidence intervals. To calculate the MLE estimator, I use Fisher's scoring computational algorithm.[91]

Another limitation related to the definition of a firm is more complex to address. While the census data provides relatively reliable information about the size of the workforce, gaps and inconsistencies exist in the partners' statistics and other variables linked with the corporate or firm structure. In other words, the information about workforces and entrepreneurs from census data has limited application for market concentration research, as it lacks complete and reliable information on business structure.

However, I argue that in the empirical settings of local labour markets, this limitation does not invalidate the results but calls for caution in their interpretation. As local labour markets capture the decisions of entrepreneurs to enter, exit and invest in expanding workforces locally, there was a minor concern about the role of corporations before the significant spike in mergers in the early 20th century. As concern could arise at the national level, I compare the CR ratios results with the modern research on local labour market concentration, using company data and a more granular sectoral classification. Therefore, using entrepreneurs as observation units does

91. As a reference, see Y. Wang, "Maximum likelihood computation based on the Fisher scoring and Gauss–Newton quadratic approximations," *Computational Statistics & Data Analysis* 51, no. 8 (2007): 3776–3787.

not fully account for the managerial structure, which calls for caution when interpreting results outside local labour markets.

Having defined the methodology and its limitations, I will now move on to reporting results. Firstly, I report the results of the firm size estimations because Robert Bennett and his coauthors have already discussed some of these questions. I revisit their estimations and propose parametric estimations rather than absolute estimations of average firm size, as the BBCE data is partially sampled. As I explained earlier, I use an entirely different approach, making estimations with confidence intervals and running additional tests on coverage. Secondly, I present the local labour market concentration estimations drawn from the 1851, 1861, 1871, and 1881 censuses. Moreover, I emphasise the heterogeneity between local labour markets from a macroeconomic history perspective. Thirdly, I draw attention to the more significant topic of business dynamism, estimating it in the second phase of the British Industrial Revolution (1851-1911).

5 Results

5.1 Business-Size Distribution, 1851-1881

As mentioned, Robert Bennett and his coauthors have extensively studied firm-size distribution in Victorian England based on BBCE.[92] They have

92. R. J. Bennett et al., *BBCE: Atlas of Entrepreneurship*; R. Bennett et al., *The Age of Entrepreneurship: Business Proprietors, Self-Employment and Corporations since 1851*; Bennett and Hannah, "British Employer Census Returns in New Digital Records 1851–81;

estimated the average size of businesses between 1851 and 1881, highlighting the significant geographical heterogeneity between centres of the British Industrial Revolution and other areas. They have argued that the average non-farm firm size changed from 7.3 to 11.8 workers per firm between 1851 and 1881.[93] However, the authors also recognise the high level of unresponsiveness from businesses with corporate legal forms, suggesting that larger firms with more than 800 employers may be less likely to respond to a census.[94] These non-responses may shift estimations, even though they are random. Therefore, I will begin by researching the previous estimates by Robert Bennett and his coauthors of average firm size from a statistical point of view.

To begin with, I access a distribution of businesses by their size. I list the following calculations in Appendix A. Section A.1. Business-size distribution follows a Pareto distribution, as shown in Figure 16 by comparing theoretical and empirical cumulative distribution functions (CDF). Furthermore, the census responses of business size follow the same tendencies for 1851, 1861, 1871, and 1881 years. I test this argument using an empirical concept of frozen probability density function (PDF) in Figure 19, fixing the moments of 1851 PDF and mapping 1861, 1871, and 1881 PDFs over fixed 1851-PDF. They all follow the same Pareto-type distribution. Despite this, the distribu-

Consistency, Non-response, and Truncation–What This Means for Analysis."

93. R. Bennett et al., *The Age of Entrepreneurship: Business Proprietors, Self-Employment and Corporations since 1851*.

94. Bennett and Hannah, "British Employer Census Returns in New Digital Records 1851–81; Consistency, Non-response, and Truncation–What This Means for Analysis."

tion becomes more heavy-tailed over time, as shown by bootstrap estimations of the Pareto distribution parameters. In other words, employment became increasingly concentrated in large firms from 1851 to 1881. Therefore, from a statistical point of view, a business-size distribution follows the Pareto distribution based on CDFs and PDF analysis, and it became more heavy-tailed over time according to bootstrap estimations.

The distribution also follows Zip'f law, as expected from the firm-size literature.[95] Even though it is difficult to determine whether data is consistent with Zip'f law from a statistical point of view, I plot the OLS of firm size in Figure 21 following the approach in Robert Axtell's paper.[96] I also use another possible approach to determine Zip'f law, plotting empirical data against theoretical Zip'f law quantiles in Figure 23. As a result, the business-size distribution follows the Zip'f law, which is entirely consistent with the literature and has numerous theoretical implications. For instance, because the firm size distribution is fat-tailed, idiosyncratic shocks to large firms, usually incumbents, are not offset over business cycles, as Robert Lucas predicts.[97] Thus, business distribution follows Zip'f law over 1851-1881; it amplifies the importance of dynamics between businesses, as they differ in idiosyncratic productivity and innovation history.

95. Axtell, "Zipf Distribution of US Firm Sizes."
96. Axtell.
97. Note: de Carvalho Et al., "On the welfare costs of business-cycle fluctuations and economic-growth variation in the 20th century and beyond," *Journal of Economic Dynamics and Control* 39 (2014): 62–78 mentions the 15-fold difference in welfare costs between the pre- and post-WWII periods, suggesting that Robert E. Lucas, *Models of Business Cycles* (Oxford: Blackwell, 1987) low loss estimates might be reasonable for his data.

Next, I present the upper bounds for average business-size estimates. Based only on average, I use Markov's inequality to provide a probability that the business size exceeds 100 employers. For the 1851 and 1861 censuses, the empirical likelihood of observing businesses with more than 100 workers in the data is 0.63% and 0.98%, respectively, as presented in Table 8. Markov inequality provides an upper bound, the probability that a company has more than 100 workers, which should not exceed 7.28% and 9.28%, respectively. Although the results for 1851 and 1861 are relatively low, emphasising that most of the data concentrated on small businesses, the 1871 and 1881 censuses show a more significant probability of being a firm with more than 100 workers. The likelihood of observing a large firm is 1.32% for 1871 and 1.59% for 1881, and their upper bounds are 10.69% and 11.84%, respectively. The more than tenfold difference between the empirical probability that a business will exceed 100 workers and the probability derived from Markov's inequality suggests a likely underrepresentation of large companies in the BBCE.

Moreover, Chebyshev's inequality highlights the significant difference between empirical and theoretical probabilities of deviating from the average firm size by more than 20 workers, as presented in Table 9. It amplifies large and medium businesses' much higher theoretical probability and their much lower empirical presence. However, there is a reason for that. Because the distribution is Pareto, significant deviations from the mean are rare, but when they occur, they are much larger than the inequality predicts. Another

reason for the difference between theoretical and empirical probabilities in Markov's and Chebyshev's inequalities could be the possible missing data of relatively large businesses. As a result, I compared censuses and found that before the 1881 census, the presence of large firms was much smaller. The increase in average firm size between 1851 and 1881 might be due to better coverage of large firms in that census. Using the *Weak Law of Large Numbers*, I show in Figure 20 that the growth of average size reported is primarily due to the presence of more large firms in the 1881 census rather than not a significant increase in the size of medium and small firms.

Lastly, I report the average business size using confidence intervals, applying both a simple *frequency approach* in Table 10 and maximum likelihood estimations (MLE) in Table 11. I plot my estimations along with Robert Bennett's and his coauthors' initial estimations in Figure 4. The reported confidence intervals include the initial firm size estimations, confirming the growing tendency. MLE method and frequency calculations yield approximately the exact confidence intervals except for the 1871 census when the MLE confidence intervals are more extensive. In sum, the new estimations using confidence intervals account for standard errors and extensive variance in data while also projecting the upper and lower boundaries of business size.

These results shed new light on previous estimations, providing more precise evidence of distribution, clearer lower and upper boundaries for average business size estimations, and highlighting disparities between theoretical and empirical probabilities of large businesses in the data. As large companies

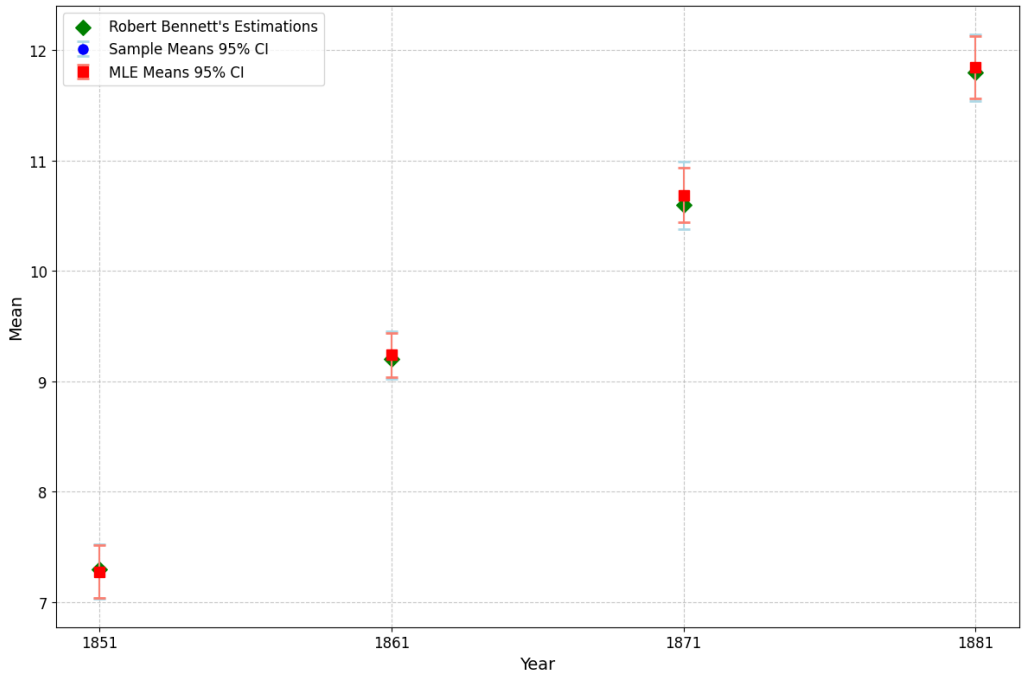


Figure 4: Comparison of Sample Means, MLE Means, and Estimates by Robert Bennett and Coauthors (1851 - 1881).

appeared to be underrepresented in the data before 1881, from a statistical perspective and based on the history of these censuses, I have adjusted the average business size according to their confidence intervals. The analysis also allows me to suggest a potential downward bias of following market concentration research, as large firms are underreported. As a result, the second phase of the British Industrial Revolution shows considerable growth in the average business size and an increasing number of upper-tail businesses, with less significant growth in small and medium firms. I now explore this heterogeneity when reporting local labour market concentration.

5.2 Local Labour Market Concentration, 1851-1881

5.2.1 Nationwide Market Concentration

The historical accounts highlight the role of large cities in facilitating changes in Victorian England. Towns, as noted by Engels, became large-scale labour markets rapidly.[98] Moreover, the rise of industrial cities degraded working conditions due to failures in providing public goods. In contrast, rapid urbanisation fuelled enormous business dynamism in the centres of the British Industrial Revolution, seemingly raising the number of new entrepreneurs. On the one hand, the growing population of cities led to a more significant dynamic of new entrants, as simple population growth facilitated the rise of entrepreneurs, which aligns, for example, with Michael Kremer's argument about technological advancements and population growth.[99] On the other hand, there are variations in city-level responses of entrepreneurs to population growth, as some markets are more dynamic. To explore how cities respond to population and entrepreneurial growth, I report the city-level differences in business dynamism starting from 1851.

On average, population growth boosted the rise of new entrepreneurs in the local labour markets. In 1851, the centres of industrialisation — Liverpool, Manchester, and Birmingham — were the largest by both population and entrepreneurs. In 1861, they also showed substantial growth in popula-

98. Engels, *The Condition of the Working Class in England*.

99. Michael Kremer, "Population growth and technological change: One million BC to 1990," *The Quarterly Journal of Economics* 108, no. 3 (1993): 681–716.

tion and entrepreneurs, maintaining this growth at the same level. However, a closer inspection of entrepreneurial growth shows its geographical skewness toward North and Central England cities. To emphasise that, I divide the markets into two categories: above and beyond the median dynamic of new entrants' growth. It broadly maps the more and less dynamic local labour markets, demonstrating their geographical distribution based on business dynamism. Figures 5 and Figure 6 show the concentration of the most broadly defined dynamic markets in Northwestern and Central England. At the same time, mapping highlights many cities that were not the geographical centres of the British Industrial Revolution but experienced business dynamism. As a result, I begin by exploring the distribution across local labor markets, examining how cities differ in their market concentration, and then move on to the distribution within labor markets.

The nationwide market concentration grew between 1851 and 1881, and cities experienced a catch-up rise in market concentration. Less dynamic local labour markets experienced a more substantial overall surge in concentration, while already concentrated markets did not face significant changes. *I present three types of evidence for this.*

First, I report the national-wide labour concentration growth between 1851 and 1881 in Figure 7. Market concentration steadily grew between 1851 and 1881.

Second, I analyze the differences between cities that were initially concentrated markets and those that first appeared in the census data after 1851,

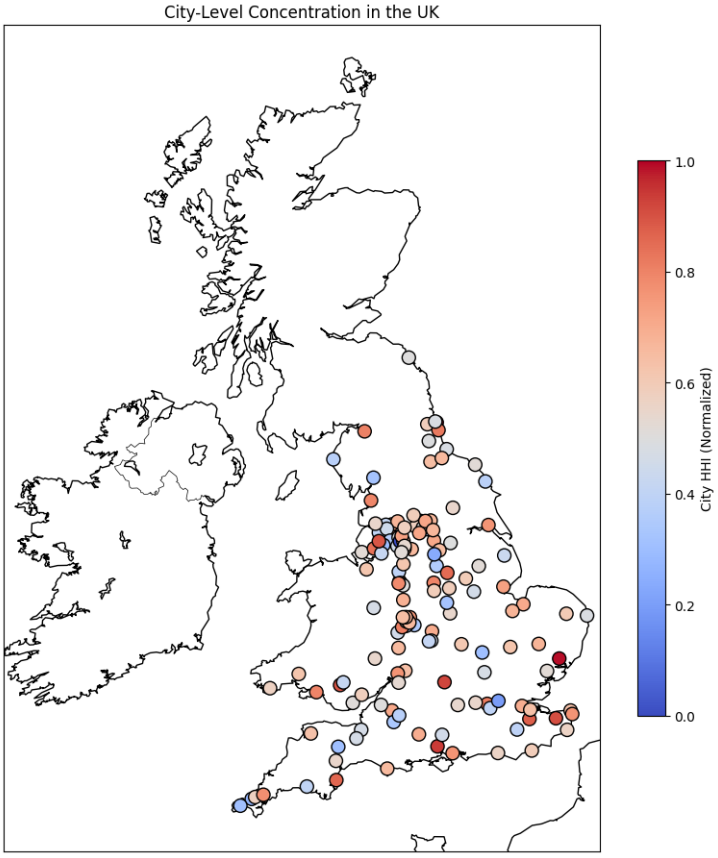


Figure 5: City-level Market Concentration, 1851.

as they experienced dramatic differences in later concentration dynamics in Figure 8. More concentrated cities in 1851 show a decrease in concentration, unlike other cities where it steadily increased.

Third, I present scatter plots in Figure 9 illustrating how a concentrated local labor market in 1851 correlates with further rising concentration in 1861 and 1871. The scatter plots demonstrate how the level of local labor

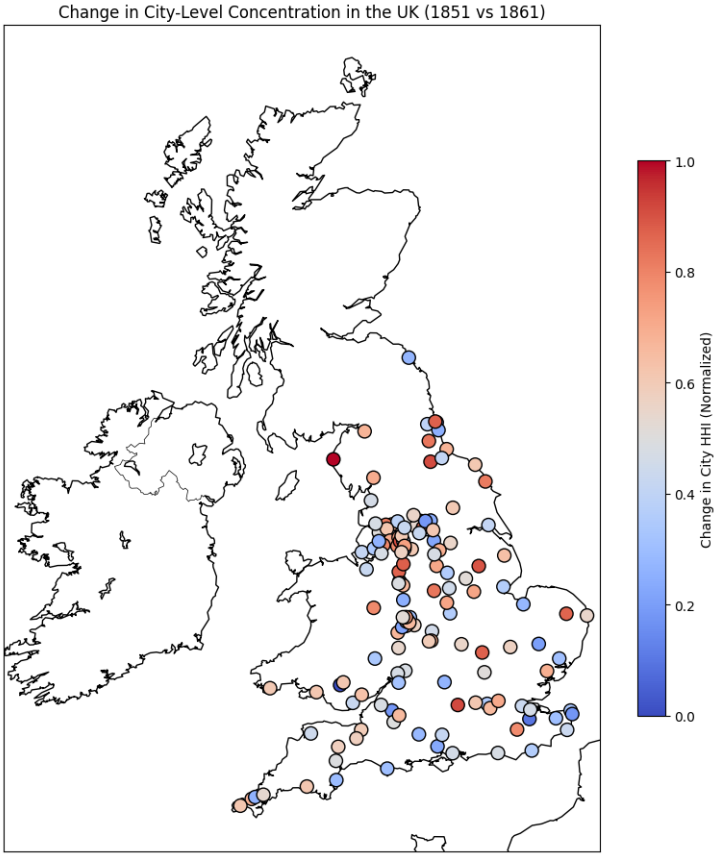


Figure 6: City-level Market Concentration Changes, 1851-1861.

market concentration in the previous year—whether more concentrated or not—predicts concentration in the following year. It turns out that only cities below the median in the previous year show a positive rise in concentration in the following year, referred as a *catch-up dynamic*.

These findings reinterpret the previously observed average increase in business size and new entrepreneurs, revealing the unequal distribution of

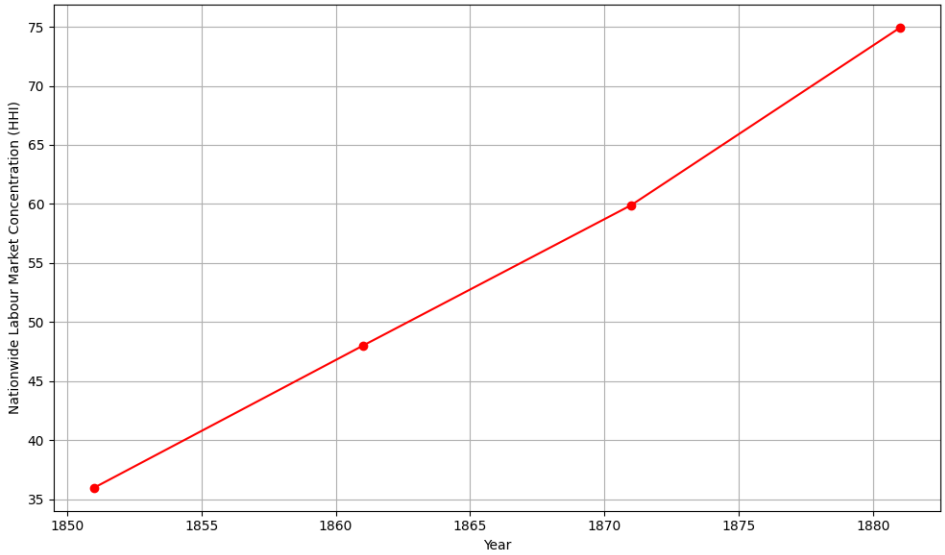


Figure 7: Nationwide Labour Market Concentration, 1851-1881.

new entrepreneurs between local labour markets and striking differences in concentration between already concentrated and others at the beginning of the second phase of the British Industrial Revolution. Next, I strengthen these findings by researching the concentration of the largest firms. As I have shown in the following two sections, they account for the growth in the average size, and they may also influence concentration dynamics.

The share of large businesses continues to increase nationwide even though more concentrated markets do not experience path-dependent growth in concentration. To elaborate, I report the dynamic of the top 1% of companies in the 10% largest firms nationwide for each census year between 1851 and 1881 in Figure 10. They grew steadily, accounting for more than 52%. Further-

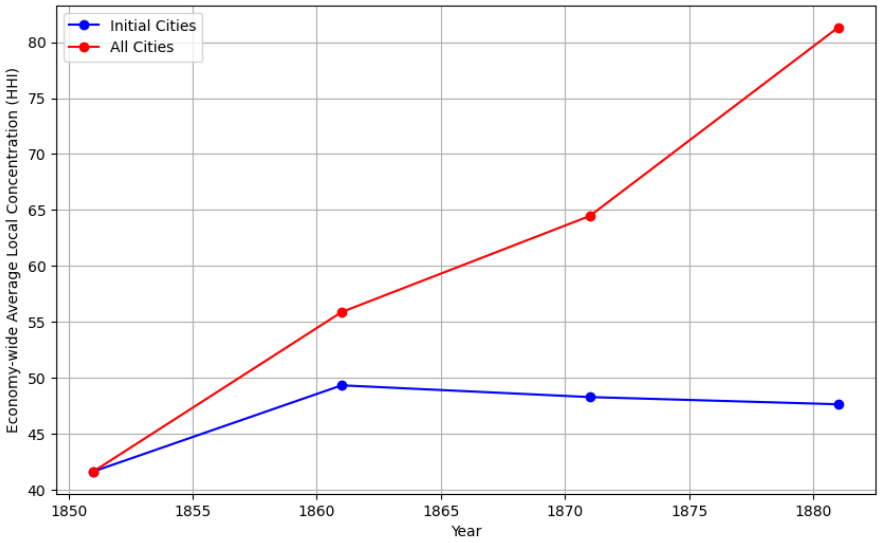


Figure 8: Differences Between Cities That Experienced a Rise in Concentration in 1851 and Others, 1851-1881.

Note: I use the 1851 census year as the initial year and crosswalk labor markets with entrepreneurs who appeared in the 1851 census across the 1861 and 1871 censuses (blue line). Afterward, I construct the measure of concentration for all cities except these blue line cities.

more, these businesses account for around 12% of nationwide employment, highlighting their relatively stable share between 1851 and 1881, as shown in Figure 25. These results are consistent with those obtained in the Business-Size Distribution, 1851-1881 section, demonstrating that the dynamics of top firms influenced the growth of average firm size and, consequently, their increased share of national employment.

To investigate the causes of rising market concentration nationwide, I use shift-share decomposition of the HHI index in Table 6. Shifts in sector employment highlight within-sector reasons, changes in the weight indicate

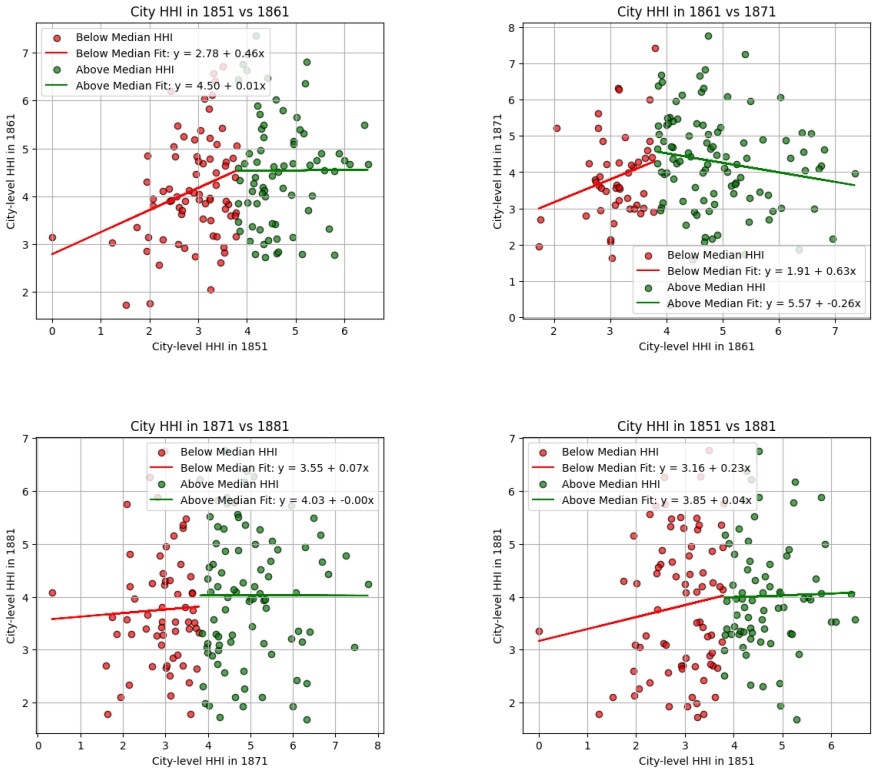


Figure 9: Market Concentration of Cities Below (red dots) and Above (green dots) the Median, 1851-1881.

sectoral-based shifts, and their covariance reflects their co-evolution.

Table 6: Shift-Share Decomposition of Nationwide Market Concentration, 1851-1881

Period	**Within Effect**	**Between Effect**	**Covariance Effect**
1851 to 1861	-6.3908	-0.3415	6.6994
1861 to 1871	-0.0185	-8.8603	9.1028
1871 to 1881	-1.0803	-1.0949	1.4947
1851 to 1871	-0.0413	-0.3231	0.7155
1851 to 1881	-0.7050	-4.1922	4.8225

Analysing market concentration, I began with a simple notion from the

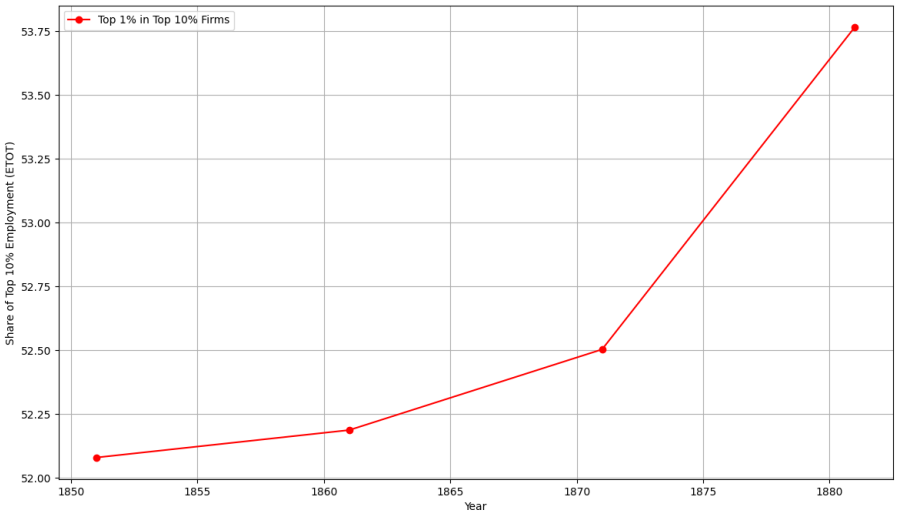


Figure 10: Top 1% within the Top 10%, 1851-1881.

literature: the association between population and entrepreneurial growth, as they tend to correlate with population and technological development. But is this growth in entries equal across different labour markets? No, I have demonstrated three uneven growth facts: the rise of market concentration, the catch-up dynamic between local labour markets, and the increasing share of top businesses in national employment. The next part describes the concentration within local labour markets and the causes of this dynamic.

5.2.2 Local Labour Market Concentration

As nationwide market concentration doubled between 1851 and 1881, it amplified the rise in concentration measured at a broader national level, as shown in Figure 10. In addition, the city-level market concentration has risen over time, with the centres of the British Industrial Revolution showing

less concentration growth compared to other areas. The differences between local labour markets generally confirm the catch-up dynamic of market concentration, as less concentrated cities became concentrated more quickly. In addition, the shift-share decomposition revealed a high level of reallocation between sectors as a source of rising concentration. However, these calculations do not clearly show how market concentration evolved locally, as opposed to the national level, nor do they confirm the usual facts about labor share and market concentration.

To further investigate it, I report local labour market concentration and its shift-share decomposition. Figure 11 show that local market concentration grew steadily between 1851 and 1871, and declined from 1871 to 1881. Labor share growth began in 1871, coinciding with the decline in local labor market concentration. Prior to this, the growth in concentration was supported by a decline in labor share, as predicted by the literature.[100] Table 7 shows the decomposition of local concentration, where the within effect is the most influential factor for both the decline and rise of market concentration.

Table 7: Shift-Share Decomposition of Local Labour Market Concentration, 1851-1881

Period	**Within Effect**	**Between Effect**	**Covariance Effect**
1851 to 1861	775.1721	215.2700	14.2056
1861 to 1871	1920.2119	-2.0667	59.9218
1871 to 1881	-3029.5582	224.0193	-52.3273
1851 to 1871	2467.4438	126.0802	73.2154
1851 to 1881	1159.2410	723.9999	159.7629

100. Autor et al., "The Fall of the Labor Share and the Rise of Superstar Firms."

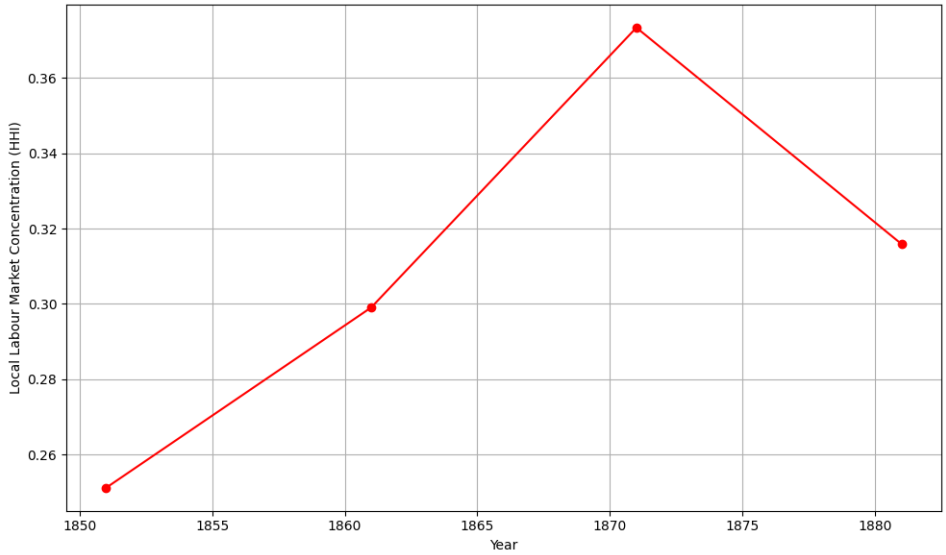


Figure 11: Local Labour Market Concentration, 1851-1881.

Since the changes in concentration primarily originated from within local labor market dynamics, it is reasonable to further explore their business dynamism. I present the business dynamism facts in the next subsection.

So far, this study has discussed results related to labour market concentration on two levels: nationwide for England and Wells and local labour markets, as outlined in the methodology. Despite the literature primarily considering the second phase of the British Industrial Revolution relatively equal, the results show a surprising heterogeneity across different sectors and cities, which is robust in various specifications. The uneven distribution of growth, related to the rising population and proportional increase in the number of entrepreneurs, is more pronounced at the local level and across cities with lower initial business dynamism. The causes for the rising market

concentration have varied over time. The decline in concentration experienced between 1871 and 1881 coexisted with the beginning of the rise in labor share. However, they are primarily associated with the significant covariance effect, as the sectors with rising local labour concentration have also experienced rising employment share. It explains why the labour share has grown along with the rising concentration. The following section will explore the business dynamism during the second phase of the British Industrial Revolution (1851-1911).

5.3 Business Dynamism, 1851-1911

The term' business dynamism' typically refers to the growth, entries, exits, and other dynamic properties, such as the age of firms. Even though, on average, firms are stable over time and exhibit stable distribution, there is a significant heterogeneity and dynamism among them. Creative distraction, or churning, defines how growth is associated with the perturbations of firms and how, surprisingly, both job creation and job distraction could lead to benefits.[101]

A much-debated question is whether market concentration lowers business dynamism. The second phase of the British Industrial Revolution provides a well-defined example of steadily rising output and real wages. Consequently, it should offer a clear answer to the question: Is business dynamism essential

101. John Haltiwanger, "Job creation and firm dynamics in the United States," *Innovation Policy and the Economy* 12, no. 1 (2012): 17–38.

for facilitating stable economic growth? As I have shown in the previous sections, market concentration was rising widely between 1851 and 1881, and it indeed provided characteristics of business dynamism as less concentrated local labour markets caught up in concentration. I will report facts about business dynamism to understand market concentration and labour share dynamics below.

Business dynamism has increased from 5.6% to 14.5% between 1851 and 1911. As measured by the entry rate in Figure 12, before 1881, business dynamism steadily declined, reaching a low of 4.1% in 1871. However, after 1871, there was a boom in the share of new entrants, coinciding with the rise, as mentioned earlier, of labour share. While business dynamism highlights certain tendencies on average, I also report other trends of businesses during the second phase of the British Industrial Revolution. The following questions the *business dynamism facts* that I explore:

- How often did firms exit the market, differentiated by age?
- How often did firms exit the market, differentiated by age? Did the businesses become more stable over time?
- Lastly, from which part of the distribution does employment growth originate?

First, most businesses exited the market within their first ten years. I construct a measure of the relative age of a business if the timeline for all companies began in 1851 in Figure 13. Most businesses exit the market

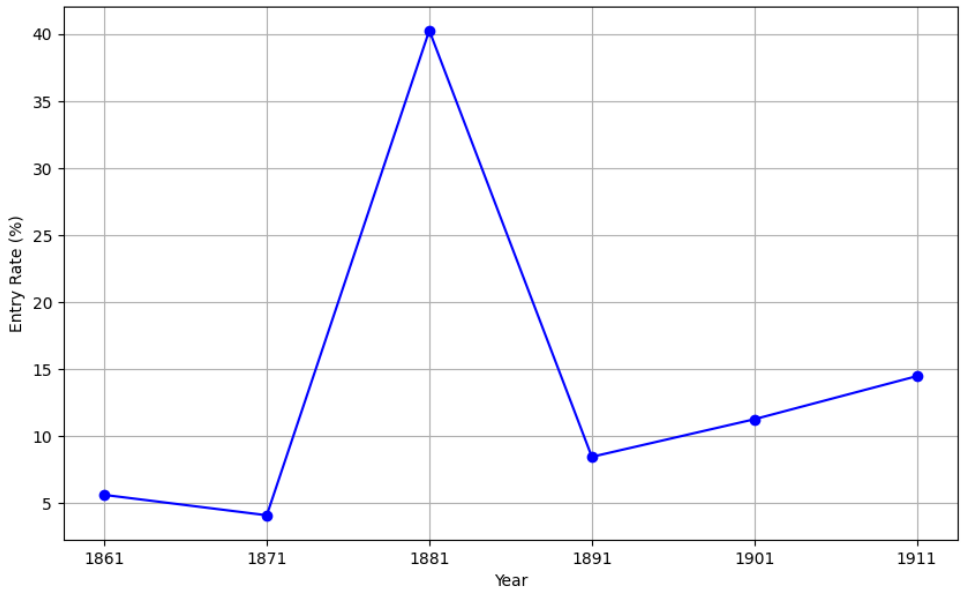


Figure 12: Entry Rate (%) 1851-1911.

within their first ten years, and these patterns are consistent for both sole proprietorships and businesses with employees.

Second, the average age of the businesses grew from 2.3 years in 1871, reaching 5.6 years by 1911, as shown in Figure 14. Starting with a low average age of companies by design, the age increases over time, but not as significantly as one might predict. This association is also robust for both types of entrepreneurs and demonstrates a massive perturbation of businesses.

Third, employment growth initially came from small businesses; however, between 1861 and 1881, the number surprisingly shifted to firms with more than 50 employers, as depicted in Figure 15. This empirical finding contradicts the literature, as conventional wisdom suggests that net job creation primarily comes from small firms. There could be plenty of explanations,

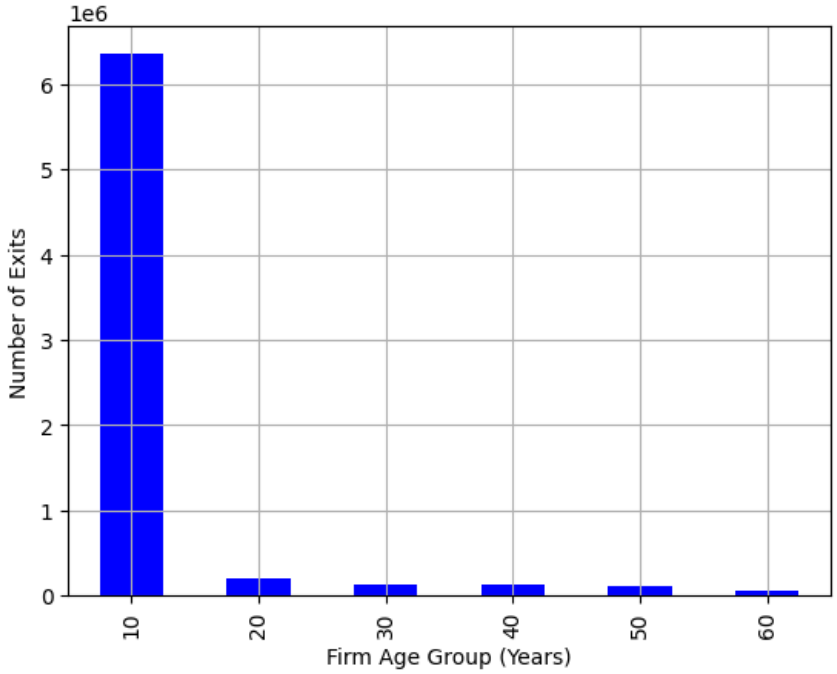


Figure 13: Firm Exits by Age Group, 1851-1911.

and I stress that the rise of fixed costs moved the net job creation to the medium firms. This shift remains robust when controlling for the relative age of business.

These tendencies highlight the substantial business dynamism between 1851 and 1911 and the surprisingly low initial levels of average size, age, and rates of entries and exits. The business dynamism significantly improved starting from 1871, evidently from entry and exit statistics and the age of businesses. However, the second phase of the British Industrial Revolution was associated with unprecedented job creation and distraction levels and much lower firm maturity levels than contemporary observations. To investi-

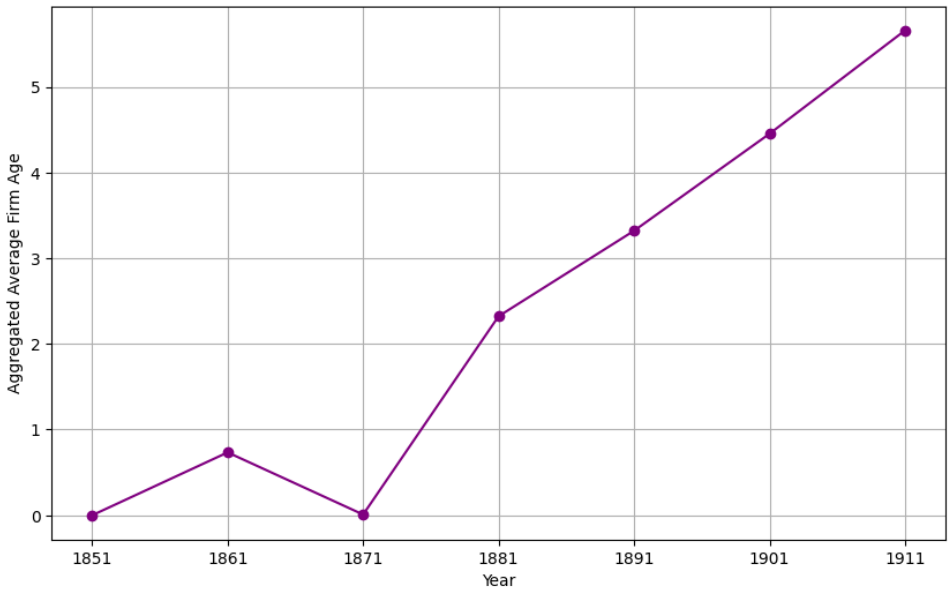


Figure 14: Aggregated Average Firm Age, 1851-1911.

gate the causes of the observed business dynamism, I highlight how creative distraction, defined as the shrinking and exiting of incumbents, influences entries and exits in these local markets.

To illustrate the impact of *incumbents' distraction* on entry and exits in local labour markets, I use a counterfactual increase in the standard deviation (SD) of exited incumbents by one SD. The counterfactual scenario results in an average effect of 0.5 SD in new entrants for 1851, 1861, and 1881, with reported no significant impact for 1871. In other words, doubling the number of incumbent exits results in a 50% increase in entries. The effect is robust for another specification with 17 economic sectors instead of 51. As a result, the counterfactual illustrates how creative distraction contributes to enormous business dynamism, measured by entry rate, in the local labour markets.

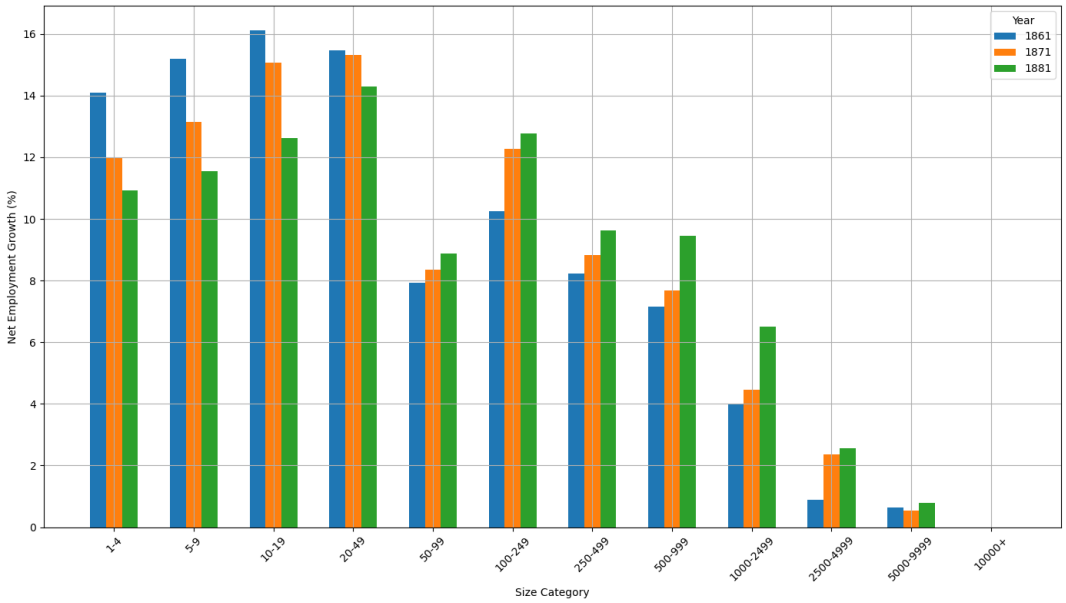


Figure 15: Net Employment Growth by Size, 1851-1881.

Thus far, I have reported three types of results. First, I have described the previous results of average firm size estimations from the BBCE data, highlighting the possible biases in those results and improving the estimations using confidence intervals. Second, I estimated local labour concentration between 1851 and 1881, uncovering the significant concentration growth and notable heterogeneity of businesses and regional labour markets. Third, I highlighted a possible mechanism behind this concentration dynamic - business dynamism - and quantified how creative distraction is essential for understanding such a significant increase in business dynamism starting from 1871. Now, discussing my results, I will describe how local labour market concentration and business dynamism relate to labour share.

5.4 Discussion and Limitations

As Kwon, Ma, and Zimmermann emphasise the lack of research on increasing labour share and market concentration dynamics, I address this gap in my dissertation.[102] Market concentration does not contradict the rise of labour share, as the dynamic after 1871 shows. Consequently, the market concentration, especially in local labour markets, could rise in both decline and rise of labour share. The more critical mechanism to facilitate long-run economic growth is seemingly the business dynamism and maturity of the firms, as improvement of those co-moves with increasing labour share. The mechanism, which interestingly accounts for a portion of business dynamism, is the creative distraction, defined as the shrinking of incumbents.

The theoretical mechanism that could account for both the decline and rise of labour share coexisting with increasing market concentration is uneven growth, where the catch-up in concentration is primarily related to seizing economic opportunities rather than depressing wage income and raising markups, as predicted by Autor et al.[103] I develop the intuition of this mechanism in the introduction.

However, my dissertation has data-related *limitations*, which I discuss below. The census data provides the near population data, and with the discussion of census data itself, it has many advantages. However, it does not allow

102. Kwon, Ma, and Zimmermann, "100 Years of Rising Corporate Concentration."
103. Moll, Rachel, and Restrepo, "Uneven Growth: Automation's Impact on Income and Wealth Inequality"; Autor et al., "The Fall of the Labor Share and the Rise of Superstar Firms."

for high-frequency identification, as censuses have been issued only every ten years by design. In this case, it is hard to disentangle causal relationships between variables and identify an effect beyond simple co-movement. In addition, the census data have many advantages for panel data research, and there are many implications. Nevertheless, using the historical census, there is a high degree of uncertainty regarding respondents' answers, which reasonably avoids high-dimensional panel data methods such as LASSO. Lastly, it is hard to approach the most popular identification strategies, such as difference-in-difference in such time-frames between observations, as assumptions of parallel trends probably will not be fulfilled.

6 Conclusion

Given the research question of incorporating local labour market concentration with labour share dynamics in the theories of the British Industrial Revolution, my dissertation has shown robust concentration growth in the second phase of the British Industrial Revolution. As in the literature, this period is considered relatively equal regarding aggregate growth; I show a mechanism of uneven growth as employment shifts to larger businesses in the local labour markets. Firm size distribution, market concentration, and business dynamism facts explain how labour share started growing stably in 1871 and how heterogeneous growth is. Businesses began to become more stable after 1871, not only extensively entering the market but also increasing

in age and size.

The labour share began to grow when 1) local labour market concentration declined, 2) extensive business dynamism and reallocation rates, and 3) nationwide market concentration continued to grow. As I explained in the Introduction, the booms in labour share triggered uneven growth, as the concentration of nationwide and top businesses did not change between 1871 and 1881. The busts in labour share depress the entrants and lower the age of businesses, causing early exits. Creative destruction explains why the boom in labour share starting from 1871 caused excessive reallocation. As a result, I link the size of firms, market concentration and business dynamism in one framework to explain the British Industrial Revolution.

The natural progression of this work would be to extend the time period back to the 17th century, to the beginning of the British Industrial Revolution. The trade directories for England and Wales will serve as valuable sources for this purpose, as they provide insights into the business dynamism within local labor markets. I believe these facts are underestimated for understanding the causes and mechanisms of the Industrial Revolution.[104]

104. Special Collections University of Leicester, *Trade and local directories for England and Wales from the 1760s to the 1910s*, https://specialcollections.le.ac.uk/digital/collection/p16445coll4, Accessed: September 2, 2024, 2024.

A Appendix: Robustness checks

A.1 Business-Size Distribution, 1851-1881: calculations

To begin with, I plot CDFs and CCDFs for 1851, 1861, 1871, and 1881 firms size distribution, using the function as follows:

$$\overline{F}(x) = P(X > x) = \int_x^{\infty} f(t)\, dt = 1 - P(X \leq x) = 1 - F(x) \qquad (18)$$

where:

- $f(x)$ is the probability density function (PDF), and $F(x)$ is the cumulative distribution function (CDF).
- The probability that the random variable X has a realization larger than x is $P(X > x) = F(x)$.
- The probability density function is given by $f(x) = -\overline{F}'(x)$.

Using these relationships between distribution functions, I have plotted the CDFs and CCDFs below.

Next, I calculate the PDFs for 1851, 1861, 1871, and 1881. First, I report the initial Pareto-style PDFs.

Second, I use the concept of a frozen PDF to compare them across years.

To investigate the coverage of BBCE data, I apply the Weak Law of Large Numbers and report the results below.

To provide evidence of Zipf's law of firm size, I use three specifications. The first is based on Axtell's paper and applies OLS regression in the following specification:

$$\log(i - \gamma) = b - \delta \log a_i + \nu_i \tag{19}$$

where γ is a shift parameter.[105]

Based on this OLS specification, I construct Zipf's law graphs for 1851, 1861, 1871, and 1881 below.

The second specification is an empirical plot of ranks against frequencies of the firm size distribution, as reported below.

The third specification is to plot the empirical distribution against the exponential distribution to reject the hypothesis of an exponential nature of the firm size distribution.

Lastly, I report the values used to construct confidence intervals in Figure 4. Table 8 summarizes the upper-bound calculations based on Markov's equation. In addition, Table 9 highlights the results based on Chebyshev's equation. Table 10 reports a frequentist approach to constructing confidence intervals. Table 11 presents the values calculated using Maximum Likelihood Estimations.

Table 8: Table of Mean Firm Size, Empirical Probability, and Markov's Bound for 1851-1881

Year	**Mean Firm Size**	**Empirical P(Size $\geq$ 100)**	**Markov's bound**
1851	7.2769	0.0063	0.0728
1861	9.2375	0.0099	0.0924
1871	10.6862	0.0132	0.1069
1881	11.8432	0.0159	0.1184

Table 9: Table of Mean Firm Size, Variance, Empirical Probability, and Chebyshev's Bound for 1851-1881

Year	**Mean**	**Variance**	**Empirical P(Size$\geq$ 20)**	**Chebyshev's bound**
1851	7.2769	3060.3629	0.0319	7.6509
1861	9.2375	2056.4645	0.0400	5.1412
1871	10.6862	3213.3362	0.0453	8.0333
1881	11.8432	4145.8936	0.0502	10.3647

Table 10: Table of Sample Mean, Sample Variance, and Standard Error using the Frequency Approach for 1851-1881

Year	**Mean**	**Variance**	**Standard Error (SE)**
1851	7.2769	3060.3629	0.1238
1861	9.2375	2056.4645	0.1083
1871	10.6862	3213.3362	0.1525
1881	11.8432	4145.8936	0.1511

Table 11: Table of MLE Mean (μ), MLE Variance (σ^2), and Standard Error (SE) using Fisher Scoring for 1851-1881.

Year	**MLE Mean (μ)**	**MLE Variance (σ^2)**	**Standard Error (SE)**
1851	7.2769	3060.3476	0.1238
1861	9.2375	2056.4528	0.1014
1871	10.6862	3213.3130	0.1262
1881	11.8432	4145.8707	0.1440

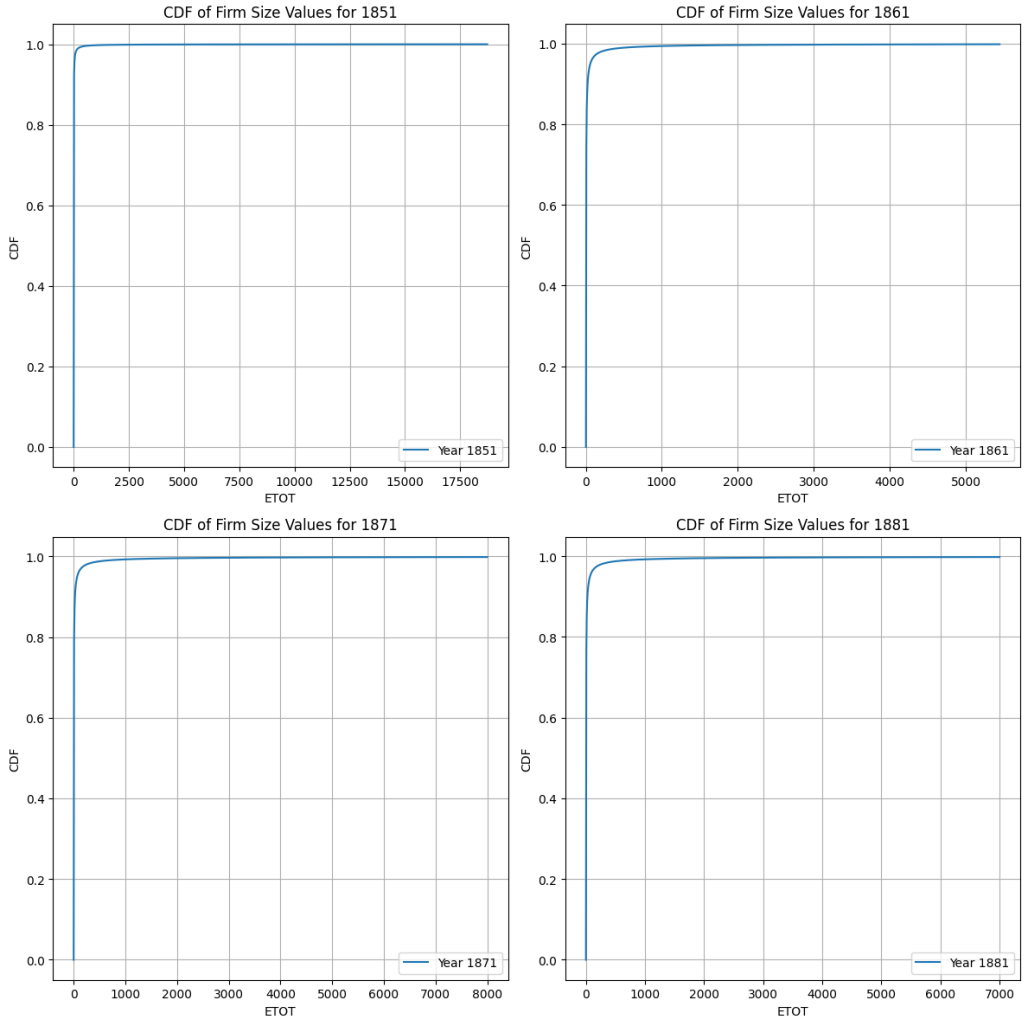


Figure 16: CDFs Functions of Firm Size for the 1851, 1861, 1871, and 1881 Censuses.

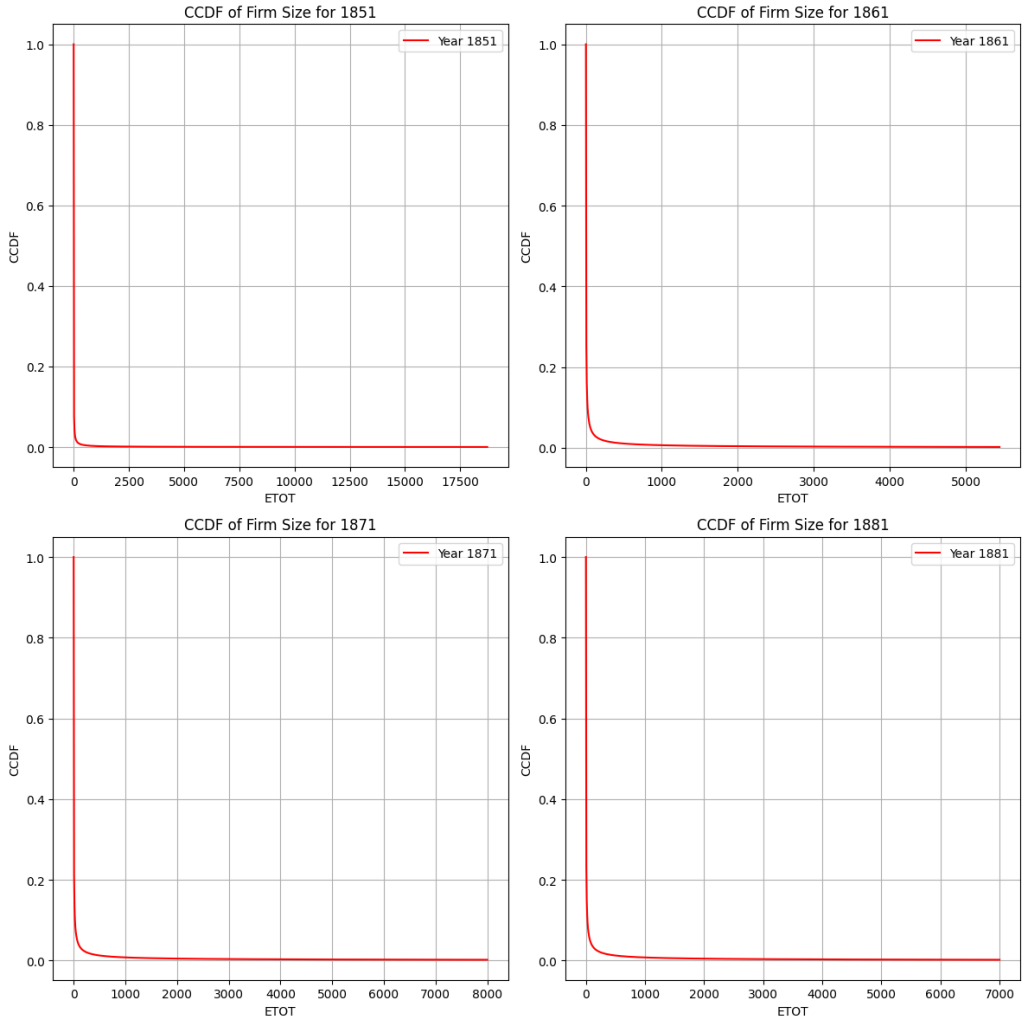


Figure 17: CCDFs Functions of Firm Size for the 1851, 1861, 1871, and 1881 Censuses.

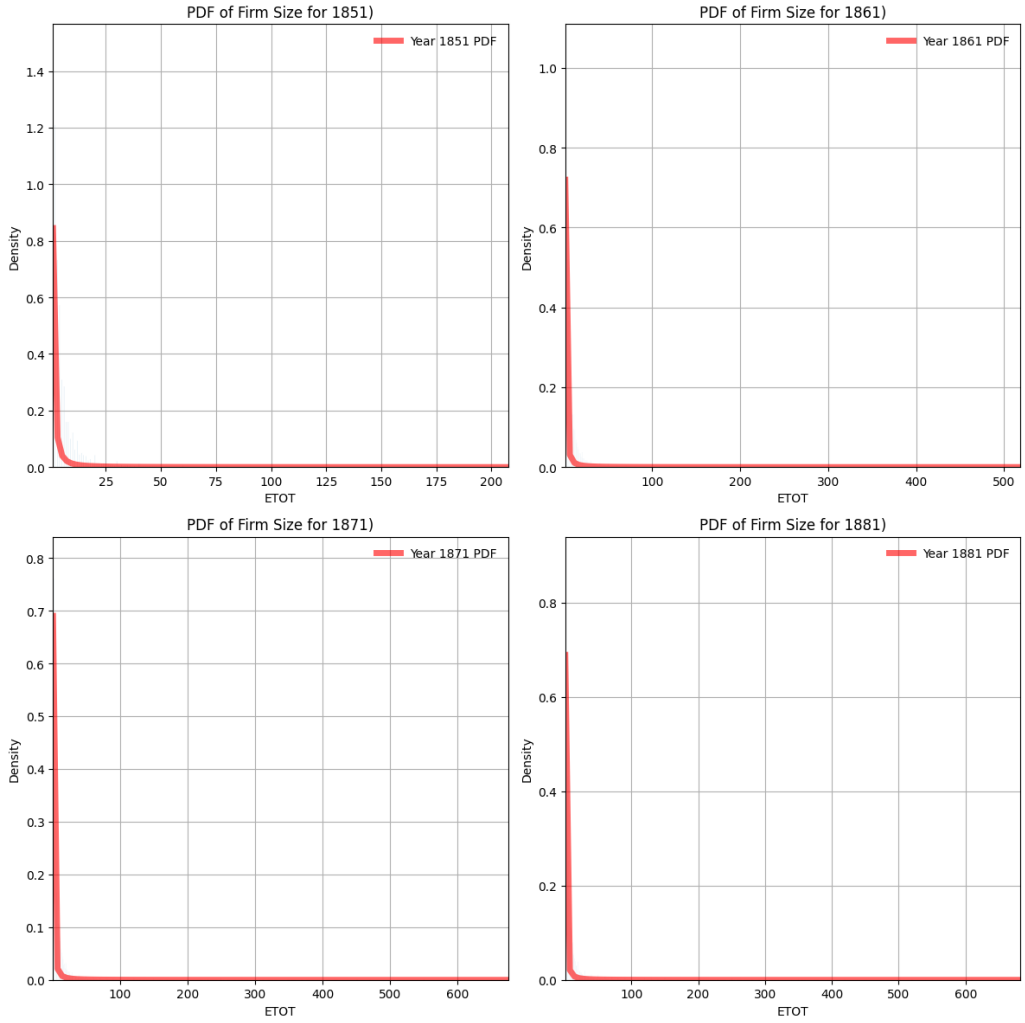


Figure 18: PDFs Functions of Firm Size for the 1851, 1861, 1871, and 1881 Censuses.

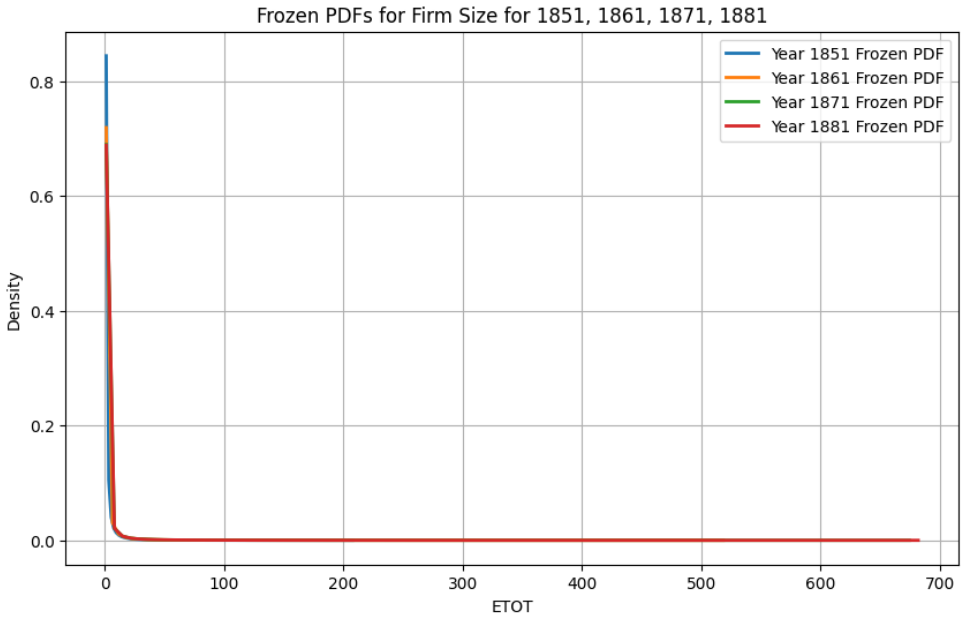


Figure 19: Frozen PDFs Functions of Firm Size for the 1851, 1861, 1871, and 1881 Censuses.

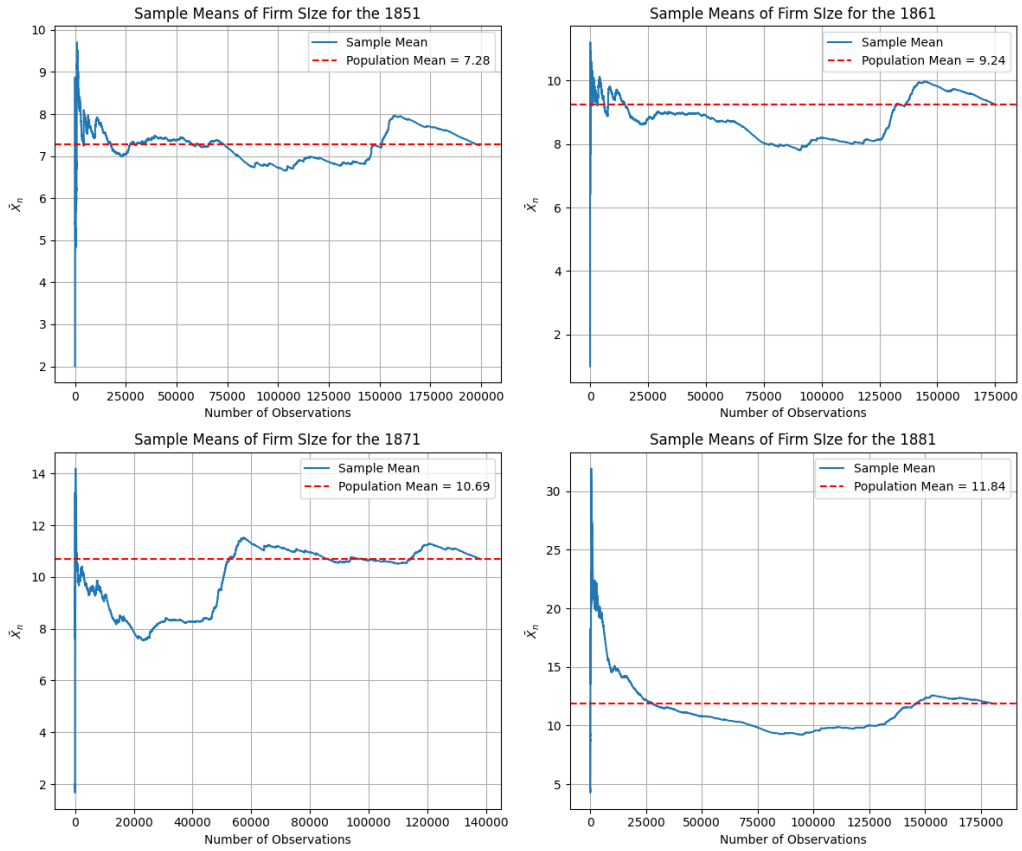


Figure 20: Sample Means of Firm Size for the 1851, 1861, 1871, and 1881 Censuses.

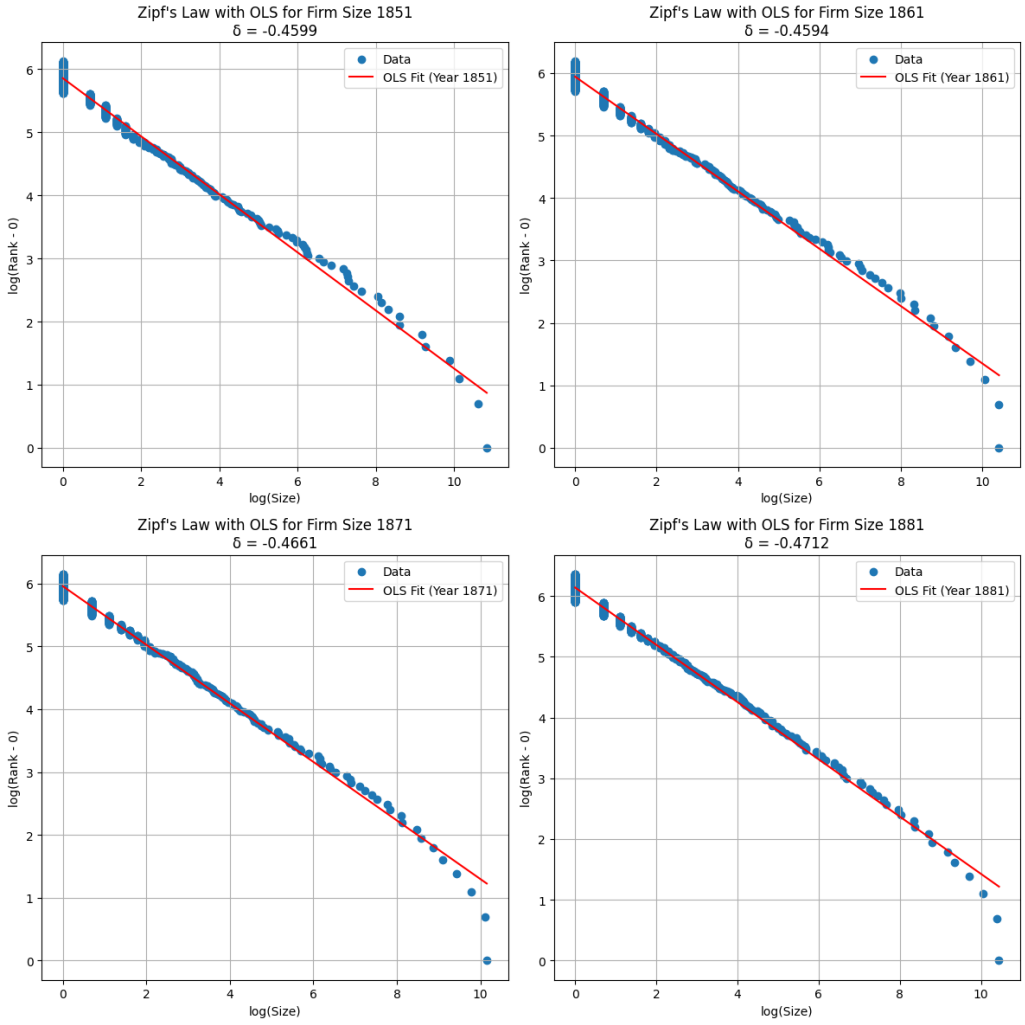


Figure 21: Zipf's Law of Firm Size for the 1851, 1861, 1871, and 1881 Censuses (Axtell's Check).

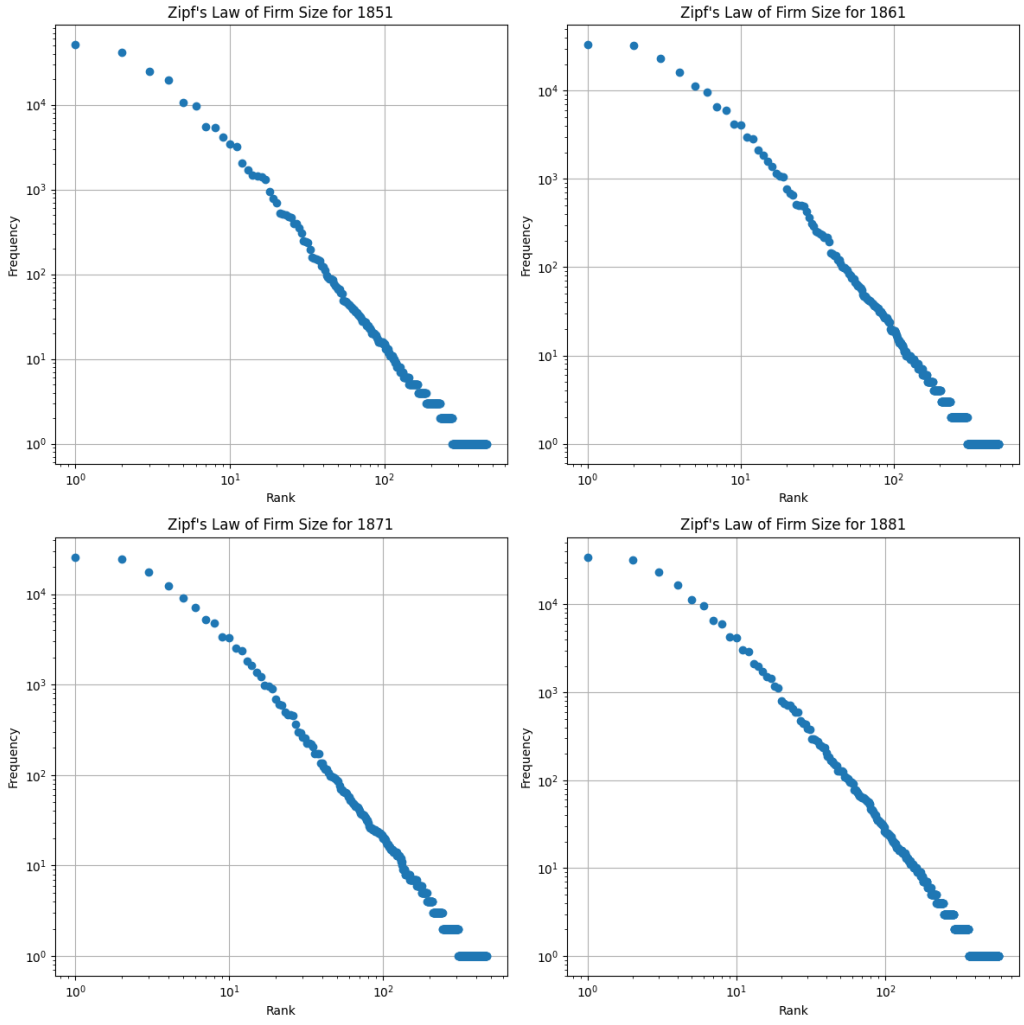


Figure 22: Zipf's Law of Firm Size Using Ranks Against Frequencies for 1851, 1861, 1871, and 1881 Censuses.

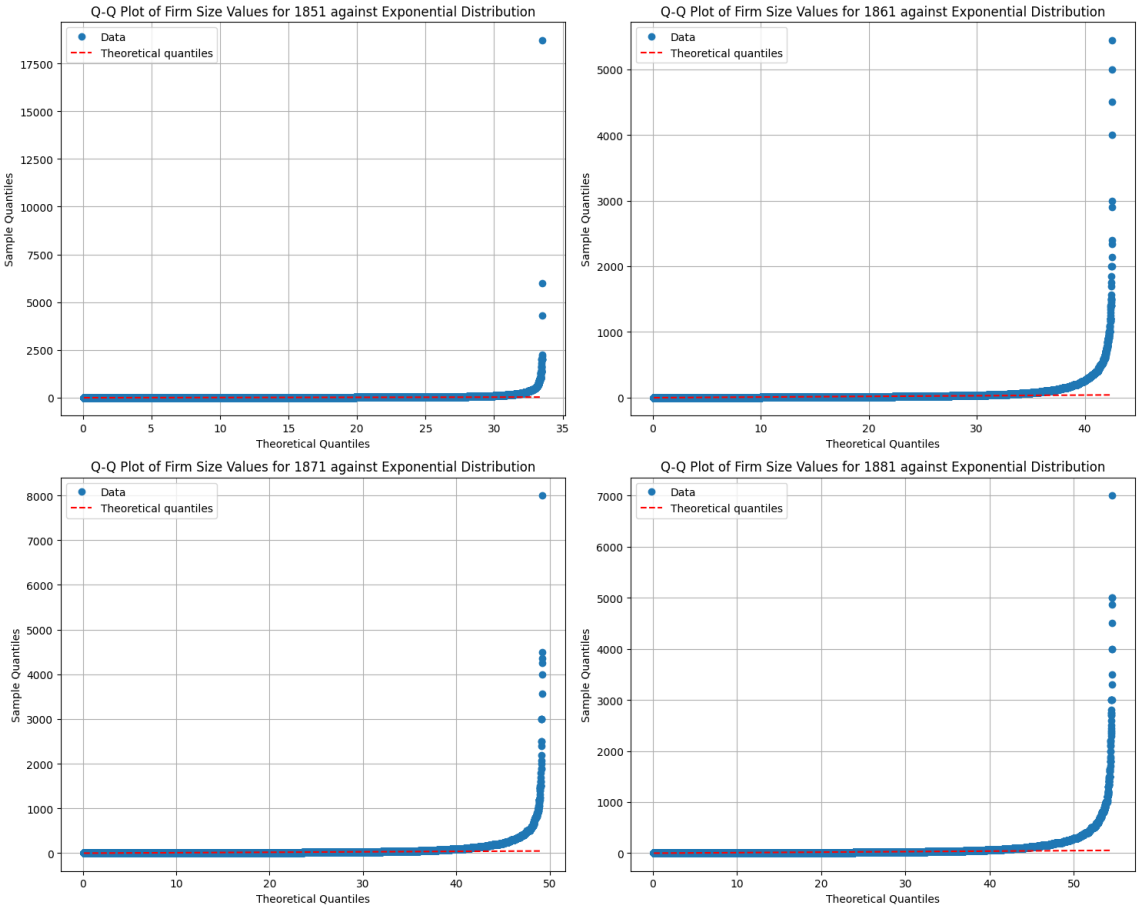


Figure 23: The Empirical Distribution Compared to the Theoretical Exponential Distribution for 1851, 1861, 1871, and 1881 Censuses.

A.2 Local Labour Market Concentration: additional calculations

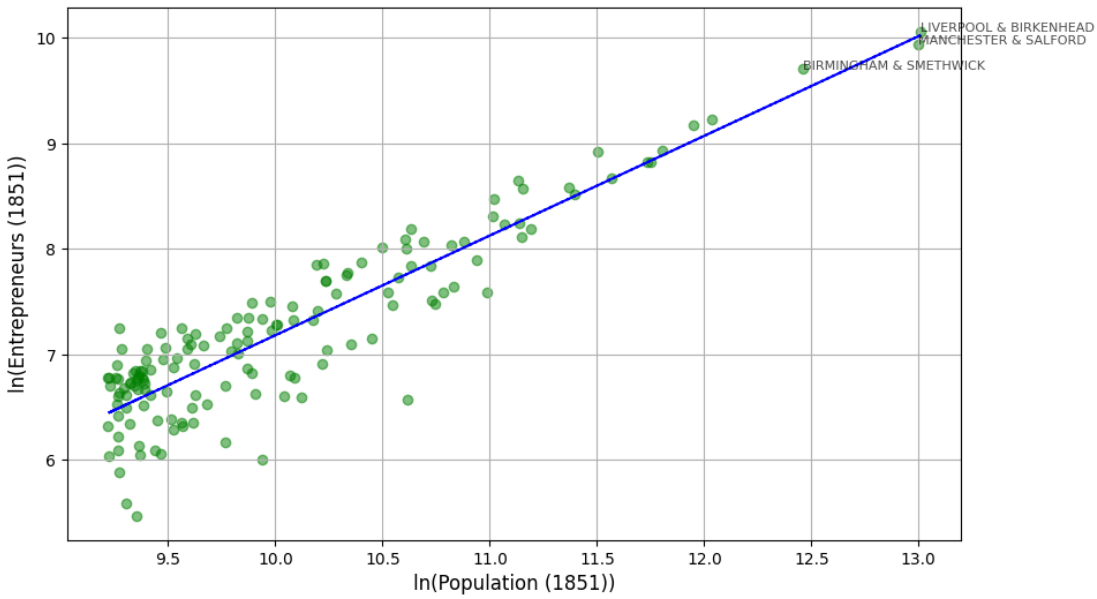


Figure 24: Cross-Sectional Association Between Population Growth and New Entrepreneurs (Excluding London), 1851-1861.

Note: The correlation is 0.63. Regression specification: y = 0.43x + 3.71, R2 = 0.40.

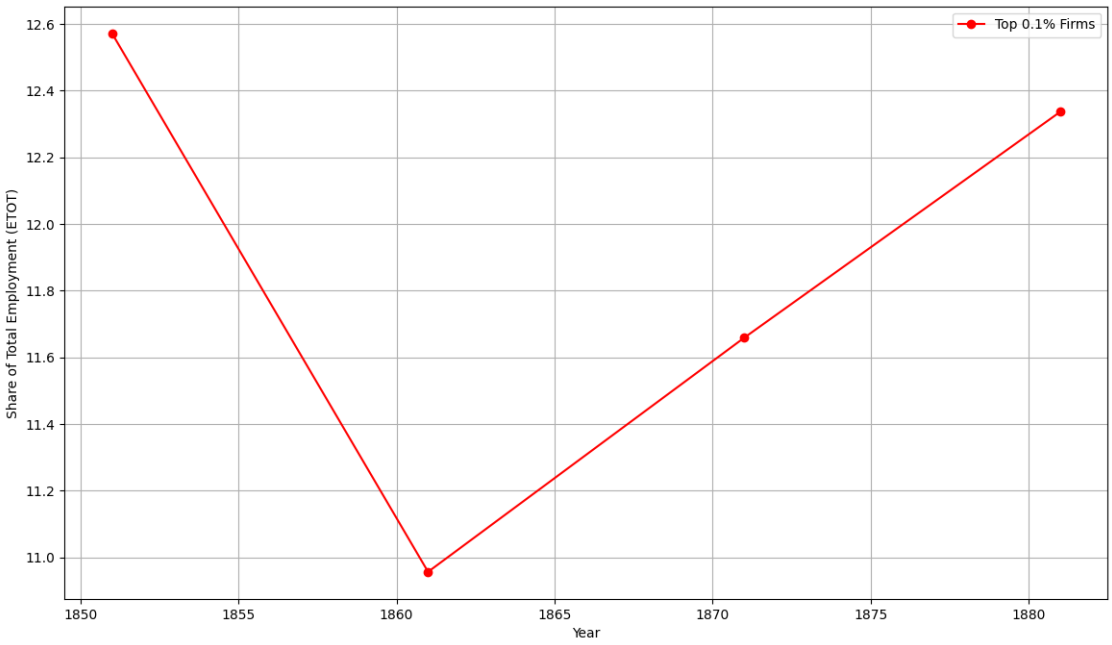


Figure 25: Share of Employment by the Top 0.1% of Businesses, 1851-1881.

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