Tuesday, March 4, 2025
Access the code, data, and analysis at https://github.com/j-jayes/who-is-who-etl and https://github.com/j-jayes/Swedish-annual-reports-archive

Technocrats to Tycoons

The Shift in Swedish Corporate Leadership and Its Economic Consequences in the 20th century

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I. Introduction

Swedish industry in the early twentieth century relied heavily on manufacturing and an engineering-driven mode of growth. Factories producing steel, machinery, and electrical equipment powered the country's economic ascent, transforming a relatively small market into an advanced industrial base. Returning Swedish engineers who had acquired professional experience in the United States and in continental Europe played a central role in this process, bringing home technical expertise and managerial innovations from firms abroad. Their dual exposure to American production methods and Swedish industrial traditions positioned them as agents of technological transfer. Over time, these individuals rose to influential positions on corporate boards, where their training and international outlook could shape strategic decisions, particularly regarding the adoption of new technologies and the management of labor forces.

Their presence influenced changes in Swedish corporate governance. Boards composed of both technically trained and finance - or business - trained directors held considerable sway over how enterprises balanced growth, employment practices, and profit objectives. This has prompted questions about how different compositions—especially the inclusion of internationally seasoned engineers—might steer a firm's financial indicators and workforce size. By comparing the impact of directors with engineering backgrounds to those primarily versed in business and finance, it becomes possible to assess whether foreign technical experience confers distinctive advantages or leads to specific patterns in labor utilization.

The goal of this paper is to understand how the presence and network influence of U.S.-experienced engineers on Swedish boards affected firms' financial performance and the evolution of their workforces. The analysis spans a century from the late 1800s through 1980, focusing on indicators such as revenue per employee to capture productivity changes. It also investigates whether the effect differs for director groups with alternative skill sets. Taken together, these inquiries draw upon debates in economic history around corporate governance, and labor and employment scholarship. They benefit from a newly compiled data set that digitizes historical company information and applies bipartite network methods to track inter-firm linkages via shared board members. This methodological approach underscores the novelty of integrating both firm-level performance metrics and detailed board composition data to examine the diffusion of innovation and its impact on employment.

To situate these contributions, the paper begins with II. a review of prior scholarship on returning engineers, board composition, and technical change as it relates to industrial employment. It then turns in III. to a detailed description of the data sources, focusing on firm financial reports, director biographies, and the strategies used to overcome issues of incomplete coverage and digitization errors. In IV., an outline of the empirical method follows, explaining how the regressions, network modeling, and key variables have been structured to address potential confounders. In V., the main analysis, the paper currently includes some descriptive statistics, presents a network visualizing relationships between firms,from shared directors, and discusses regression results assessing whether American-trained engineers influenced firm outcomes. A placeholder remains for the final findings, after some next steps are explained.

II. Literature Review

Engineers and Technological Change in Swedish Industry

Engineers played a pivotal role in Sweden's rapid industrialization and the management of its early 20th-century firms. As Sweden's industries expanded in technical complexity (steel, electrification, machinery), professional engineers increasingly assumed top managerial roles (Högfeldt 2005). Many large firms by the 1920s were run by engineer-CEOs with significant autonomy, reflecting the technocratic character of Swedish industry, as argued by Högfeldt (2005). Business historians note that engineers dominated executive positions in Sweden's biggest firms, especially in industrial sectors – highlighting the historical importance of technical training in corporate leadership (Henrekson, Lyssarides, and Ottosson 2021). This contrasts with some other countries where legal or financial elites held sway; in Sweden the engineering profession emerged as a powerful elite driving industrial growth, according to Henrekson, Lyssarides, and Ottosson (2021).

A distinctive feature of Swedish industrialization was the influence of engineers who trained or worked abroad, particularly in the United States. Studies of return migration find that a "brain gain" occurred: a majority of Swedish engineers who went to the U.S. (or Germany) for experience later returned home, bringing valuable knowledge (Grönberg 2003). Per-Olof Grönberg's thesis (2003) shows these returnee engineers diffused advanced technologies and organizational innovations into Swedish firms during the country's "second industrial breakthrough", as coined by Lars Magnusson (2014). They not only introduced new technical expertise but also modern management practices – notably Taylorist efficient workflows and corporate welfare programs learned in America, according to Grönberg (2003). For example, at electrical firm ASEA and steelmaker and later engineering services firm Sandvik, foreign-trained engineers filled many key positions, injecting know-how that rationalized production and improved productivity. Grönberg (2003) focuses on four important companies in Sweden, due to the availability of detailed records at the time. By the early 1900s Swedish industry actively encouraged this knowledge transfer: contemporary observers remarked that American and German experience became a form of "symbolic capital" that boosted engineers' influence in firms (Grönberg 2003). Case studies confirm that returning engineers were catalysts for technology diffusion – from mining equipment to electrotechnical systems – adapting foreign innovations to domestic needs. Engineer-entrepreneurs and internationally trained technologists were central to Sweden's technological adoption and industrial leadership in the first three-quarters of the 20th century.

Grönberg (2003) documented specific instances of how engineers spurred technological change. For example, Hugo Hammar (an engineer-CEO of shipbuilder Götaverken) used political and donor networks to fund naval technology experiments, illustrating how engineering know-how combined with savvy management advanced key industries. Swedish engineers abroad often studied cutting-edge methods and upon return to Sweden implemented them – such as advanced steel processes or automotive designs – in the firms in which they ended up. This "reverse technology transfer" was a key mechanism for Sweden's industrial upgrading, as engineers brought back not just blueprints but also new organizational structures and quality control systems. Grönberg notes that engineers coming back from U.S. firms frequently brought home a welfare capitalist ethos (company housing, worker benefits) along with efficiency methods. The impact of these returning engineers on firm performance and workforce dynamics, however, remains underexplored.

Board Composition and Corporate Governance

Historically, Sweden's corporate governance has been characterized by concentrated ownership and technocratic management, which influenced board composition and firm performance. In the early 20th century, many industrial companies were founded by inventors or families but eventually came under bank or holding-company control. Banks like Stockholms Enskilda became dominant shareholders and placed representatives on boards, maintaining close control of the firm (Högfeldt 2005). This led to boards that mixed financiers (owners or bankers) with career engineers in top executive roles. As Högfeldt (2005) notes, given the technically advanced nature of Swedish manufacturing firms, industrialist Marcus Wallenberg sr argeud that the firms "lacked the competence to run the firms themselves," so they installed engineer-managers and oversaw as active owners. In effect, Swedish boards functioned with a balance between the technical expertise of managers and the financial oversight of owners, a structure somewhat distinct from the purely managerial or family-dominated models elsewhere.

Research on board composition generally finds it can significantly affect firm outcomes, and this has both historical and modern dimensions. For instance, a recent study of Swedish companies in the 21st century noted that larger board size correlates with weaker financial performance (possibly due to coordination difficulties) (Jönsson 2015). This suggests that even historically, leaner governance structures might have benefited firms in Sweden's relatively concentrated ownership environment. Board expertise and background also matter: in Sweden, many directors and CEOs throughout the mid-20th century had engineering or science educations, whereas later decades saw more with business or finance degrees, as noted by Henrekson, Lyssarides, and Ottosson (2021), who study the chief executives of the 30 largest firms in Sweden in the 20th century. They find in their analysis of top Swedish CEOs over 1945–2005, a large share held engineering degrees, although by the late 20th century it became common to couple technical training with business education. This mix of backgrounds on boards can influence corporate strategy – technically trained directors may prioritize R&D and long-term product development, while finance-trained directors might emphasize cost control, acquisitions, or shareholder returns. Comparative studies in more recent business history support this notion: for example, Adams, Hermalin, and Weisbach (2010) survey the literature on board composition and actions taken, and find that boards with more engineers or scientists tend to invest more in R&D and innovation, while those with more financiers focus on cost-cutting or M&A.

In terms of governance models, Högfeldt (2005) argues that Sweden has been seen as a coordinated market economy with stakeholder-oriented governance, in contrast to the Anglo-American shareholder model. Throughout the 20th century, Swedish boards were typically insider-dominated, featuring controlling shareholders or their proxies (e.g. the Wallenberg family members) alongside key executives. This is akin to continental European practices (e.g. German universal banks and interlocking directorates). By the late 1900s, however, some convergence occurred. Sluyterman and Westerhuis (2022), studying the changing role of CEOs in the second half of the 20th century note a general shift in many countries from "managerial capitalism" – where industrial experts and managers had primacy – to "investor capitalism" focused on shareholders. In Sweden, the 1980s and 1990s brought reforms (e.g. a Corporate Governance Code) emphasizing board independence and accountability, more similar to U.S./UK practices , according to Sabelfeld and Jonäll (2023). Still, differences remain: Swedish boards to this day often include employee representatives and maintain high ownership concentration via dual-class shares and family foundations (Högfeldt 2005).

Historically, an engineering-trained director in Sweden wielded influence through deep firm-specific knowledge, whereas a finance-trained director might exert influence through external networks and capital access. The interplay of these skills on boards has been crucial. For instance, Marcus Wallenberg Sr. in 1905 highlighted that Sweden had "able engineers and good workers but lacked entrepreneurs," proposing to educate more businesspeople and let banks invest in industry (Högfeldt 2005). This led to a governance system that deliberately blended technical and financial leadership. Overall, the literature suggests that a balanced board – combining technical expertise with financial oversight – was key to robust firm performance in Sweden's high-growth era, and governance structures evolved to institutionalize that balance.

Firm Performance and Technical Change

The composition of a firm's leadership and board can significantly influence its performance, especially during periods of technological change. A growing body of evidence links board composition (skills, size, and diversity of directors) to financial outcomes like productivity and profitability. For example, firms that appoint directors with relevant industry or technical expertise tend to see positive market reactions and long-run results. von Meyerinck, Oesch, and Schmid (2016), who conducted a study of S&P 500 companies found that adding a new director with industry experience led to significantly higher stock price gains around the announcement. This suggests that specialized knowledge – such as engineering know-how in a tech-driven company – is valued by investors and likely helps firm performance. Likewise, research indicates that executives' educational backgrounds can shape firm strategy. CEOs with science/engineering training are often more innovation-oriented, correlating with greater R&D investment and patenting activity (Ghardallou, Borgi, and Alkhalifah 2020). In fact, Hambrick & Mason's theory of managerial characteristics influencing outcomes is supported by findings that "firm R&D spending is positively related to the science and engineering education of its CEO" (Ghardallou, Borgi, and Alkhalifah 2020). While a finding from more recent business hsitory, this implies that when technical experts lead firms, they tend to allocate more resources to innovation, potentially driving productivity growth. Conversely, leaders with primarily financial backgrounds might focus on efficiency metrics and short-term returns, affecting measures like revenue per employee or labor costs in different ways.

Historical analyses of Swedish companies provide empirical insight into how technical leadership affected performance and employment. During Sweden's era of industrial ascendancy, many firms achieved world-class productivity levels. By 1950, Sweden had caught up with some of the richest nations in GDP per capita – a feat usually credited to its manufacturing industries' success in adopting and advancing frontier technology, as summarized by Prado and Molinder (2022). Within manufacturing, engineer-led firms introduced process improvements and new products that boosted output per worker. Indeed, from 1950 to 1970 Swedish manufacturing output grew about 4.8% annually, contributing more than half of national GDP growth in that "golden age", as noted by (**?**). Firms like ASEA (electrical equipment) or Volvo (automotive) saw rapid productivity gains as they implemented technical innovations and modern management, often under the guidance of technically trained executives. Revenue per employee and related metrics rose as these companies scaled up and optimized production. However, the link between technical change and employment is complex. In the early and mid-20th century, industrial employment expanded alongside productivity – manufacturing employment kept rising up to the 1960s as firms grew (**?**). High productivity and output often went hand in hand with more jobs during this expansion phase.

After the 1970s, a shift occurred in performance dynamics, illustrating the impact of technological transformation on employment. As Sweden and other advanced economies faced the ICT revolution and globalization, manufacturing employment peaked and then "deindustrialization" set in. Automation and technical efficiencies meant output could keep growing with fewer workers. For Sweden, the period 1970–1990 saw manufacturing value-added growth drop to about 1.5% per year (from ~4.8% earlier), and the sector's share of total growth fell markedly (**?**). Yet manufacturing's productivity continued to improve – output did not collapse, it simply required far less labor input. As Ljungberg and Taalbi note, after 1970 the output of manufacturing kept rising despite workforce cuts, implying that capital deepening and technical change drove up labor productivity. The consequence was a decline in the labor share and industrial employment, even as firms became more efficient. Corporate governance may have played a role in this transition: starting in the 1980s, more financially driven management (sometimes replacing engineer-leaders) pursued restructuring, outsourcing, and cost reduction to please shareholders, which often entailed layoffs or wage restraint. Here, historical data illustrate that technical leadership and board expertise can yield higher innovation and productivity (raising performance indicators like revenue per employee or profit margins), but the distribution of those gains between capital and labor can shift. Early on, technology-driven growth supported broad employment, whereas later, rapid technical change improved output while trimming workforces. Understanding this evolution is crucial, and it highlights why examining the backgrounds of board members (engineers vs. businessmen) is key to interpreting firm strategies on growth, innovation, and employment.

Network Analysis and Firm Governance

In recent years, historians and economists have applied bipartite network analysis to study corporate governance in a historical context. A bipartite network (two-mode network) is a representation that links two types of nodes – for example, companies and their board members – without direct connections among nodes of the same type (Liew et al. 2023). Pavlopoulos et al. (2018) notes that by projecting such a network, one can derive the inter-firm director network (directors are connected if they sit on a common board) or the interlocking firm network (firms are connected if they share a director). This approach has opened new avenues to quantify how board interlocks and elite networks influence firm decision-making and performance. By digitizing century-long board membership records of Swedish companies, one can identify which individuals sat on multiple boards and measure their network centrality (influence). Such quantitative network measures (degree, centrality, etc.) can then be used as variables in regression models to assess impact on firm outcomes (Hsieh et al. 2022). This method allows us to test, for instance, whether firms that are more centrally connected in the director network had better financial performance.

Studies of corporate networks in Sweden reveal a tightly interlocked business community, historically dominated by a few key "nodes." Perhaps the most famous example is the Wallenberg sphere – a cluster of firms linked by the Wallenberg family through ownership and board positions. By mid-20th century, the Wallenbergs' investment company Investor AB and affiliated bank (SEB) held significant stakes in numerous industrial giants (ASEA, Ericsson, SKF, etc.), and Wallenberg representatives occupied board seats across these companies (Högfeldt 2005). This created a dense network of interlocking directorates where a handful of individuals oversaw multiple firms. Ottosson (1997) conducts a network analysis that confirms Swedish big business was highly connected: an analysis of early 1900s interlocks showed that the rise of modern banking went hand in hand with interlinked boards in industry. Ottosson (1997) 's analysis covers five benchmark years; 1903, 1912, 1918, 1924 and 1939, and finds that that Swedish banks became more central actors in corporate networks over time, especially after financial crises, as they stepped in to restructure and stabilize industry. By the 1960s, the three largest banks each had direct or indirect board links to myriad companies, effectively coordinating corporate strategy in what one commentator called a "consultation economy", according to Högfeldt (2005). Further, Högfeldt (2005) argues that these inter-firm networks sometimes facilitated resource sharing, risk management, and technology transfer among companies. For example, a director sitting on boards of both a steel company and an engineering firm could help channel investments or collaborative R&D between them. Such positive effects of interlocks – spreading best practices or providing stable long-term capital – have been noted in historical accounts of Swedish conglomerates.

On the other hand, network concentration also meant a small elite could exert outsized influence. de Jong, Fliers, and Westerhuis (2021) mapped Dutch interlocking directorates and found a high degree of centrality among a few "big linkers" (individuals with many board seats) who could shape multiple firms' decisions. Using modern network analysis tools on historical data, researchers can evaluate how these interlocks correlated with firm outcomes. The evidence provided by Ottosson (1997) in the first half of the 20th century suggests that firms at the core of interlock networks often had more consistent performance (thanks to coordinated support during downturns), but overly dense networks might also stifle competition or innovation if the same directors resisted change later in the period.

By using a bipartite network analysis based on digitized annual reports and shareholder registers, I can create a longitudinal panel and yearly network of board interconnections and then test hypotheses about governance and performance. Through regression-based network analysis, it becomes possible to isolate effects: e.g. did firms with more connected engineers on their boards achieve higher revenue growth compared to others? Did a change in board network centrality precede changes in employment or labor share? Was the international experience of these engineers important? That is what I aim to explore in this paper.

III. Data and Source Criticism

Data sources

This study draws on two interrelated data sources to examine the link between U.S.-experienced engineers on Swedish corporate boards and firm-level outcomes; firm-level financials, board composition, and biographical details of directors. The first two come from company reports, while the third is extracted from two sets of biographical dictionaries that detail the lives of prominent Swedes in the 20th century.

I access the annual reports for companies listed on the Stockholm Stock Exchange, collected from the online archives of the Swedish House of Finance at the Stockholm School of Economics (SSE). These reports span 1873–2006, and are provided in PDF form. For the present project, the focus is on data from 1873 to 1980. I extract from these reports income statement information including revenue, cost of goods sold, operating expenses, wages, taxes, depreciation, net income, as well as balance sheet line items; total assets, current assets, fixed assets, total liabilities, current liabilities, long-term liabilities, and shareholder equity. I also extract the number of workers (sometimes disaggregated into white-collar vs. blue-collar).

I limit the sample to firms with at least 30 years of data betwen 1873 and 1980, resulting in 71 firms included. For these 71 firms, the annual reports list the names and positions of their board members (alongside auditors) near the balance sheet. Figure 1 displays the coverage by firm and year.

To know about each director's educational background, international experience, and broader career trajectory, information was gathered from Swedish biographical dictionaries *Vem är Vem?* and *Vem är Det?*. These references document education (e.g., engineering vs. business), overseas postings or study, and other notable career milestones. I detail the digitization of this data in the third paper of my thesis, and include a summary below.

Data Collection and Digitization

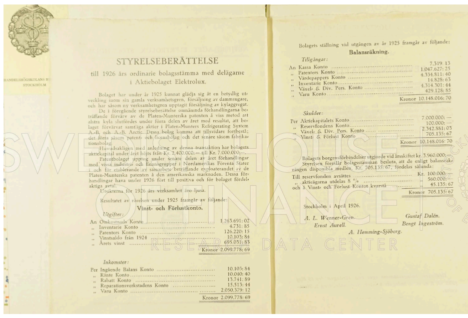
The digitization process involved scraping the scanned archival annual reports from the Stockholm School of Economics Library - which along with drawing on their own archive, collected some reports from the Royal Library and Centrum för Näringslivshistoria to fill coverage gaps. This scraping script is available in the code repository linked above.

A novel digitization process was needed to manage changes in financial reporting and layout over eight decades. Conventional Optical Character Recognition (OCR) methods proved insufficient due to inconsistent table structures, especially when reports extended over multiple pages to detail subsidiaries and international branches. Instead, the project used Large Language Models from Google's "Gemini" family, combined with a custom pydantic data schema, to extract structured information from images. This approach sidestepped the need for traditional

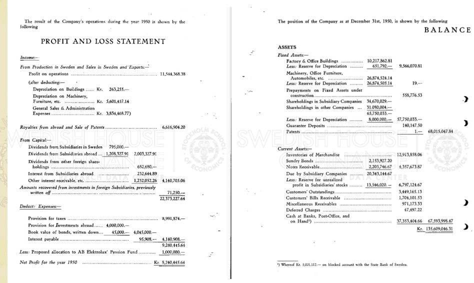
Figure 1: Annual Report Coverage

OCR by relying on multimodal image-processing capabilities, which improved accuracy and consistency. Nonetheless, certain complexities remain. Reporting language gradually shifted from Swedish to English for some companies, and the scope of financial disclosure expanded, with some early reports totaling only two pages and later ones exceeding one hundred. Although the main income statement and balance sheet items remained comparable, firm-level coverage of current assets, current liabilities, and subsidiary performance varied from year to year. The data is made accessible in the code repository linked above, as well as in an interactive dashboard for exploration, detailed in Figure 5.

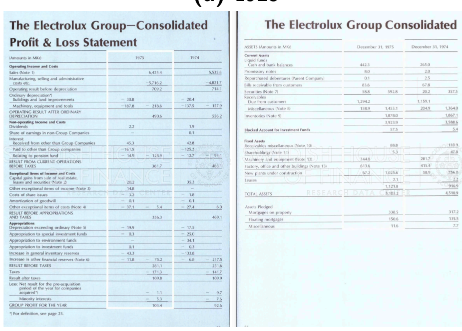
Despite these technical advances, certain challenges remained. Variations in balance sheet reporting posed difficulties, as some firms presented multi-page breakdowns of assets or liabilities across subsidiaries or international branches, making it difficult to aggregate consistently. Additionally, language changes over time added complexity; reporting language shifted from Swedish to English in the mid-20th century for some companies. This issue was partially addressed by prompting the extraction models to recognize both Swedish and English terms, as evidenced in the reproduced PyDantic data schema in the appendix.



(a) 1925



(b) 1950



(c) 1975

Figure 2: Profit and Loss Statements and Balalnce Sheets for Electrolux AB from 1925, 1950, and 1975. Souce: Swedish House of Finance at the Stockholm School of Economics Library Archives.

Board composition data were generally easier to extract, given that names and positions typically appeared in a standard location beneath the balance sheet. Individual directors' surnames, initials, full names, and any listed title (e.g., Verkställande Direktör or Ordförande) were recorded.

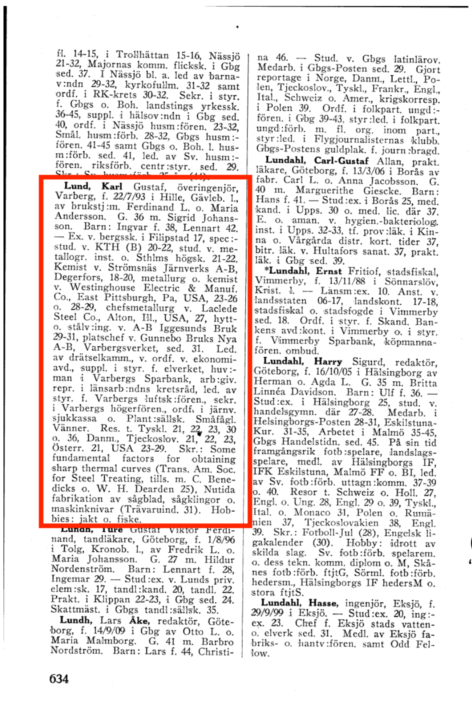
To supplement these board lists with directors' backgrounds, a fuzzy string-matching algorithm was employed to match board members against the *Vem är Vem?* and *Vem är Det?* biographical dictionaries. Approximately 72% of board members were successfully matched using surname and initials; improving upon this match rate — potentially by incorporating mentions of employers or corporate affiliations into the matching routine — remains an area for future work. In the later periods towards 1980, the match rate drops slightly as we are drawing mainly on the *Vem är Det?* biographical dictionaries, which are published later and have less coverage than the *Vem är Vem?* volumes. It would be possible to improve the match rate by expanding the search to other biographical dictionaries such as the SBL, or company archives, but this is beyond the scope of the paper at present.

An example of the biographical data is shown in Figure 3a, and the distribution of biographies across volumes and time period is shown in Figure 3b.

Source Criticism

Although these biographical dictionaries offer a valuable repository of career information, they have certain limitations. Inclusion was partly self-selective, in that individuals could pay a nominal fee to appear, and the depth of information varies from one entry to another. A comparison with the Swedish Biographical Lexicon (SBL), which selects figures on broader historical grounds, revealed that fewer than one-fifth of the sampled individuals from Vem är Vem? also appear in the SBL. This discrepancy implies that Vem är Vem? may overrepresent socially prominent individuals, but that limitation is less consequential for studying board members of listed firms, who tend to hold influential positions by definition. Nonetheless, caution is warranted when interpreting patterns of foreign training or professional networking, since those who invested in a biographical listing may differ systematically from peers who did not.

Another key limitation involves the composition of the 71 firms under study. The sample primarily includes the largest listed companies, many of which are finance and investment entities or engineering and industrial firms. According to internal categorization, finance and investment comprises 30.43 percent of the sample and engineering and industrial another 20.29 percent, with the remainder distributed across consumer goods, mining and metals, telecommunications, technology, automotive, and machinery. These proportions mean that the findings will not necessarily generalize to smaller, non-listed firms in other sectors. See Table 1 for a breakdown of the sample by broad industry classification.



fl. 14-15, i Trollhättan 15-16, Nässjö 21-32, Majornas komm. flicksk. i Gbg sed. 37. I Nässjö bl. a. led av barnav:ndn 29-32, kyrkofullm. 31-32 samt ordf. i RK-krets 30-32. Sekr. i styr. f. Gbgs o. Boh. landstings yrkessk. 36-45, suppl. i hälsov:ndn i Gbg sed. 40, ordf. i Nässjö husm:fören. 23-32, Smål. husm:förb. 28-32, Gbgs husm:fören. 41-45 samt Gbgs o. Boh. l. husm:förb. sed. 41, led. av Sv. husm:fören. riksförb. centr:styr. sed. 29.

Lund, Karl Gustaf, överingenjör, Varberg, f. 22/7/93 i Hille, Gävleb. l., av brukstj:m. Ferdinand L. o. Maria Andersson. G. 36 m. Sigrid Johansson. Barn: Ingvar f. 38, Lennart 42. — Ex. v. bergssk. i Filipstad 17, spec:stud. v. KTH (B) 20-22, stud. v. metallogr. inst. o. Sthlms högsk. 21-22. Kemist v. Strömsnäs Järnverks A-B, Degerfors, 18-20, metallurg o. kemist v. Westinghouse Electric & Manuf. Co., East Pittsburgh, Pa, USA, 23-26 o. 28-29, chefsmetallurg v. Laclede Steel Co., Alton, Ill., USA, 27, hytt- o. stålv:ing. v. A-B Iggesunds Bruk 29-31, platschef v. Gunnebo Bruks Nya A-B, Varbergsverket, sed. 31. Led. av drätselkamm., v. ordf. v. ekonomiavd., suppl. i styr. f. elverket, huv:man i Varbergs Sparbank, arb:giv. repr. i länsarb:ndns kretsråd, led. av styr. f. Varbergs luftsk:fören., sekr. i Varbergs högerfören., ordf. i järnv. sjukkassa o. Plant:sällsk. Småfågl. Vänner. Res. t. Tyskl. 21, 22, 23, 30 o. 36, Danm., Tjeckoslov. 21, 22, 23, Österr. 21, USA 23-29. Skr.: Some fundamental factors for obtaining sharp thermal curves (Trans. Am. Soc. for Steel Treating, tills. m. C. Benedicks o. W. H. Dearden 25), Nutida fabrikation av sågblad, sågklingor o. maskinknivar (Trävaruind. 31). Hobbies: jakt o. fiske.

Lundh, Ture Gustaf Viktor Ferdinand, tandläkare, Göteborg, f. 1/8/96 i Tolg, Kronob. l., av Fredrik L. o. Maria Johansson. G. 27 m. Hildur Nordenström. Barn: Lennart f. 28, Ingemar 29. — Stud:ex. v. Lunds priv. elem:sk. 17, tandl:kand. 20, tandl. 22. Prakt. i Klippan 22-23, i Gbg sed. 24. Skattmäst. i Gbgs tandl:sällsk. 35.

Lundh, Lars **Åke,** redaktör, Göteborg, f. 14/9/09 i Gbg av Otto L. o. Maria Malmborg. G. 41 m. Barbro Nordström. Barn: Lars f. 44, Christina 46. — Stud. v. Gbgs latinlärov. Medarb. i Gbgs-Posten sed. 29. Gjort reportage i Norge, Danm., Lettl., Polen, Tjeckoslov., Tyskl., Frankr., Engl., Ital., Schweiz o. Amer., krigskorresp. i Polen 39. Ordf. i folkpart. ungd:fören. i Gbg 39-43, styr:led. i folkpart. ungd:förb. m. fl. org. inom part., styr:led. i Flygjournalisternas klubb. Gbgs-Postens guldplak. f. journ:bragd.

Lundahl, Carl-Gustaf Allan, prakt. läkare, Göteborg, f. 13/3/06 i Borås av fabr. Carl L. o. Anna Jacobsson. G. 40 m. Marguerithe Giescke. Barn: Hans f. 41. — Stud:ex. i Borås 25, med. kand. i Upps. 30 o. med. lic. där 37. E. o. aman. v. hygien.-bakteriolog. inst. i Upps. 32-33, tf. prov:läk. i Kinna o. Vårgårda distr. kort. tider 37, bitr. läk. v. Hultafors sanat. 37, prakt. läk. i Gbg sed. 39.

***Lundahl, Ernst** Fritiof, stadsfiskal, Vimmerby, f. 13/11/88 i Sönnarslöv, Krist. l. — Länsm:ex. 10. Anst. v. landsstaten 06-17, landskont. 17-18, stadsfiskal o. stadsfogde i Vimmerby sed. 18. Ordf. i styr. f. Skand. Bankens avd:kont. i Vimmerby o. i styr. f. Vimmerby Sparbank, köpmannafören. ombud.

Lundahl, Harry Sigurd, redaktör, Göteborg, f. 16/10/05 i Hälsingborg av Herman o. Agda L. G. 35 m. Britta Linnéa Davidson. Barn: Ulf f. 36. — Stud:ex. i Hälsingborg 25, stud. v. handelsgymn. där 27-28. Medarb. i Helsingborgs-Posten 28-31, Eskilstuna-Kur. 31-35, Arbetet i Malmö 35-45, Gbgs Handelstidn. sed. 45. På sin tid framgångsrik fotb:spelare, landslagsspelare, medl. av Hälsingborgs IF, IFK Eskilstuna, Malmö FF o. BI, led. av Sv. fotb:förb. uttagn:komm. 37-39 o. 40. Resor t. Schweiz o. Holl. 27, Engl. o. Ung. 28, Engl. 29 o. 39, Tyskl., Ital. o. Monaco 31, Polen o. Rumänien 37, Tjeckoslovakien 38, Engl. 39. Skr.: Fotboll-Jul (28), Engelsk ligakalender (30). Hobby: idrott av skilda slag. Sv. fotb:förb. spelarem. o. dess tekn. komm. diplom o. M, Skånes fotb:förb. ftjtG, Sörml. fotb:förb. hedersm., Hälsingborgs IF hedersM o. stora ftjtS.

Lundahl, Hasse, ingenjör, Eksjö, f. 29/9/99 i Eksjö. — Stud:ex. 20, ing:ex. 23. Chef f. Eksjö stads vatten- o. elverk sed. 31. Medl. av Eksjö fabriks- o. hantv:fören. samt Odd Fellow.

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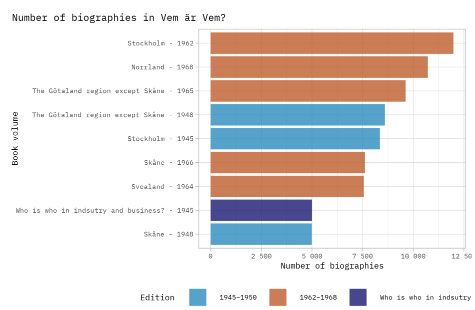
(a) An example of a biogaphy from Karl Gustav Lund



(b) Number of biographies in each volume of 'Vem är Vem?'

Figure 3: Example of a biographical entry from *Vem är Vem?* and the number of biographies in each volume. Source: Projekt Runeberg scans of *Vem är Vem?* volumes and author's own analysis.

Table 1: Distribution of firms in sample by broad industry classification.

Broad Industry	Percentage (%)
Finance & Investment	30.43%
Engineering & Industrial	20.29%
Other	18.84%
Consumer Goods	15.94%
Mining & Metals	7.25%
Telecommunications & Technology	4.35%
Automotive & Machinery	2.90%

Constructing Variables

Firm coverage being such as it is, I then construct several key variables to test whether boards with engineers that have experience in the United States performed differently. The first variable is the presence of a board member who has documented work experience in the United States. This information is extracted from the biographical dictionaries, which often note foreign postings or study abroad. I differentiate between individuals who travel to foreign counties, another commonly listed attribute in the biographical dictionaries, and individuals who work overseas by requiring the name of a firm that an individual worked at abroad to be present.

Regarding board composition, this is coded both in binary form - indicating that at least one such individual exists - or by a share with the number of U.S.-trained engineers on the board. I use both specifications in the analysis.

Additional categorization sorts directors by educational background (e.g., engineering versus business), based on their educational degree and institute, if available. These classifications, drawn from dictionary entries, can show the relative importance of foreign exposure in shaping corporate practices.

The outcome measures center on firm performance, particularly revenue per employee and net revenue. Revenue per employee is especially useful for analyzing potential productivity gains or labor-saving measures.

Regarding networks, a bipartite network of firms and directors is created in order to provide variables to the time series analysis. A bipartite network has two kinds of nodes. On the one side, there are board members who can serve on different boards, and on the other, are firms which are connected by common board members. Such a network allows me to measure whether strongly interconnected firms exhibit similar policy decisions, employment trends, or performance trajectories. Standard measures of centrality - degree, betweenness, or eigenvector - are used to test whether firms situated in well-connected networks share similar characteristics or outcomes.

Overall, the dataset assembled here—covering both extensive financial records and board composition details—enables an investigation of how U.S.-experienced engineers affected firm productivity and employment strategies in twentieth-century Sweden. While the archival approach and the reliance on biographical dictionaries introduce certain biases, the consistency of key income statement and balance sheet items, combined with the strength of the board-level matching, provides a valuable foundation for analyzing historical corporate governance.

IV. Empirical Method

The empirical analysis begins with a longitudinal design that exploits firm-level data assembled from 1873 to 1980. Each firm enters the panel in years where sufficient financial information and board composition records exist, forming an unbalanced panel that covers varying intervals for different companies, where coverage is shown in Figure 1. This approach allows for the exploration of how changes within each firm — such as the arrival of a U.S.-experienced engineer on the board - correlate with shifts in its performance indicators.

The preferred measure of firm performance is revenue per employee, computed by dividing total revenue by employee headcount. This indicator approximates labor productivity and highlights whether board-level expertise - particularly engineering plus American experience - translates into efficiency gains. To allow for the possibility that new appointments effects employment policies, a second model regresses overall employment on same explanatory terms. Comparing the two outcomes helps distinguish whether foreign-trained engineers primarily spur labor productivity improvements or also drive workforce expansion.

The key explanatory variables focus on the presence and proportion of directors with specialized backgrounds. One specification includes a binary indicator that equals one if any board member meets two criteria: holding an engineering education and having worked in the United States. A complementary specification substitutes this binary measure with a continuous one, reflecting the share of board members who fit the same criteria. To address the sub-question about contrasting the effects of business- or finance-trained directors, further terms partition board composition into two dimensions: first, whether a director has an engineering or business/finance background, and second, whether that individual has foreign experience in the United States. In practice, this is done by interacting the director's training (engineer vs. business/finance) with the U.S.-experience indicator, allowing the regression coefficients to capture how these backgrounds combine in shaping performance.

By including firm fixed effects, the regression specifications control for any unobserved, time-invariant characteristics of individual companies, such as historical reputations, founding conditions, or long-standing ownership structures. Time dummies, capturing broad economic cycles and periods of expansion or downturn, help further isolate the relationship between board composition and performance from macroeconomic influences. The model incorporates basic controls—such as firm size (log of total assets), firm age (determined by the first annual report), and sector dummies tied to the classification in Table 1.

Changes in board composition might not yield immediate effects on productivity. Accordingly, the main specification is adjusted include lagged board-composition variables to capture the delayed impact of new directors on performance. In addition, as noted above, I make use of time fixed effects to account for potential reverse causality; that better-performing firms might attract sought-after U.S.-experienced engineers.

The panel regression specification is:

Let i index firms and t index years.

The preferred empirical specification for the panel analysis of revenue per employee can be written as:

$$\text{RevenuePerEmployee}_{i,t} = \alpha + \beta_1 (\text{ShareUSExpEngineers})_{i,t} + \beta_2 (\text{Controls})_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t}$$

In this specification, $\text{RevenuePerEmployee}_{i,t}$ is the primary outcome variable, measuring the firm's total sales divided by its number of employees. The explanatory term $(\text{ShareUSExpEngineers})_{i,t}$ is the proportion of board members in firm i and year t who combine an engineering background with documented work experience in the United States. This variable may capture how technology-focused expertise, supplemented by exposure to American industrial or managerial practices, shapes productivity outcomes.

The vector $(\text{Controls})_{i,t}$ includes relevant firm-level characteristics, such as logarithm of total assets, firm age, and sector indicators drawn from Table 1. Including these controls accounts for the possibility that older or larger firms, or certain industrial classifications, systematically differ in how effectively they convert workforce inputs into revenue. In addition, macroeconomic or temporal shifts are addressed by δ_t, a year fixed effect that nets out time-specific shocks such as recessions or wartime disruptions. Meanwhile, γ_i is a firm fixed effect that absorbs all time-invariant attributes of each company, such as founding conditions, enduring ownership patterns, or longstanding reputations.

Finally, $\varepsilon_{i,t}$ is the idiosyncratic error term. Standard errors in such models are typically clustered by firm to allow for heteroskedasticity and serial correlation within each company's observations. This framework is designed to disentangle how board composition—particularly the presence and share of U.S.-experienced engineers—relates to productivity measures like revenue per employee, while holding constant all other observable and unobservable differences among firms across the historical period under study.

In terms of robustness, four approaches are used. First, lagged board composition is tested to determine whether productivity effects emerge with a delay. Second, alternative outcomes are considered by substituting total employment or employment growth for revenue per employee. Third, sub-period analyses are conducted by splitting the sample into historical intervals, such as before and after 1930 or post-1945, to check the stability of results. Finally, interactions with network measures are examined, where relevant, by adding metrics of network centrality or board interlocks to see if well-connected directors influence productivity more strongly.

The network analysis uses a bipartite representation of directors and firms. Directors can occupy board seats on multiple companies, creating the potential for inter-firm ties when the same individual sits on more than one board. Visualizing these ties in a two-mode network highlights the connections that might facilitate the diffusion of business practices, managerial styles, and technological knowledge, particularly if directors bring specialized engineering skills or international experience. Because certain directors hold multiple seats, they serve as potential conduits for transferring ideas between firms, while boards that share members may coordinate or emulate each other's strategies. To capture the structure, the study calculates degree centrality at the director level (indicating how many boards a person joins), along with firm-level connectivity measures (counting the number of directors shared with other firms). It also examines clusters of boards that appear "engineer heavy," hypothesizing that these companies may form cohesive groups—sometimes anchored by powerful industrial families like the Wallenbergs - where common network linkages enhance trust and learning.

In the regression analysis, these network metrics are introduced as additional explanatory variables. Specifically, each firm-year observation includes (a) an aggregate measure of the board's centrality, such as the average centrality score of its directors or the fraction of directors in the top percentile of director-level degree, and (b) a firm connectivity index, capturing how many other companies are directly linked by shared board members. The models also allow interactions between these network variables and the presence of U.S.-experienced engineers; for example, to test whether central, foreign-trained engineers foster greater productivity gains than foreign-trained engineers on more isolated boards. By adding these terms—while still retaining firm fixed effects, time dummies, and core controls—the analysis can distinguish whether simply having U.S.-experienced engineers matters more or less than having them embedded in a highly connected board network.

V. Analysis

In Figure 4 below I show a network of firms based on common board members in 1950. This visualization highlights the dense interconnections among firms, with several clusters of companies sharing multiple directors. The Wallenberg sphere, for instance, is visible as a tight-knit group of firms linked by common board members in the center. I chose to display 1950 because it is a year when many of the firms in my sample have complete data. I need to think carefully how to deal with network centrality measures when firms are missing from the network.

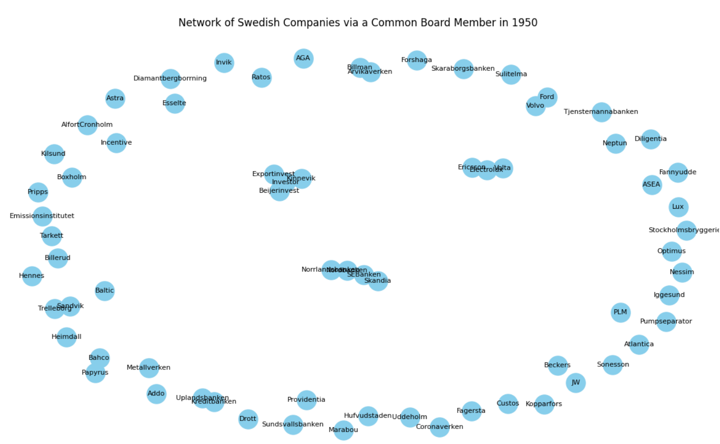


Figure 4: Network of firms based on common board members in 1950

Tentative regression results are shown in Table 2.

There are several things I need to do before finalizing the analysis. First, I need to check that the deflators I have used from Rodney Edvinson's website are the ones I should be using, I will check this with Anton Svensson as I know he has used deflators in his project.

Second, I need to check the level changes that exist in the data. I have already done this to some extent, but I need to make sure that the changes are not due to changes in accounting standards or other factors that might affect the data. When I log and take differences in analysis.

Once I have done this, I need to check that the stationarity / unit root tests still hold, and if not, potentially take the first differences of the series that I use.

Then I need to check the lag effects, and complete the other robustness checks.

I also need to experiement with the variable for international (non-US) experience, and see if this has an effect on the results.

Finally, I need to write up the results and the conclusion.

Table 2

[htbp]

Table 3: Regression Results on Revenue per Employee

	Dependent Variable: Revenue per Employee		
	(1)	**(2)**	**(3)**
Share of U.S.-Exp. Engineers	0.105**	0.112**	0.094**
	(0.048)	(0.050)	(0.045)
Engineer $\times$ U.S.-Exp. Directors		0.036	0.041
		(0.027)	(0.029)
Board Centrality			0.063**
			(0.025)
Firm Connectivity			0.018
			(0.012)
log(Assets)	0.210***	0.195***	0.198***
	(0.059)	(0.057)	(0.054)
Firm Age	0.001*	0.001*	0.001*
	(0.0006)	(0.0005)	(0.0005)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	49	71	71
R-squared	0.42	0.43	0.46

Notes: Standard errors in parentheses, clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1.

VI. Conclusion

TODO

Appendix

List of Companies in the Dataset

Company Name	Classification/Industry
AGA	Industrial gases & chemical technology
ASEA	Electrical engineering & industrial technology
Addo	Office machines & calculators
AlfortCronholm	Wholesale trade (hardware and tools)
Arvikaverken	Heavy machinery / industrial engineering
Astra	Pharmaceuticals & healthcare
Atlantica	Insurance services
Bahco	Hand tools & metalworking equipment
Baltic	Shipping / maritime services
Beckers	Paints & coatings
Beijerinvest	Investment & holding company
Billerud	Pulp, paper & packaging
Billman	Engineering components (industrial valves)
Boxholm	Steel production & metal fabrication
Coronaverken	Iron & steel works
Custos	Investment & holding company
Diamantbergborrning	Mining & drilling (mining services)
Diligentia	Real estate & property management
Drott	Real estate & property management
Electrolux	Home appliances & consumer electronics
Emissionsinstitutet	Environmental research & consultancy
Ericsson	Telecommunications & networking equipment
Esselte	Office products & stationery
Exportinvest	Investment & export finance
Fagersta	Steel & metallurgical engineering
Fannyudde	Engineering & manufacturing (marine equipment)
Ford	Automotive manufacturing (Swedish operations)
Forshaga	Chemical industry (plastics and resins)
Heimdall	Security services
Hennes	Fashion retail (origin of H&M)
Hufvudstaden	Real estate & property management
Iggesund	Iron & steel, later pulp and paper
Incentive	Investment & holding company
Investor	Investment & holding company
Invik	Investment & finance
JW	Engineering & manufacturing (industrial equipment)
Kilsund	Maritime engineering & metal works
Kinnevik	Investment & holding company
Kopparfors	Forestry & paper industry
Kreditbanken	Banking & finance
Lux	Consumer goods (lighting/appliances)

Company Name	Classification/Industry
Marabou	Confectionery & food production
Metallverken	Metalworking & industrial manufacturing
Neptun	Maritime services (tugboats and salvage)
Nessim	Investment & finance
Nordbanken	Banking & finance
Norrlandsbanken	Banking & finance
Optimus	Portable stoves & heating equipment
PLM	Packaging & containers
Papyrus	Stationery & paper products
Pripps	Brewery & beverage production
Providentia	Investment & holding company
Pumpseparator	Industrial equipment (fluid handling)
Ratos	Investment & holding company
SEBanken	Banking & finance
Sandvik	Engineering (materials technology & mining tools)
Skandia	Insurance & financial services
Skaraborgsbanken	Banking & finance
Sonesson	Consumer goods (food production)
Stockholmsbryggerier	Brewery & beverage production
Sulitelma	Mining (zinc and copper)
Sundsvallsbanken	Banking & finance
Tarkett	Flooring & building materials
Tjenstemannabanken	Banking & finance (service bank)
Trelleborg	Industrial engineering (polymer-based products)
Uddeholm	Tool steels & metallurgical production
Uplandsbanken	Banking & finance
Volta	Electrical appliances (vacuum cleaners)
Volvo	Automotive & heavy machinery manufacturing

Summary of companies

Broad Industry	Percentage (%)
Finance & Investment	30.43%
Engineering & Industrial	20.29%
Other	18.84%
Consumer Goods	15.94%
Mining & Metals	7.25%
Telecommunications & Technology	4.35%
Automotive & Machinery	2.90%

```python
# --- Pydantic Models ---

class IncomeStatement(BaseModel):
    """
    Standard representation of an Income Statement.
    Note: In many older reports, board member names are listed below this statement.
    """
    revenue: Optional[float] = Field(
        None, description="Total revenues or sales. (Swedish: Intäkter)"
    )
    cost_of_goods_sold: Optional[float] = Field(
        None, description="Cost of goods sold. (Swedish: Kostnad såld vara)"
    )
    operating_expenses: Optional[float] = Field(
        None, description="Total operating expenses. (Swedish: Rörelsekostnader)"
    )
    wages_expense: Optional[float] = Field(
        None, description="Total wages and salaries expense. (Swedish: Lönekostnader)"
    )
    tax_expense: Optional[float] = Field(None, description="Tax expense. (Swedish: Skatt)")
    depreciation: Optional[float] = Field(None, description="Depreciation (Swedish: Avskrivn
    net_income: Optional[float] = Field(
        None, description="Net income (profit or loss) for the period. (Swedish: Årets resul
    )


class BalanceSheet(BaseModel):
    """
    Standard representation of a Balance Sheet.
    """
    total_assets: Optional[float] = Field(
        None, description="Total assets at period end. (Swedish: Tillgångar)"
    )
    current_assets: Optional[float] = Field(
        None, description="Current assets. (Swedish: Omsättningstillgångar)"
    )
    fixed_assets: Optional[float] = Field(
        None, description="Long-term or fixed assets. (Swedish: Anläggningstillgångar)"
    )
    total_liabilities: Optional[float] = Field(
        None, description="Total liabilities. (Swedish: Skulder)"
    )
    current_liabilities: Optional[float] = Field(
        None, description="Current liabilities. (Swedish: Kortfristiga skulder)"
    )
```

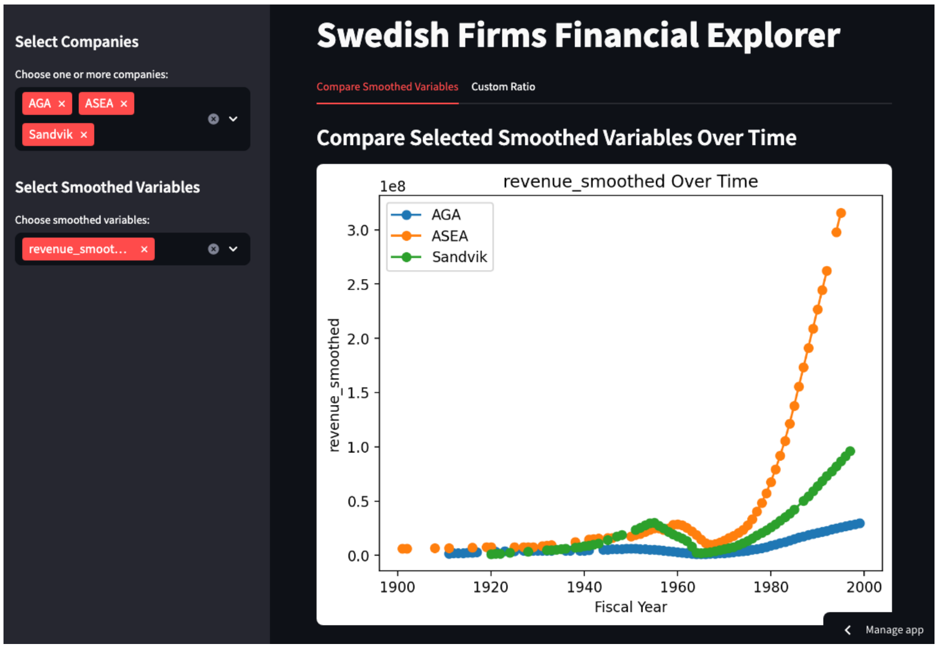
```
    long_term_liabilities: Optional[float] = Field(
        None, description="Long-term liabilities. (Swedish: Långfristiga skulder)"
    )
    shareholders_equity: Optional[float] = Field(
        None, description="Total shareholders' or owners' equity. (Swedish: Eget kapital)"
    )


class BoardMember(BaseModel):
    """
    Representation of a single board member.
    Typically listed below the Income Statement in older reports.
    """
    surname: str = Field(..., description="The surname of the board member.")
    first_name: Optional[str] = Field(None, description="The first name of the board member.
    initials: Optional[str] = Field(None, description="Initials of the board member.")
    position: Optional[str] = Field(None, description="The board position held by the member


class Auditor(BaseModel):
    """
    Representation of a single auditor.
    Typically listed after the board members.
    """
    surname: str = Field(..., description="The surname of the auditor.")
    first_name: Optional[str] = Field(None, description="The first name of the auditor.")
    initials: Optional[str] = Field(None, description="Initials of the auditor.")
    auditing_firm: Optional[str] = Field(None, description="The auditing firm, if specified.


class Employees(BaseModel):
    """
    Representation of the number of employees in a company.
    """
    n_employees: Optional[int] = Field(None, description="Total number of employees. (Swedis
    n_blue_collar_workers: Optional[int] = Field(None, description="Total number of blue col
    n_white_collar_workers: Optional[int] = Field(None, description="Total number of white c


class FinancialReport(BaseModel):
    """
    Comprehensive financial report model, including:
    - Income Statement (with Swedish term references)
    - Balance Sheet (with Swedish term references)
    - Employees (with Swedish term references)
```

```
    - Board members (often listed under the P&L statement)
    - Auditors (often follow after the board list)
    """
    company_name: str = Field(..., description="The name of the company.")
    fiscal_year: int = Field(..., description="Fiscal year of the report.")
    income_statement: IncomeStatement = Field(..., description="Income statement details.")
    balance_sheet: BalanceSheet = Field(..., description="Balance sheet details.")
    employees: Optional[Employees] = Field(None, description="Employee details.")
    board: Optional[List[BoardMember]] = Field(None, description="List of board members with
    auditors: Optional[List[Auditor]] = Field(None, description="List of auditors with detai
    additional_notes: Optional[str] = Field(None, description="Any extra commentary or notes
```

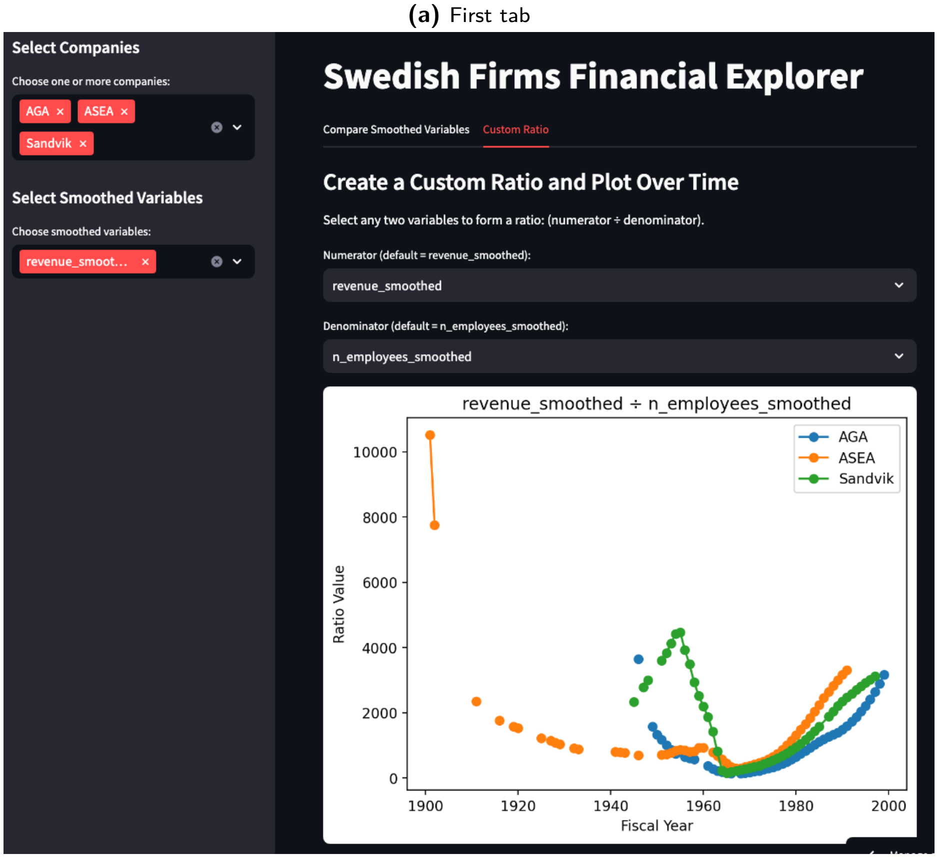
Data portal to examine company report data

I have created a Streamlit app to explore the company report data. The app allows users to select a set of companies, and view the extracted financial data. The second tab of the app allows users to calculate ratios of interest, such as revenue per employee, and view the development of these ratios across the selected companies and across time.

The app is available at the following link: https://swedish-annual-reports-archive-explorer.streamlit.app/.



(a) First tab



(b) Second tab

Figure 5: Screenshots of the Streamlit app interface. Source: Author's own work.

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