

# Gender Equality and Digital Education as Catalysts for Economic Growth - A Comparative Study of Japan and the Nordic Countries

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## Abstract

This study conducts a comparative analysis of the economic growth models of Japan and the Nordic five countries, Denmark, Finland, Iceland, Norway, and Sweden, from 1990 to 2022, with a particular emphasis on three aspects: education systems, political participation, and digitalization. Progress and challenges in achieving gender equality, promoting digital education, encouraging entrepreneurship, and fostering innovation are examined to discern how these aspects have affected economic growth in both regions. Through the analysis, the differences in economic growth models of Japan and the Nordic countries, especially in the realms of educational reforms brought about by gender equality and economic growth, are discussed.

*Keywords:* Digitalization, economic growth models, education systems, entrepreneurship, gender equality.

## 1 Introduction

The primary focus of this study is on how progress and challenges in achieving gender equality, promoting digital education, encouraging entrepreneurship, and fostering innovation have affected the economic growth in Japan and the Nordic countries. The comparison of Japanese and Nordic economic growth models can provide policymakers and researchers in both regions with important insights that can shape future strategies for economic growth and sustainable development. Economic growth is crucial for a nation's sustainable development and the improvement of living standards for its citizens. The economic growth model is significantly influenced by a country or region's education system, political structure, technological advancements, and sociocultural factors. Education shapes the skills and knowledge of citizens, serving as a foundation for promoting innovation and entrepreneurship. Political participation reflects a diversity of opinions and values in policy making and execution, fostering good governance and a fair society. Digitalization, through the advancement of information and communication technologies, catalyzes economic efficiency and productivity, which streamlines economic activities and creates new business models and markets.

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In the early 1990s, Japan held a position next to the US regarding economic strength, exhibiting outstanding performance in per capita productivity. However, Japan later experienced the collapse of the bubble economy, plunging into a prolonged period of deflation and economic stagnation, which have left discernible impacts on Japan's economy, even today. Since the bubble economy collapsed, Japan has struggled to adapt to waves of global competition and technological innovation while maintaining the institutions and structures of its period of rapid economic growth. The economic stagnation in Japan is believed to be attributed to a myriad of factors such as the failure of financial and fiscal policies post-economic collapse, the decline in the global competitiveness of companies, and issues in the labor market and productivity. On the other hand, the Nordic countries have achieved sustainable economic growth, maintained a high standard of living, and upheld advanced social security systems. The Nordic countries have deployed policies supporting sustainable and inclusive social change in education, innovation, gender equality, and women's political participation.

## 2 Literature Review

### 2.1 Background of Economic Growth Models in Japan and the Nordic Countries

Japan's economic growth model historically relied on industrial policies, being the first non-Western country to achieve successful industrialization [1]. In contrast, the Nordic countries have adopted a socioeconomic model that harmonizes growth with social equality and embraces universal healthcare, quality education, and affordable housing [2][3]. An annual report on economic development highlights the collaborative efforts in tracking growth, business cycles, and public finance among the Nordic countries [4].

### 2.2 Progress of Gender Equality

The contrasting historical paths to gender equality in the Nordic countries and Japan demonstrate the pivotal role of political and sociocultural context. While the Nordic countries are recognized as leading countries, Japan continues to struggle to achieve comprehensive gender equality because of traditional sociocultural norms ingrained in the society despite legal foundations for gender equality.

The Nordic nations demonstrate how active policies and cultural shifts can advance gender equality. Before World War II, child labor and patriarchal norms were common, but the war's labor demands brought women into the workforce, a trend that persisted post-war. Nordic governments promoted gender equality by developing social security and education, fostering an environment conducive to gender equality. These efforts have spurred social change towards equality, though the journey is ongoing [5][6][7].

Japan's experience underscores the need for sociocultural change, political commitment, and a legal foundation for gender equality. Following World War II, Japan adopted a democratic constitution, making strides in educational gender equality and establishing a legal framework for it. However, postwar economic priorities led to women being used as cheap labor, and the prevailing political party maintained a patriarchal system that limited women to short-term full-time work pre-marriage, impeding career development. Consequently,

part-time female workers faced low pay and limited hours, which hindered their economic and social advancement and contributed to their minimal political participation [8][9][10].

### **2.3 Comparison and Analysis of Education Reforms in Japan and the Nordic Countries**

Japan's post WWII educational system, crucial for its economic boom, focused on skill and knowledge enhancement. During economic stagnation, it clung to old ways, resisting reform. Today, as global competition demands, there is a need for an education that nurtures global talent, diverging from Japan's traditional "cramming education" which stifles creativity and critical thinking [11][12][13][14].

The Japanese education system, criticized for gender bias, limits women's leadership and STEM roles. Its curriculum, lacking in diversity and global outlook, curtails competitiveness and innovation, impeding skill development and Japan's economic progress.

The educational policies of the Nordic countries focus on digital education, entrepreneurship, and innovation. They emphasize on critical thinking, creativity, collaboration, and communication as the 21st-century skill sets. Digital technology is essential as the educational curriculum focuses on students asking questions and exploring solutions. Students are encouraged to develop business ideas and learn skills to realize them, fostering independent learning and a sense of contribution to society. In addition to improving ICT literacy, digital education provides a curriculum that equips children with skills necessary for future careers such as programming, AI, and data science. In this way, Nordic countries stay ahead of the wave of digital transformation and increase their global competitiveness. Gender equality is also a hallmark of education in the Nordic countries, providing an equal educational environment for men and women and promoting women's advancement in society [15] [16][17][18][19][20][21][22][23][24][25][26][27][28].

The educational systems of Japan and the Nordic countries differ notably in their approach to gender equality and academic excellence. The Nordics advance gender equality, enhancing women's educational and work prospects, which drives economic diversity and innovation. Japan, however, lags in gender equality, restricting women's opportunities and stifling economic progress. The Nordic model, integrating digital technology and entrepreneurship, encourages student creativity, while Japan's focus on exams neglects diverse student talents. Embracing the Nordics' practices of gender equality, digital, and entrepreneurship education is crucial for Japan's educational reform and sustainable economic growth. The adaptation of these models will be key for future global economic development.

### **2.4 Progress of Digitalization in Japan and the Nordic Countries**

Despite remarkable progress in recent years, the digitalization of education in Japan lags that of other developed nations, but there have been notable strides, especially in recent years. Since the 1990s, the direction of Japan's educational reform has been hotly debated among experts, along with criticism of the "rigid control" of Japanese education, which is "heavily weighted toward uniformity and student behavioral management" [29]. In more recent years, spurred by the pandemic, the Japanese government has finally fulfilled its commitment to provide each school with a high-speed Internet connection and each schoolchild with a

computer terminal. However, no conclusions have yet been reached about the effects of the increasing use of digital technology in education in Japan [30]. The government's "GIGA" program is a significant step toward digital transformation, helping schools incorporate online elements into their learning and equip students with the electronic tools they need. In 2022, Japan's Ministry of Education, Culture, Sports, Science and Technology has allocated 74 million USD for lifelong learning in digital reskilling and upskilling, which indicates a move to embrace digital education [31][32].

In the last 10-20 years, the Nordic countries have experienced rapid changes related to digital technologies, both in their educational systems and in society as a whole and they have been recognized as world leaders in integrating digital technology into education. For example, the integration of digital technology in beginning teacher education in Norway and Denmark has followed very similar paths over the last few decades, with Norway being one of the first countries in the world [33]. A collection of studies comparing Nordic countries' attitudes toward the digitalization of education, with a particular focus on digital competence and technology in K-12 schools and teacher education, shows that the Nordic countries are digital frontrunners in the European context, [34]. In 2020, Norway implemented a groundbreaking initiative to modernize the country's primary and secondary school curriculum by incorporating digital elements, reflecting the ongoing commitment to digital education in the region [35][36][37].

A comparison of Japan and the Nordic countries regarding the digitalization of education reveals significant differences. While Japan has made progress toward the digitalization of education in recent years, especially during the pandemic, the Nordic countries stand out concerning the speed and extent of digitalization. These regions are ahead of the curve, and several countries have been recognized for their early adoption and integration of digital technology in education. In the Nordic countries, aggressive policies and significant investments in digital education have resulted in a digitally competent educators and a more technology-integrated curriculum. This comparison underscores the need for Japan to accelerate its digital transformation in education to strengthen its global competitiveness and adapt to the evolving educational landscape.

## **2.5 How Europe Develop a Smart Strategy**

For the promotion of digital education in Europe, there are important functions separate from national implementation policies. The Joint Research Center (JRC) of the European Commission facilitates cooperation among EU member states and maximizes economic and social benefits by providing strategies and frameworks. Europe, with its many smaller countries, can optimize resources and efficiently implement policies through the common standards and goals provided by JRC. Member states can develop effective policies best suited to their needs by researching, aggregating data, and learning from successes and failures. Meanwhile, the JRC framework aims to reduce education and R&D costs, accelerate economic growth, enhance digital skills, and make the labor market more competitive. The role of JRC is significant because it is difficult for smaller countries to pursue large-scale projects independently. Successful examples of digital education policies and digital skills frameworks show that JRC initiatives promote cooperation and knowledge-sharing among member countries, improving digital skills and economic growth [38].

JRC promotes a wide variety of projects related to digital skills and education to support EU Member States' policies with scientific knowledge. These include; DigComp to enhance the digital skills of individuals and organizations; DigCompOrg as an educational institution; DigCompConsumers to strengthen the digital skills of consumers; OpenEdu to integrate online resources into education; EntreComp to foster entrepreneurship; the self-assessment tool SAQ (Self-Assessment Questionnaire); MOOCKnowledge, which shares knowledge about MOOCs; MOOCs4Inclusion, for groups that are often socially excluded; Computhink, which supports computer science education; and DigEduPol, which promotes digital education policies. These initiatives support education, vocational training, and workplace learning and enable digital transformation [39].

### 3 Methodology

This study aims at comparing the economic growth models of Japan and the Nordic five countries of Denmark, Finland, Iceland, Norway, and Sweden through quantitative and qualitative analysis. The following describes the main components of this study's methodology.

#### 3.1 Data Collection

**(1) Secondary data collection - public statistical data:** Collect public data provided by the statistical offices of each country and international organizations. The data includes Gross Domestic Product per capita (GDPpc), productivity per capita, digitalization indices, and gender equality indices.

**(2) Government reports:** Analyze reports issued by the governments and related agencies of each country to understand policy directions and implementation statuses.

**(3) Academic papers:** Review past studies to gather existing knowledge on the economic growth models and related factors in each region.

#### 3.2 Methods of Analysis

**(1) Quantitative analysis – descriptive statistics:** Calculate basic statistical measures (mean, median, variance) to grasp an overview of the data.

**(2) Regression analysis:** Quantitatively evaluate how each factor influences economic growth.

**(3) Qualitative analysis – content analysis:** Analyze the content of government reports and academic papers to evaluate the characteristics and impacts of the economic growth models in each region.

**(4) Comparative analysis:** Compare the economic growth models of Japan and the Nordic countries to identify the strengths and weaknesses of each model.

## 4 Analysis

### 4.1 Analysis of the Relationship Between Gender Equality and Economic Growth

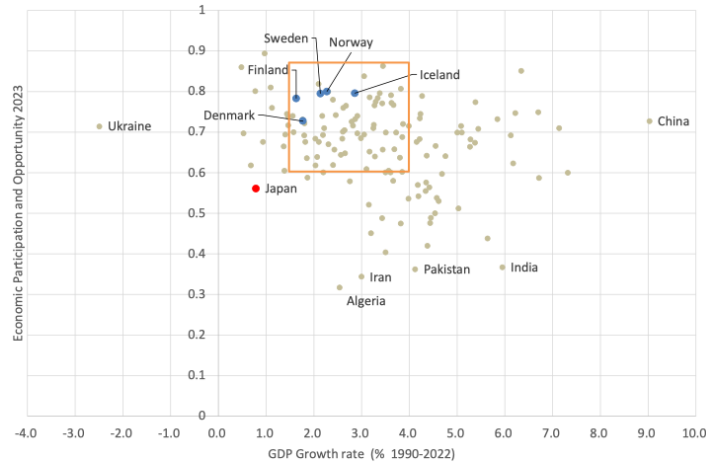


Figure 1: Relationship between gender equality and economic growth (1990-2022)

Figure 1 illustrates the link between each country's economic growth rate and gender equality in economic participation among 141 countries from 1990-2022. Numerous countries exceed a 0.7 gender equality score, with the median at 0.692 and Japan lagging at 0.561, akin to Africa's emerging economies beset by strife and financial woes and far below Ukraine due to Russia's incursion, which slashed its economy by 30%. A cluster of 71 nations (over 50%) falls within the 0.6-0.85 range, with 1.5%-4.0% annual growth rates, translating to a GDP increase of 1.6 to 3.5 times since 1990. This contrast highlights why Japan's global economic presence is diminishing, with its growth averaging only 0.8% annually, the only country among the under 0.6 score countries. Conversely, the Nordics, with scores above 0.72, maintain stable growth. China boasts a 9.0% growth, though this may be inflated. Despite gender scores under 0.6, South Asia and Islamic countries across Asia to North Africa report 2.5%-6% growth rates.

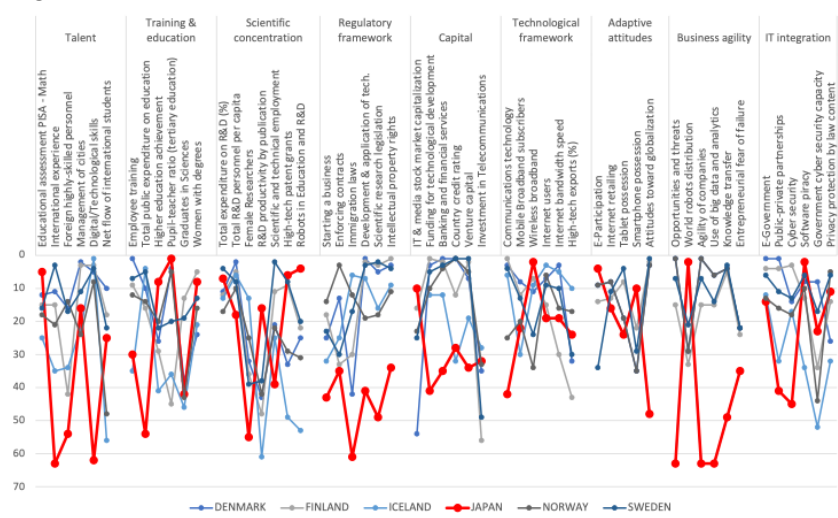


Figure 2: Comparison of competitiveness 2022, Japan and the Nordic countries

Figure 2 contrasts the digital competitiveness of the Nordic countries with Japan in 2022, revealing Japan's uneven performance against the Nordics' balanced scores. Japan excels in "tertiary education levels," "wireless broadband," "robotics," and "software piracy control," showcasing its digital strengths. However, it falls short in "international experience," "immigration laws," and "corporate agility," among others, ranking lowest in the G7 for "female researchers," "ease of starting a business," and "cybersecurity."

The disparity is stark in the underutilization of female talent, with Japan ranking 55th for "female researchers" despite high education levels. This gap suggests a loss of potential as educated women are not entering research fields. Addressing these imbalances is crucial for Japan to match the Nordics' digital competitiveness and capitalize on its educated workforce.

#### 4.2 Comparative Analysis of Global Changes in Industrial Structure

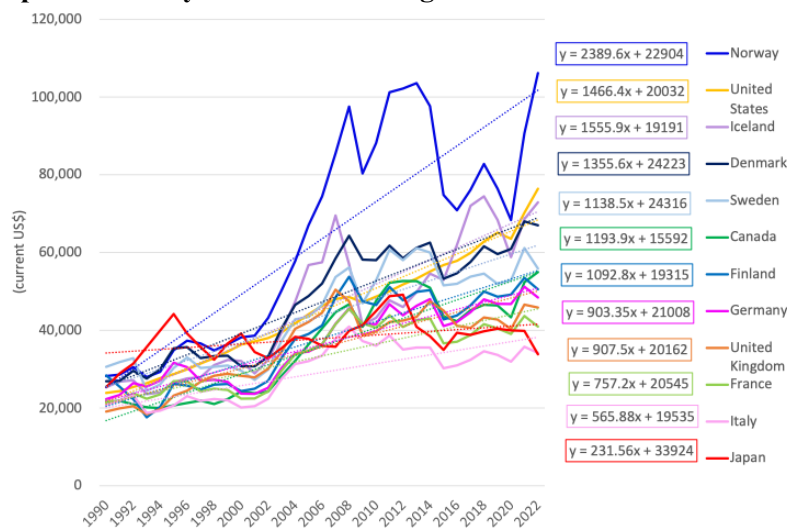


Figure 3: Transition of GDP per capita, G7 and the Nordic 5 countries (1990-2022)

Figure 3 compares GDP per capita from 1990 to 2022 among the G7 and Nordic countries, showing Japan's GDP per capita stagnation versus the Nordics' significant growth. Excluding resource-rich Norway, the US, Iceland, and Denmark have seen their GDP per capita triple, with annual increases exceeding \$1,300. Meanwhile, Sweden, Canada, Finland, Germany, the UK, and France have doubled their productivity, with yearly growth between \$750 to \$1,100. Italy, like Japan, shows stagnation but still doubles Japan's annual increase of \$230. The data underscores Japan's productivity challenges over the last 32 years, highlighting the need for strategies to boost economic growth.

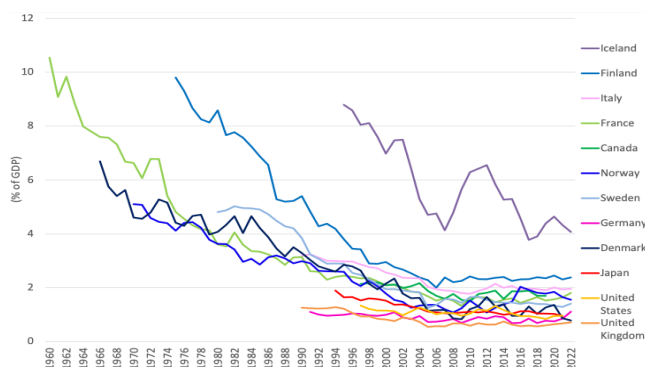


Figure 4: Transition of agricultural value to GDP %, G7 and the Nordic countries (1960-2022)

Figure 4 illustrates the declining contribution of agriculture, forestry, and fisheries to GDP, now accounting for only 1-2% in most countries, indicating a move away from traditional sectors towards knowledge economies.

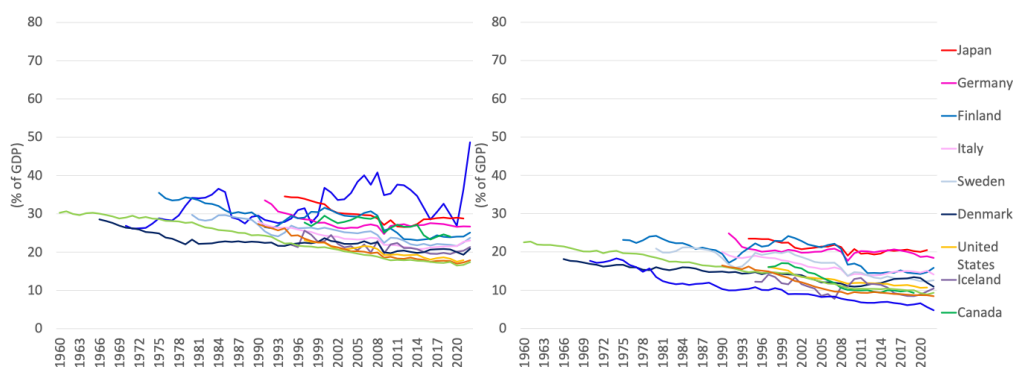


Figure 5: Transition of industry value added to GDP % (1960-2022) [left]

Figure 6: Transition of manufacture value added to GDP % (1960-2022) [right]

Figures 5 and 6 analyze the industrial and manufacturing sectors' GDP contributions, showing a general decline. The y-axis across both figures is meticulously aligned to enhance clarity and facilitate a straightforward comparative evaluation. It shows that Japan and Germany's slower decrease highlights their strategic focus on these sectors. In contrast, Norway's value added has surged to 50% of GDP, reflecting its economic strategy of leveraging natural resources.



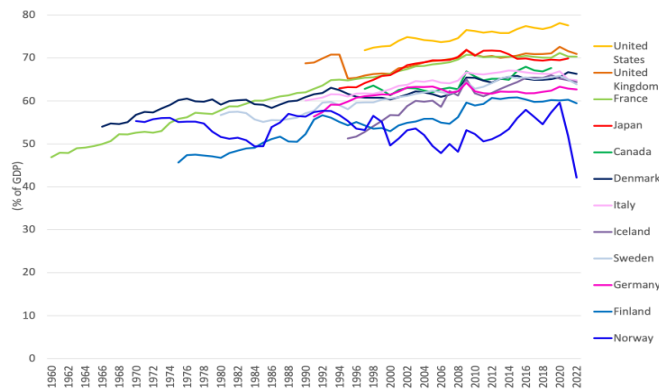


Figure 7: Transition of service value added to GDP % (1960-2022)

Figure 7 shows the service sector's growing GDP share, now 60-70% in most countries except Norway, signaling a shift towards service-oriented economic activities.

### 4.3 Qualitative and Quantitative Changes in Productivity

Figure 8 reveals a widening productivity gap since the 1990s, with Japan's agricultural productivity lagging significantly. By 2019, Japanese farmers added less than \$18,000 per worker, far behind the intermediate group's \$40,000 to \$60,000 and the leading group's \$84,000 to \$110,000. This disparity highlights the urgency for Japan to enhance its agricultural productivity to ensure economic sustainability.

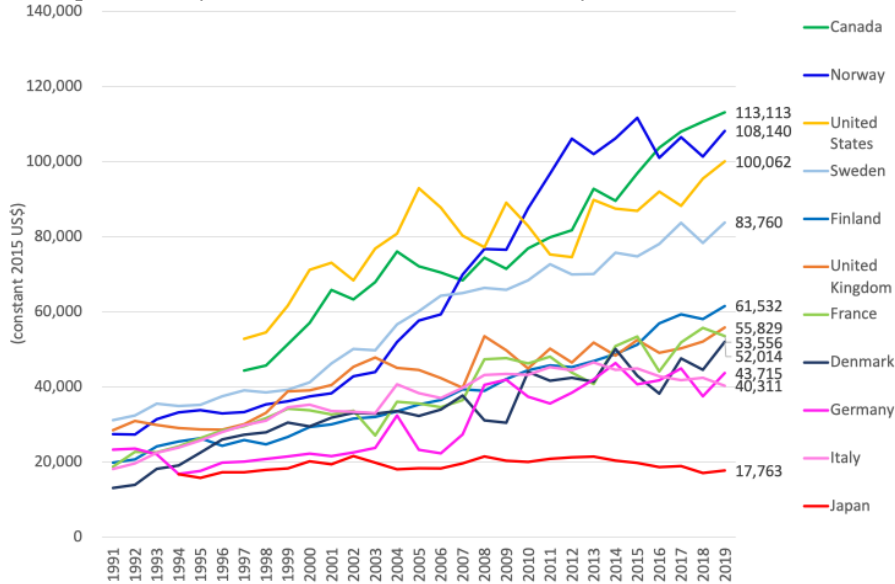


Figure 8: Transition of agriculture sector value added per worker, constant 2015 US\$, G7 and the Nordic countries (1991-2019)

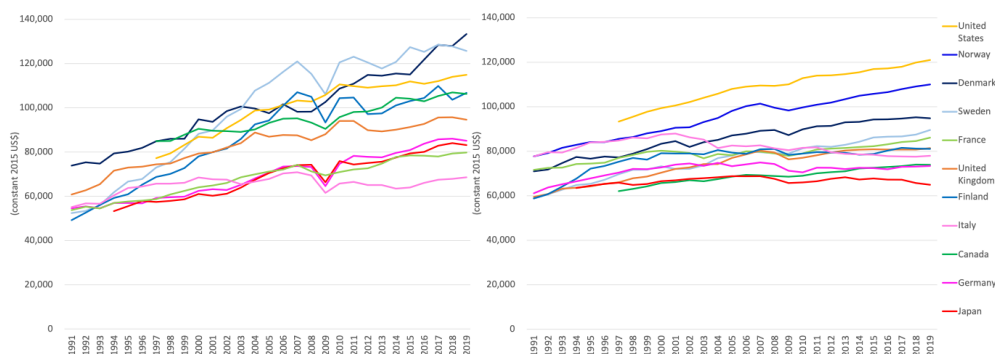


Figure 9, 10: Transition of value added per worker, constant 2015 US\$, G7 and the Nordic countries (1991-2019), industry sector [left], service sector [right]

Figures 9 and 10 illustrate the changing productivity within the industrial and service sectors from the 1990s to 2019. Japan, Germany, and France show parallel industrial growth, while Italy's stagnation post-financial crisis suggests a loss of competitiveness. The Nordic countries, however, have seen industrial productivity rise to \$100,000-\$130,000 per worker. In services, Japan's productivity remains stagnant at \$65,000, unlike other countries where service productivity reflects a vibrant, growing sector.

The analysis reveals that alongside quantitative improvements in productivity driven by social development, the concurrent integration of qualitative enhancements can further accelerate productivity gains. For instance, while advancements in production technology may boost industrial sector productivity, incorporating additional productivity-enhancing methods – such as streamlining operational efficiency via computerization, evolving logistics systems, and developing commercial frameworks – can expedite these improvements. Thus, a multifaceted approach can lead to a more rapid increase in productivity.

#### 4.4 What Drives Productivity in the Right Direction

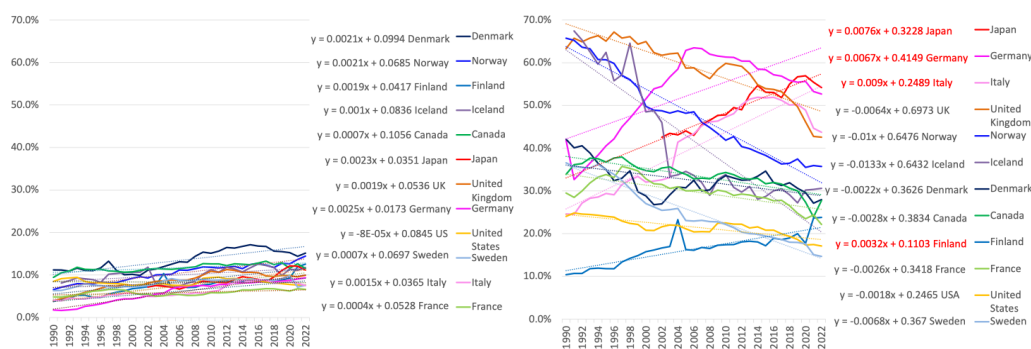


Figure 11: Transition of men non-regular employment ratio (1990-2022) [left]

Figure 12: Transition of women non-regular employment ratio (1990-2022) [right]

Figures 11 and 12 chart the shifts in regular versus non-regular employment among men and women from 1990 to 2022. The graphs, with a consistent Y-axis from 0-70%, show that men's unstable employment rose slightly from 1.8-11% in 1990 to 6-15% in 2022. For women, the early 1990s saw 25-67% in informal roles, except in Finland, where policies

kept it around 10%. By 2022, women's non-regular employment rates improved but remained high at 15-44%, with notable peaks in Iceland, Norway, and the U.K. The data from the 1990s, with up to two-thirds of women in non-regular jobs, highlights that the Nordic gender equality achievements were not instant, but evolved through persistent, targeted efforts. The progression towards gender parity continues, especially in the Nordic regions, as they strive for further advancements.

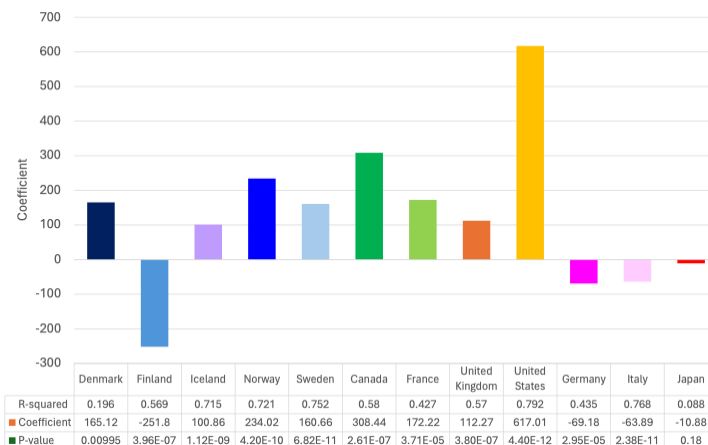


Figure 13: Impact of decrease in women non-regular employment ratio to GDP per capita

Figure 13 shows a regression analysis examining the effect of decreasing the proportion of women non-regular employees on GDP per capita in the Nordic countries and the Group of Seven (G7). This analysis reveals that, with the notable exception of Finland, which maintained a unique socialist economic framework under Soviet influence, a reduced percentage of women in non-regular employment is associated with increased GDP per capita in the Nordic countries. The findings are statistically significant in 11 countries, Japan being the exception. In the Nordic region specifically, a one percentage point decrease in the proportion of women non-regular workers is linked to an increase in GDP per capita of \$100 in Iceland, \$160 in Sweden, \$165 in Denmark, and \$234 in Norway. Among the G7 nations, the United States experienced the most pronounced increase at \$617, followed by Canada, France, and the United Kingdom.

In contrast, Germany, Italy, and Japan, known as manufacturing giants in the latter half of the 20th century, have encountered challenges adapting to the digitalization-driven changes in industrial structure. These countries have increasingly relied on non-regular employment as a cost-effective labor strategy to sustain their economic status. The absence of statistical significance in Japan's case suggests deeper systemic issues that hinder the reduction of women in non-regular employment.

## 5 Results

### 5.1 Nordic Innovation Model

After World War II, the Nordic countries broke away from their previous practices of male chauvinism, violence, and alcoholism. They aimed for a comprehensive welfare state based

on social democratic principles. They established a social security network that included free education and universal health insurance to increase people's autonomy and promote social mobility. The expansion of public sector employment also contributed to this trend. The Nordic countries did not transform their societies by advocating reforms or leading people into a frenzy, but instead by steadily improving the daily, everyday problems of life that were right in front of them.

The Nordic model emphasized labor market flexibility and adaptation to economic fluctuations through vocational training and transfer services. As part of the social corporatist economic model, it reduced the conflict between labor and capital and combined worker protection with social welfare. Promoting gender equality was a hallmark of the Nordic welfare model, which enabled full-time employment for both male and female and advanced legislation on parental leave. This concept encouraged female's entry into society and labor force participation. Educational reforms created a highly educated workforce adapted to a knowledge-based economy, and the introduction of digital education further boosted productivity. Entrepreneurship was encouraged, creating an environment that emphasized innovation and guaranteed ease of doing business.

Through these reforms, the Nordic countries have significantly increased productivity and GDP per capita. They have earned a global reputation for well-being, equality, and standard of living and have become successful social and economic models. The model attracts attention worldwide as an example of the balance between social welfare and economic efficiency.

## 5.2 Japanese Stagnation Model

Japan experienced a period of accelerated economic growth, which has shaped the contemporary societal structure. Despite the passage of time, some aspects of this system persist. To describe Japan in the terms used in the West at that time, "Japan is the country where 'salaryman' of the 'economic animal' with 'groupism' are living in a 'rabbit hutch' called 'danchi' (housing complex). 'Seniority system' and 'lifetime employment' make people 'workaholics' and become 'karoshi' or death from overwork. This expression is not a happy society, and there is room for improvement.

On the contrary, words of praise for Japan include 'technological prowess,' 'Japanese efficiency,' 'quality craftsmanship,' 'cultural richness,' 'Japanese discipline,' 'design aesthetics,' and 'gourmet cuisine' - words that express Japanese values that have little to do with the economy.

The potential for substantial societal transformation lies in the ability to sow the seeds of sustainable change within Japan. Consider the special spousal deduction, a tax incentive introduced in 1950 to support taxpayers with spouses, which played a role in bolstering Japan's post-war economic expansion [40]. This policy, while keeping traditional family structures, also inadvertently discouraged female workforce participation, reinforcing the male 'breadwinner' model.

Contemplating the implications of discontinuing such a system raises intriguing questions. What if Japan adopted a remuneration framework akin to Nordic countries? Such a shift

could herald a new era of economic and social dynamics, fostering a more inclusive and diversified labor market.

If female labor force participation rate ( $P_f$ ) of 54.2% equaled male rate ( $P_m$ ) of 71.4%:

Additional female joining workforce ( $N_{add}$ )

= 30.96 million (current female workers)  $\times$   $((P_m / P_f) - 1) = 9.97$  million

Direct GDP increase ( $G_i$ ) =  $N_{add} \times 5.453$  million yen (average male salary)

= 9.97 million  $\times$  5.453 million yen = 54.27 trillion yen

Considering 31.8% savings rate ( $S$ ) and consumption multiplier ( $k$ ):

Total economic impact =  $G_i + k \times (1 - S) \times G_i$

= 54.27 trillion yen + 113.73 trillion yen = 168 trillion yen

Through these calculations, it is concluded that increasing the female labor force participation to the same rate as male would add an additional 53.27 trillion yen to the GDP, and when considering the multiplier effect of consumption, a total economic effect of 168 trillion yen is anticipated.

## 6 Conclusion

Compared to the Nordic countries, Japan's societal system exhibits a pronounced lag in gender equality, particularly in political participation and economic engagement. Emulating the progressive reforms of the Nordic countries and rectifying the inequities in economic participation in Japan is a pivotal step towards revitalizing the society and escaping deflationary pressures. The Nordic countries have placed gender equality at the core of their societal reforms, fostering women's participation in the labor market. This approach has engendered economic diversification and innovation, leading to sustainable development. In contrast, Japan's insufficient economic engagement of women poses a significant impediment to economic growth. Creating an environment where women can work full-time and build careers is directly linked to economic revitalization. Educational reform also necessitates a gender equality perspective. Following the Nordic example by promoting digital and entrepreneurial education and creating an environment where women can assume leadership roles in all fields, including STEM, is imperative. This reform will enhance women's economic participation and elevate the overall innovation and competitiveness of society. Addressing the inequities in economic participation in Japan is not solely for the benefit of women, but it is also integral to the activation of the economy, sustainable societal growth, and the enhancement of international competitiveness. By incorporating the advanced reforms of the Nordic countries and leveraging Japan's unique cultural values, promoting women's economic participation can lead Japan out of deflation and pave a new path for economic growth.

This analysis posits that aligning female labor force participation with that of males, akin to the Nordic model, could potentially catalyze comprehensive societal transformation. It is imperative to acknowledge, however, that the underlying calculations derive from theoretical models. In practical terms, many variables may significantly influence economic outcomes following the repeal of the spousal deduction. These variables include shifts in labor market dynamics, alterations in women's career trajectories, modifications in working hours, a

decline in part-time roles, and an escalation in full-time and permanent positions. Furthermore, anticipated changes will likely extend beyond the labor market, impacting work-life balance and precipitating shifts across various sectors. Such transformations may encompass childcare reforms, an expansion and diversification of the educator workforce, the emergence of new enterprises, and the broader societal changes engendered by political equality. This scenario epitomizes the 'butterfly effect' as described by E. N. Lorenz, wherein slight initial differences may lead to significant unforeseen consequences. The precise magnitude of the multiplier effect 'k' is contingent upon a confluence of factors and warrants rigorous design and study through methodologies such as Agent-Based Modeling.

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