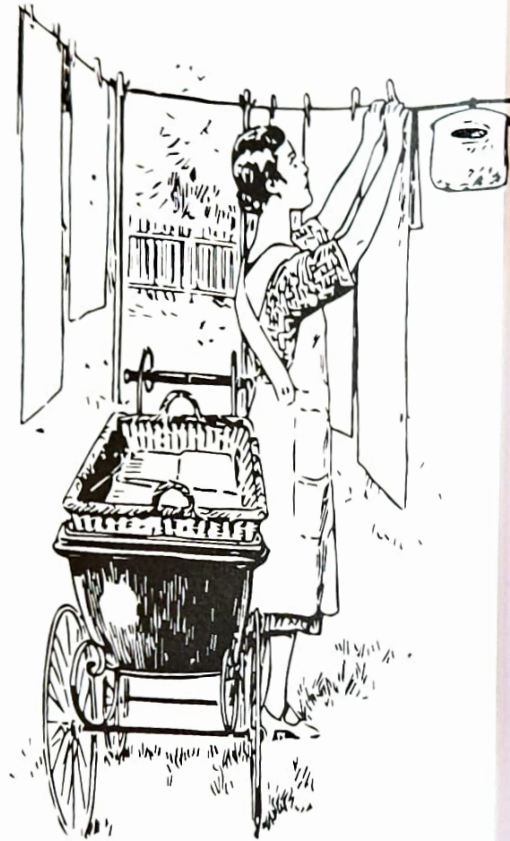


# The household equipment revolution

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Steps of the washing process in Germany, as illustrated in the 1920s.

Nowadays, in most countries a standard home is typically equipped with an oven, a refrigerator, a vacuum cleaner, and a washing machine. People take for granted the existence of these household appliances and do not realize the enormous amount of time that household equipment saves in daily life.

This is the original, English version of the essay. All translations from German are provided by the essay authors. Notes, references and sources can be found on p. 241.

Imagine one day that you wake up and discover all of your household appliances have disappeared! What would you do? How would you prepare meals, wash the dishes, clean the floor, and do the laundry?

A journey through economic history is taken here illustrating how the introduction of modern household appliances, together with the rationalization of the home, have reduced the burden of household work around the world. Women in both Germany and the United States played key roles in this process. The household equipment revolution facilitated the entry of women into the labor force.

### **Housework at the turn of the 20th century**

Back in 1900, without household appliances, the average US household spent 58 hours per week on housework.<sup>2</sup> Christine Frederick, an American home economist, communicated the laborious nature of housework around 1910.<sup>3</sup> “In our country home on Long Island, it required almost an hour for me to daily clean and fill seven portable oil lamps. I operated a hand pump to secure water from the cistern, placed my soup in a box fireless cooker, washed the children’s rompers in an unwieldy ‘dolly’ type washer by plunging its lever up and down, and smoothed these garments with a coal-heated ‘sad-iron.’ I used a broom and an oil mop on the floors.”<sup>4</sup>

In 1900, around 98% of households relied on a 12-cent scrub board for laundering clothes. The process involved transporting water to the stove where it was heated using wood or coal. Clothes were then cleaned using either a washboard or a mechanical washing machine. Subsequent rinsing was necessary. To remove excess water, clothes were either wrung out manually or through a mechanical wringer. Then, they were hung on a clothesline for drying. The final step involved the laborious task of ironing, utilizing weighty flatirons that required constant heating on the stove.

A similar picture was depicted for Germany during the 1920s by Erna Meyer, a German economist and journalist (see figure on the left).<sup>5</sup>

### **The decline in hours of housework**

The time spent on household chores has declined sharply in the United States over the 20th century, reaching just 18 hours per week by 1975 (from 58 hours per week in the beginning of the century).<sup>6</sup> This process was gradual and stabilized after the 1990s. Nowadays, there are still differences across countries in the average weekly hours spent on housework. Households in poorer countries tend to spend more time on cleaning and cooking as the adoption of modern home appliances and

technological innovations is slower than in richer countries. For example, in 2005 only 36% and 64% of households in Brazil and Mexico, respectively, owned a washing machine as opposed to 82% in the United States.<sup>7</sup>

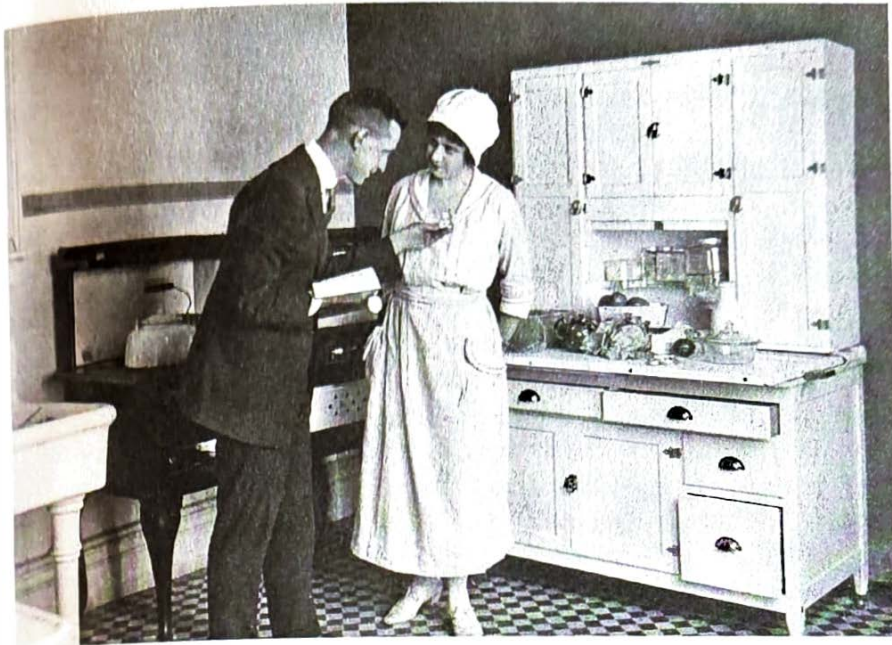
### **Engines of liberation**

The drop in time spent on household chores took place in a period during which household appliances, such as refrigerators, washing machines and dishwashers, emerged and became widely adopted among American households.<sup>8</sup> The widespread adoption of these appliances was driven by a significant decline in their time prices, namely the time needed on average to work, in order to afford the respective appliance.<sup>9</sup> For example, no households had a refrigerator in 1925 but 100% did by 1978. Between 1949 and 1983 the time price of refrigerators, adjusted for quality, fell 8.1% annually. Miele launched Europe's first mass-produced washing machine in 1901 and the first dishwasher in 1929.

In 1945-46, the Rural Electrification Authority conducted a study, focusing on 12 farm wives in the United States to assess the impact of electrification on laundry activities. The comparison involved evaluating the time spent handwashing versus utilizing electrical equipment. Each participant was equipped with a pedometer. One of them was Mrs. Verett from Floydada, Texas. Before electrification, she employed a gas-powered washing machine (as opposed to a scrub board) for laundry tasks. Post-electrification, she adopted electrical appliances such as a washer, dryer, and iron, along with the installation of a water system featuring a water heater. The study estimated that, before being equipped with electric appliances, handwashing a 38 lb. load took approximately 4 hours, with an additional 4.5 hours for ironing, using traditional irons. In contrast, utilizing electrical appliances reduced laundry time to 41 minutes, with ironing taking 1.75 hours. The distance Mrs. Verett walked for handwashing decreased from 3,181 feet to 332 feet with electrical equipment. Similarly, the distance covered during ironing fell from 3,122 feet to 333 feet with the adoption of electrical appliances.

The Second Industrial Revolution and electrification brought about, among other things, women's magazines brimmed with articles praising the benefits of household appliances in assisting women with domestic tasks. For example, a 1920 piece in the "Ladies' Home Journal" titled "Making Housekeeping Automatic" asserted that household appliances could save a four-person family 18.5 hours of weekly housework (of which 8.5 was for meal preparation and 7.75 for cleaning, dishwashing, washing, and ironing).

A similar movement took place also in Germany. Authors Hildegard Margis and Mechthilde Raetsch mention in their book: "Considering that there is hardly any need for constant supervision during electric cooking, and the homemaker can



Author Christine Frederick presents her kitchen laboratory.

attend to other tasks during the cooking process, it is safe to say that electric cooking is a significant relief for the homemaker." "The housewife is no longer tied to monitoring the cooking process as before, freeing her up to engage in other household tasks during cooking. It is a considerable relief for her, especially since she is no longer confined to 'the kitchen' even during cooking."<sup>10</sup>

The microwave oven is another time-saving device. It was invented in 1945 by Percy LeBaron Spencer, an American physicist and inventor. While working with a magnetron, a high-power vacuum tube used in radars, he noticed that a chocolate bar in his pocket melted. Investigating, he then placed an egg in a tea kettle by the magnetron. It exploded with hot yolk. He then built a metal box and saw that food could be cooked by microwaves. This was the genesis of the microwave oven. The company he worked for, Raytheon, filed a patent application in 1945.

The first use of microwave ovens was in commercial restaurants. The food industry used them for various things such as drying potato chips and roasting coffee. These commercial microwaves were expensive and huge, \$2,000 to \$3,000 (or about \$22,000 to \$33,000 in today's terms) and 6 feet high. The microwave oven entered the home in the 1970s. It diffused rapidly among households, propelled by a rapid (quality-adjusted) price drop of 60% by 1980.

### **Taylorism in the home**

In 1909 Frederick Winslow Taylor, an American mechanical engineer, published a book titled "The Principles of Scientific Management". A mechanical engineer by training, he was interested in increasing industrial efficiency by rationalizing the industrial workplace. It wasn't long before groundbreaking women, such as Christine Frederick and Erna Meyer, strived for efficiency in the home.

In parallel to the advancement of new home appliances, the organization of household tasks also underwent rationalization. In 1912, Christine Frederick set up the Applecroft Experiment Station (see figure above). The station's goal was to promote efficiency in housework. To this end, she conducted time and motion studies on housework, tested various new household appliances, and studied kitchen design.

Frederick initially applied her innovative approach to dishwashing, later extending its application to various tasks. She meticulously dissected dishwashing into three distinct phases: scraping and stacking, washing, and drying, as well as putting away dishes and utensils. Frederick's calculations led her to determine the optimal sink height, and she discovered that efficiency in dishwashing could be significantly improved by incorporating drainboards on the left, utilizing deeper sinks, and connecting a rinsing hose to the hot water outlet—yielding a time-saving benefit of approximately 15 minutes per dinner. In 1913, she reflected on the unnecessary physical strain experienced by countless women who stooped over kitchen tables, sinks, and ironing boards, drawing parallels to the strain endured by bricklayers.”

Frederick, along with others in the home economics movement, exerted a substantial influence on the design of appliances and homes. The evolution of the kitchen serves as a notable example. In the 1800s, kitchens were characterized by large tables and isolated dressers. However, by the 1930s, an organized kitchen with continuous working surfaces and built-in cabinets began to emerge. The integration of kitchens with dining rooms and other living areas in the 1940s marked the end of the housewife's isolation.

The correct arrangement of kitchen furnishings as envisioned by Leta Stetter Street Taft, mid-1920s



In her book "Household Engineering"<sup>12</sup>, Christine Frederick illustrated a poorly organized kitchen versus an efficiently organized one. In the efficiently organized kitchen, equipment for food preparation and clearing are strategically arranged in proximity, contrasting with the more haphazard arrangement in the poorly planned kitchen.

A few years later, Erna Meyer emphasized efficient kitchen organization in her 1926 book "Der neue Haushalt" (The new household in English). She proposed an efficient kitchen floor plan, which could be implemented in both the simplest and most luxurious kitchens (see figure on the left).

The quest for attaining the most ergonomic work posture gives rise to another crucial requirement, already extensively addressed by industrial workers due to its long-acknowledged significance: ensuring the proper working height. All items need to be adjusted at a certain height, referred to as the working height. According to Meyer, this height is deemed correct when it minimizes tension, even in muscle groups not directly engaged in the task, and when there is no discomfort or pain in the feet, legs, chest, back, or neck, even during prolonged periods of work.

### **Selling Mrs. Consumer<sup>13</sup>**

When marketing was in its infancy, Christine Frederick wrote a book titled "Selling Mrs. Consumer." The first chapter was titled "The Growing Recognition of the Need for Consumer Study." She wrote that "consumer market research is the bridge that covers the great gap by which most business firms are separated from the consumers,"<sup>14</sup> further writing "knowledge of the consumer is gained by analytical study, research, test, consultation and experimental contact."<sup>15</sup> She was particularly interested in marketing new household appliances to women.

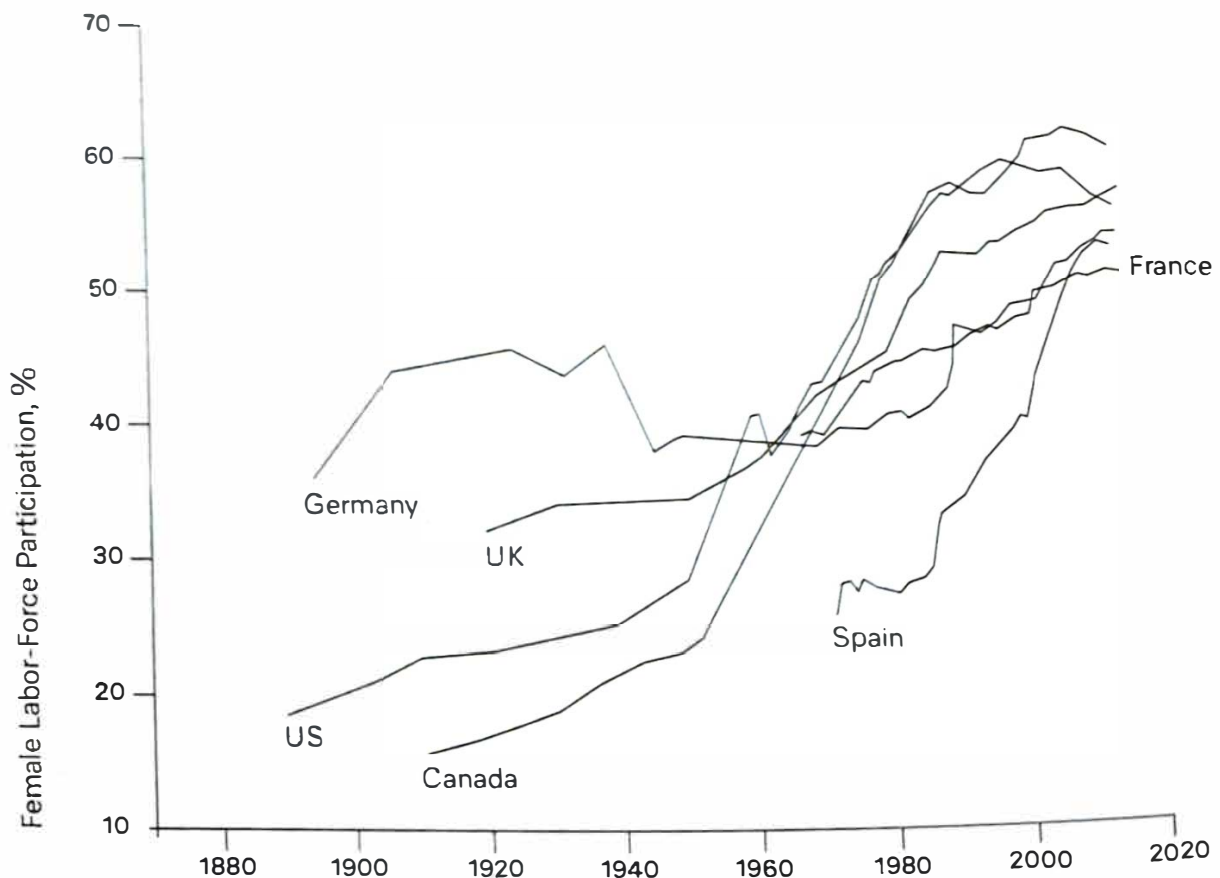
In her book she presented many facts about the American consumer. She showed a pie chart displaying the percentage shares of 5 broad categories of spending to total consumer spending in 1913 and the growth of each category from 1913 to 1923: food, clothing, housing, fuel-light, furniture-furnishing, and miscellaneous. She subsequently provided a detailed breakdown of per-capita spending within each category. She also examined three aggregated consumption categories by 10 income levels. As income levels fell, families spent proportionately more on necessities, less on advancement, and had smaller surpluses.<sup>16</sup> Spending was also broken down across men and women.

Marketing campaigns in that period emphasized the gain in leisure from new electric appliances. For example, an Irish advertisement from the 1930s stated

“The Mistress of the Home free from unnecessary toil, free from health-destroying fatigue, free to rest and read.”<sup>17</sup> In the same vein, a German advertisement by Miele from the 1950s stated “The housewife had a long, tiring day at work. Any relief is very welcome.” Christine Frederick advised “the seller must always keep in mind when offering household equipment: does this tool, device, or appliance give Mrs. Consumer more leisure?”<sup>18</sup>

### Evolving households

The household equipment revolution changed the way of life for households around the world during the 20th century (see figure below). A celebrated study in sociology found that 87% of married housewives in a small town in Indiana named Middletown spent more than 4 hours per day on housework in 1924 and none spent less than 1 hour.<sup>19</sup> A follow-up study in 1999 reported that only 14% of housewives spent more than 4 hours per day on housework and 33% spent less than 1 hour. Over the course of this same period married female labor-force participation in the United States rose from 7% to 61%. It would have been infeasible for married women to enter the labor force if labor-saving household technologies had not reduced the burden of labor in the home. Laboring 58 hours in the home, as in 1900, and then spending roughly 40 hours per week at a job in the market these days would not be workable for most women. Additionally, American time-use studies find that women’s leisure increased somewhere between 4 to 8 hours per week



Evolution of female labor-force participation rates in a set of countries.

In vielen Ländern  
in vielen Sprachen -  
es geht nichts  
über eine

**Miele**

Miele macht's der Hausfrau leichter

In 1958, Miele advertised its washing machines with the slogan "In many countries, in many languages there's nothing like a Miele. Miele makes things easier for housewives." The intent of the advertisement, in part, was to highlight the broad international distribution of Miele washing machines in 1958. The use of stereotypes regarding national dress was in keeping with the historical context of the time.

over the period 1965 and 2003. This amounts, in just over a 40-year period, to between two and four weeks of extra free non-sleeping time per year. The same trends in female labor-force participation are observed worldwide (see figure above).<sup>20</sup>

Additionally, the reduction in the household labor needed to maintain a home has made it easier for people to live a single life. This has lessened the incentive to get married. At the beginning of the 20th century in the United States the fraction of young independent households made up by a single woman was close to zero, while it reached around 50% in 2000. This has contributed to a worldwide reduction in marriage rates. In the United States the number of marriages per 1,000 people fell from 16.4 to 6.5 between 1946 and 2018, while in Germany it declined from 8.5 to 4.9 over the period 1960 to 2017.<sup>21</sup>

The household equipment revolution is significant even when judged alongside the new technologies in industry brought about by the Second Industrial Revolution at the turn of the last century. The decline in household labor also reduced the benefits of the traditional division of labor, with a breadwinner husband and housekeeper wife. The household equipment revolution was an engine of liberation.

**EDITOR'S NOTES TO GUEST CONTRIBUTION  
'THE HOUSEHOLD EQUIPMENT REVOLUTION'**

1 Our special thanks go to Jiangting Wang for her excellent research assistance. Sections in this article are taken from: Greenwood, Jeremy: *Evolving Households: The Imprint of Technology on Life*, The MIT Press, Cambridge (MA) 2019; Greenwood, Jeremy; Guner, Nezih; Marto, Ricardo: *The Great Transition: Kuznets Facts for Family-Economists*, in: Lundberg, Shelly; Voena, Alessandra (eds.): *Handbook of the Economics of the Family*, Elsevier, Amsterdam 2023, pp. 389-441.

2 Greenwood, *Evolving Households: The Imprint of Technology on Life*, p. 45.

3 Biography of Christine Frederick contained in: Rutherford, Janice Williams: *Selling Mrs. Consumer: Christine Frederick and the Rise of Household Efficiency*, University of Georgia Press, Athens (GA) 2003.

4 The cooking box was an insulated metal box in which a pot containing food that had previously been cooked on a wood or coal cooker was placed. The preheated soapstone discs on the bottom of the box ensured that the food cooked without any further energy input. Frederick, Christine: *Selling Mrs Consumer*, Business Bourse, New York 1929, p. 167.

5 Meyer received her doctorate in economics from the University of Berlin in 1913.

6 Greenwood; Guner; Marto: *The Great Transition*, pp. 389–441, see: p. 393.

7 Cubas, German: *Distortions, Infrastructure, and Female Labor Supply in Developing Countries*, in: *European Economic Review*, 87/2016, pp. 194–215, see: p. 200.

8 Greenwood, Jeremy; Seshadri, Ananth; Yorukoglu, Mehmet: *Engines of Liberation*, in: *Review of Economic Studies* 72 (1)/2005, pp. 109–133, see: p. 111.

9 Gaffney, Ruth: *The Complete Farm Laundry*, in: *Electrical Merchandising*, 1st March 1947, pp. 38–39.

10 Margis, Hildegard; Raetsch, Mechthilde: *Köstliche Küche: Anleitungen zum elektrischen Kochen*, Frauendienst-Verlag, Berlin 1933, p. 13; p. 18. Original quotes: "Wenn man bedenkt, dass beim elektrischen Kochen kaum ein Zwang zur Beaufsichtigung besteht, also die Hausfrau während des Kochprozesses andere Arbeiten erledigen kann, darf man ruhig behaupten, dass das elektrische Kochen eine große Entlastung für die Hausfrau ist." "Die Hausfrau ist nicht mehr wie früher an die Überwachung des Kochguts gebunden. Sie wird von der lästigen Herdarbeit befreit und kann während des Kochens anderen Hausarbeiten nachgehen. Das ist eine erhebliche Entlastung, insbesondere weil sie während des Kochvorgangs nicht mehr ausschließlich an ‚die Küche‘ gebunden ist."

Hildegard Margis was a staunch advocate of household technology and the rationalization of the household. She not only wrote articles and books on household topics, but also founded the Hauswirtschaftlichen Einkaufs-, Beratungs- und Auskunftsdienst (Heibaudi). Together with the Deutsche Verlags-Anstalt, Margis founded the Verlag für Hauswirtschaft, a publishing house, in 1928. In 1930, she joined Ullstein Verlag, where she published texts on women's issues. Margis was also present on the radio and reported on measures to rationalize the household. She died in 1944 at the age of 57 as a result of torture by the Gestapo. Hildegard Margis was Jewish. Detailed information on her life and work can be found in: Braun von, Christina: *Stille Post: Eine andere Familiengeschichte*, Propyläen, Berlin 2007.

11 The American engineer, consultant and author Frank Bunker Gilbreth (1886-1924) was an early advocate of scientific management. Gilbreth developed labor-saving tools for bricklayers (such as an adjustable working scaffold) so that they no longer had to bend down when reaching for bricks. This enabled a massive increase in efficiency. His book "Bricklaying System", published in 1909, focused on this topic.

12 Frederick, Christine: *Household Engineering. Scientific Management in the Home*, American School of Home Economics, Chicago 1919.

13 The title of Christine Fredrick's book, published in 1929.

14 Frederick, *Selling Mrs. Consumer*, p. 89.

15 Frederick, *Selling Mrs. Consumer*, p. 99.

16 It is not entirely clear exactly what Frederick meant by the terms "advancement" and "surplus". It is reasonable to assume that "advancement" referred to personal development such as education, personal hygiene, leisure and travelling, while "surplus" stood for savings.

17 Electricity supply board: *Leisure Electricity*, Dublin undated (ca. 1930s), URL: [https://commons.wikimedia.org/wiki/File:ESB\\_Showroom\\_25\\_St.\\_Stephen%E2%80%99s\\_Green\\_and\\_advertisement,\\_1930s.png](https://commons.wikimedia.org/wiki/File:ESB_Showroom_25_St._Stephen%E2%80%99s_Green_and_advertisement,_1930s.png) (as at 23/05/2024).

18 Frederick, *Selling Mrs. Consumer*, p. 170.

19 Greenwood, *Evolving Households: The Imprint of Technology on Life*, p. 55. The study was conducted by renowned American sociologists, the couple Robert and Helen Lynd.

20 Proportion of the employed female population aged 15 and over based on OECD figures, taken from: International Labour Organization (via World Bank): *Our World in Data*, Labor force participation rate for ages 15-24, female, URL: <https://ourworldindata.org/grapher/labor-force-participation-rates-for-women-ages-15-24-2020-vs-1980> (as at 23/05/2024); Long, Clarence D.: *The Labor Force under Changing Income and Employment*, Princeton University Press, Princeton 1958.

21 Ratio of the number of marriages during the year to the average population in that year, per 1,000 inhabitants, taken from: OWID based on UN, OECD, Eurostat and other sources (processed by Our World in Data): *Crude marriage rate (per 1,000 inhabitants)*, URL: <https://ourworldindata.org/grapher/marriage-rate-per-1000-inhabitants> (as at 23/05/2024).

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