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Home Office and Remote Work
Potentials across Swiss Industries

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Abstract

This paper documents the remote potential across Swiss industries, relying on data provided by the Swiss Statistical Office. Overall, the obtained results show that 47.1% of jobs in the current Swiss economy can at least partly be performed from home. In comparison, only 25.8% of employees indicate that they work remotely. Consequently, the implementation of remote work could almost be doubled to fully exploit the existing potential. Furthermore, there exists a substantial variation across Swiss industries and for employees' socio-demographic characteristics. Overall, Swiss industries are able to adopt remote work when required, which is demonstrated by the exploitation of previously untapped potentials during the COVID-19 pandemic.

Keywords

Remote work, Switzerland, digital transformation, teleworking

JEL Classification

D240, J240, J220, R120, O330, P180

1 Introduction

Due to current political events, remote work is discussed as potential measure to reduce industrial energy consumption. However, such an approach would also shift costs to private households. To estimate aggregate effects, it is hence necessary to evaluate the extent to which different industries can implement remote work.

Therefore, this paper documents the remote potential in Switzerland. More specifically, the analysis relies on a binary measure, indicating whether specific occupations can be performed at least partly from home. This information is combined with the Swiss Labor Force Survey SAKE, provided by the Swiss Statistical Office. The representative data allows to explore the variation across industries, as well as between Swiss regions and employees' socio-economic characteristics. Thus, the obtained results represent an upper bound to which extent industries can implement remote work in Switzerland. Overall, the obtained results show that 47.1% of jobs in the current Swiss economy can at least partly be performed from home. In comparison, only 25.8% indicate that they work remotely. Therefore, the implementation of remote work could almost be doubled to fully exploit the potential. Furthermore, the results reveal significant variation across Swiss industries and for employees' socio-demographic characteristics.

The analysis relates to two strands of the literature: First, it adds to the literature on new work in general, and to the literature on remote potentials in specific. Secondly, it provides a scientific foundation for the evaluation of potential energy saving due to remote work in Switzerland.

Over the last two years, the COVID-19 pandemic accelerated the use of home office. Existing studies and surveys show that employees strongly value the access to a hybrid working environment and report positive experiences (Bonin et al., 2021; Stuerz et al., 2020; Ozimek, 2020; Barrero et al., 2021; Criscuolo et al., 2022; Microsoft Corporation, 2021; Criscuolo et al., 2022). Attrition rates decrease significantly, and teleworkers report improved work satisfaction (Bloom et al., 2015; Angelici and Profeta, 2020). However, pandemic-related working conditions in home office also negatively affected family satisfaction, for instance due to increased child care obligations and stress (Möhrling et al., 2021). Furthermore, teleworking significantly increases the number of working hours per day and relates to higher coordination costs (Krumm et al., 2016; DeFilippis et al., 2020; Gibbs et al., 2021). Still, job applicants are willing to accept average wage cuts of 8% in exchange for the access to remote work (Mas and Pallais, 2017). When forced to return to the office full time, 40% of employees indicate that they consider a change of employment (Barrero et al., 2021). Overall, the pandemic shifted preferences towards remote work, and relative employment growth increased in industries with high telework potential (Barrero et al., 2021). This analysis contributes to the existing literature by providing first results on the remote potential of Swiss industries.

Thereby, the analysis also adds to the literature on remote work potentials. Dingel and Neiman

(2020) develop the methodology to evaluate the remote work potential for specific occupations. They show that 37% of jobs in the US economy can completely be performed remotely and that in general, higher-income economies have a higher share of jobs that can be done from home. Related work by Mongey et al. (2021) finds that US workers with low teleworking potential have lower income, fewer liquid assets, and are less educated than those with high teleworking potential. Also, this type is more likely to experience job loss, which is confirmed by Adams-Prassl et al. (2020) for the UK. Alipour et al. (2020) analyze for Germany the potential to work from home. According to their results, home office is feasible for approximately 56% of the German work force. Here, I apply the methodology of Dingel and Neiman (2020) to Swiss data and evaluate additional data on home office use after the pandemic.

Currently, remote work is also discussed in the context of potential energy savings. On the one hand, remote work contributes to the decline of energy consumption and air pollution due to reduced traffic and lower energy demand for office buildings. Working remote reduces commuting time and distances (Hamer et al., 1991; Henderson and Mokhtarian, 1996; Larson and Zhao, 2017). Also, it improves individuals' energy efficiency behavior as employees internalize related costs (O'Brien and Aliabadi, 2020). On the other hand, remote work shifts costs to private households. Remote work requires lighting, heating, and office equipment (Nakanishi, 2015). Overall, research on net effects are mixed, although the majority of existing studies finds an overall reduction (see O'Brien and Aliabadi, 2020 for a review). Therefore, obtaining insights on the degree to which remote work would be feasible in Switzerland is crucial for policy makers and for the evaluation of aggregate effects from remote work on private households and industries.

Overall, this paper contributes to the existing research in three ways. First of all, this is the first empirical study that specifically addresses home office potentials in Switzerland. Hereby, the analysis expands the research field by additionally analyzing the number of remote working hours per week. Secondly, it offers first results on remote working patterns after the lock-down was lifted. These show that after the pandemic, the average number of remote working hours increased substantially across industries, even though the share of employees working from home decreased to the pre-pandemic level. Thirdly, the results provide the scientific foundation for further evaluations of potential energy savings due to remote. As noted by Wöhner (2022), the Swiss ICT infrastructure is highly developed and therefore, teleworking potentials can be largely exploited. Consequently, unused home office potentials are of high economic and political relevance. In the following, the implemented methodology and the data set are discussed in section 2, whereas section 3 presents the obtained results. Finally, section Section 2 provides information on the data set, whereas section 3 presents obtained results. Finally, section 4 concludes the analysis with a discussion.

2 Empirical Approach

2.1 Methodology

The calculation of the remote potential relies on the methodology of Dingel and Neiman (2020) and the US database O*Net. For each occupation, this database provides information on knowledge, skills, abilities, work activities, and work context. An occupation is categorized as having no potential of being performed remotely, when the average survey respondent agrees to at least one of the statements listed in Appendix Table 5. Dingel and Neiman (2020) create a binary variable which is coded to 0 when an occupation meets one of the exclusion criteria, and 1 else. Hence, based on this binary measure, the analysis provides an upper bound for the existing home office potential.

Each occupation in the database has an 8-digits O*NET occupation code. To match the data provided by the Swiss Statistical Office, this information is aggregated to the 4-digits International Standard Classification of Occupations (ISCO 08).¹ The ISCO occupation file includes information on 422 occupations. Of those, 35.93% can potentially be performed remotely.

The occupation data is combined with the Swiss labor force survey SAKE ('Schweizer Arbeit-kräfteerhebung'). SAKE is a representative sample of the Swiss population providing information on occupational activities, economic outcomes, and socio-demographic characteristics. The annual 2021 SAKE survey data is used for this analysis. The sample is restricted to employees with occupations for which information on the remote potential is available, and cross-sectional sample weights are used for all calculations. The final sample includes 33'427 observations.

2.2 Data

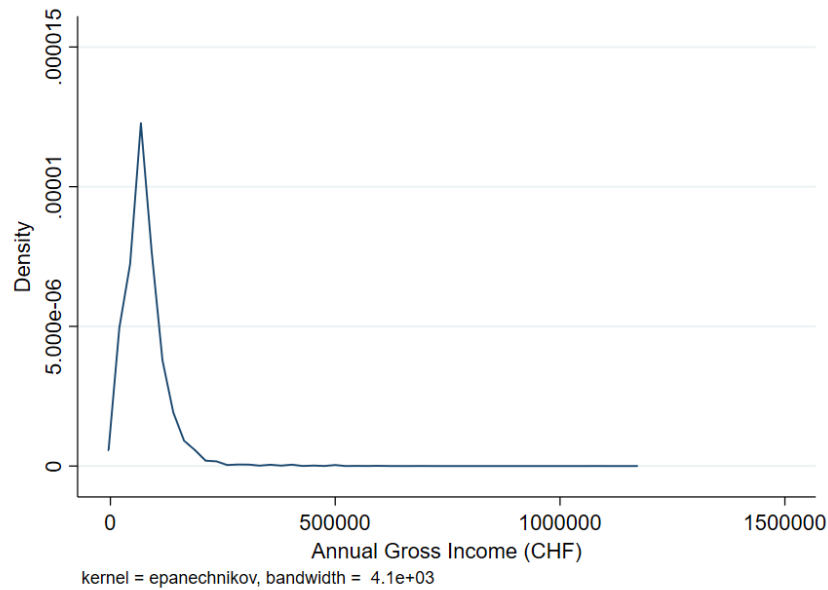
Table 1 shows descriptive statistics. On average, Swiss employees are 43.8 years old, and the sample is approximately balanced between females and males. They earn an average annual gross income of 75,932.17 Swiss Francs (CHF). Figure 1 shows the kernel density plot of the income distribution, which ranges up to 1,167,679 CHF.

Educational attainment is measured by binary dummy variables. Overall, vocational training is dominant with a share of 22.3%. Additional 6.2% of individuals have compulsory education, and 13.2% advanced secondary degrees such as Matura, college degrees, and the national professional examination ('Eidgenössischer Fachausweis'). Finally, 17.5% have an academic degree from universities and applied universities.

Binary variables also capture in which industry an individual is employed. Table 1 shows industries at the 1-digit summary level, following the Swiss NOGA classification. Considerable employment

¹More specifically, the 8-digits O*NET are converted into 6-digits Standard Occupation Codes (SOC 10), and then further into ISCO 08. Unweighted means are used in the aggregation process.

Figure 1: Income Distribution of Swiss Employees in 2021



Source: Swiss Labor Market Survey (SAKE) 2021, own calculations. This figure shows the kernel density plot of Swiss employees' income distribution with applied cross-sectional sample weights.

shares exist in the industry of human health and social work activities (16.3%), and furthermore in trade (11.5%), mining and quarrying (12.8%).

The question “Have you worked from home at least once in the last 4 weeks?” is used to construct the home office variable. This is a binary variable indicating whether individuals already have access to remote work, which is the case for 25.8% of employees. This home office variable is also calculated for the SAKE waves from 2001 to 2021 to illustrate changes over time. Additionally, the sample includes the average number of hours employees work from home, conditional on reporting positive values.

Thereby, the analysis differs from the approach of the Swiss Federal Statistical Office to report home office use. Provided summary statistics of the Swiss Statistical Office focuses on teleworking. Teleworking measures whether individuals use the internet at home to communicate with employers or clients. According to the Statistical Office, 39.6% of the Swiss labor force engages in teleworking activities.² This is significantly higher than the use of home office provided by this analysis. However, the Statistical Office's measure might also captures simple email responses after work which do not represent full home office days. Therefore, this analysis relies on actual home office use rather than on teleworking use.

²<https://www.bfs.admin.ch/bfs/de/home/statistiken/kultur-medien-informationsgesellschaft-sport/informationsgesellschaft/gesamtindikatoren/volkswirtschaft/teleheimarbeit.html>.

Table 1: Descriptive Statistics

	Mean	N
Age	43.797 (12.264)	33,427
Gender	0.498 (0.500)	33,427
Annual Gross Income	75,932.17 (51,072.82)	31,220
Worked from Home	0.258 (0.437)	33,427
Weekly Home Office Hours	13.334 (9.794)	4,348
Education		
Compulsory Education	0.062 (0.242)	33,427
Vocational Training	0.223 (0.417)	33,427
Advanced Secondary Degrees	0.132 (0.338)	33,427
Tertiary Degrees	0.175 (9.380)	33,427
Industry		
Agriculture, forestry and fishing	0.008 (0.090)	33,427
Mining and quarrying	0.128 (0.334)	33,427
Manufacturing	0.066 (0.248)	33,427
Wholesale and retail trade, repair of motor vehicles and motorcycles	0.115 (0.320)	33,427
Transportation and storage	0.047 (0.212)	33,427
Accommodation and food service activities	0.037 (0.188)	33,427
Information and communication	0.039 (0.194)	33,427
Financial and insurance activities	0.063 (0.243)	33,427
Real estate activities	0.051 (0.219)	33,427
Professional, scientific and technical activities	0.090 (0.271)	33,427
Public administration extraterritorial organisations	0.061 (0.239)	33,427
Education	0.085 (0.279)	33,427
Human health and social work activities	0.163 (0.369)	33,427
Arts, entertainment and recreation	0.056 (0.230)	33,427

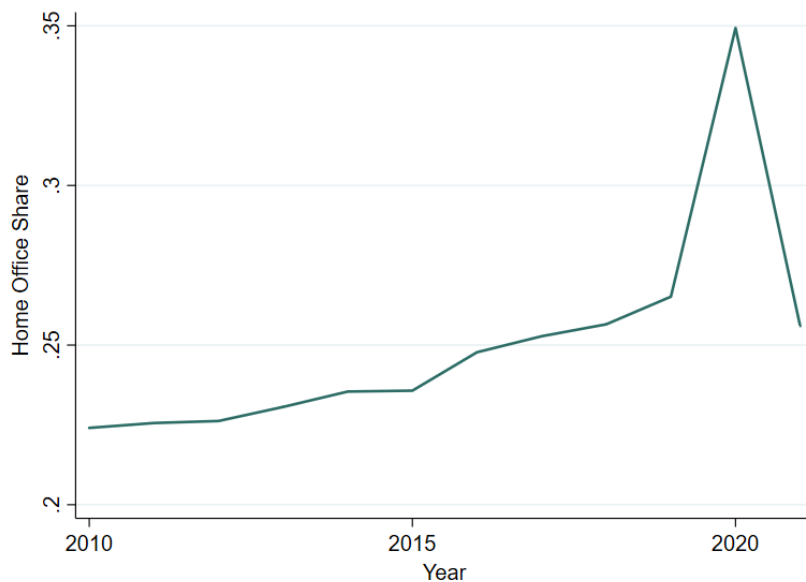
Note: Standard errors in parentheses. All descriptive statistics are obtained using cross-sectional sample weights. The annual gross income is measured in current Swiss Francs (CHF).

3 Results

3.1 The Access to Remote Work in Switzerland

Table 2 shows the share of employees working from home between 2010 to 2021. This share has moderately increased over the last decade, before spiking in 2020 due to the COVID-19 pandemic. In 2010, 22.4% of employees worked from home, which slowly increases to 26.5% in 2019. The pandemic relates to a 10-percentage point increase in remote work, however, one year later, the share is even slightly below the pre-pandemic level.

Figure 2: Home Office in Switzerland



Source: Swiss Labor Market Survey (SAKE) 2010 - 2021, own calculations.

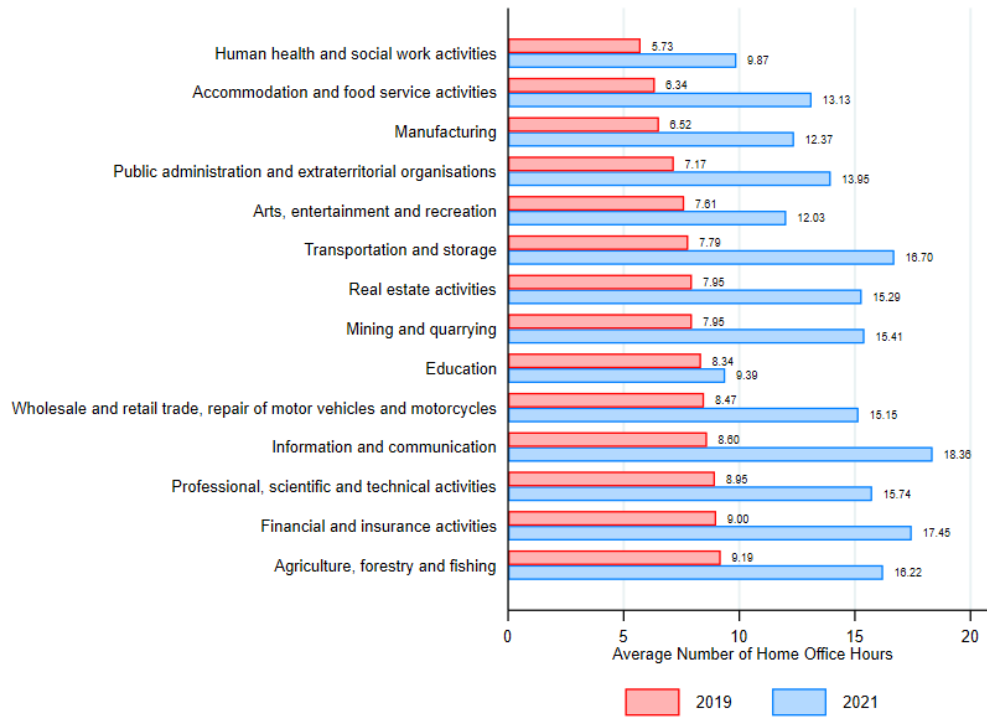
This picture changes when looking at the average number of hours which employees work from home, which is illustrated by Figure 3. Those employees who work from home tend to do so at a significantly higher rate than before the COVID-19 pandemic. The overall average number of remote working hours increased from 8.00 hours per week in 2019 to 13.44 hours per week in 2021.

3.2 The Remote Potential of Swiss Industries

Overall, I find that 47.1% of jobs in Switzerland can potentially be performed from home. In comparison, only 25.8% of employees indicate that they have worked from home at least once over the last month. This implies that the implementation of remote work could almost be doubled to fully exploit the potential.

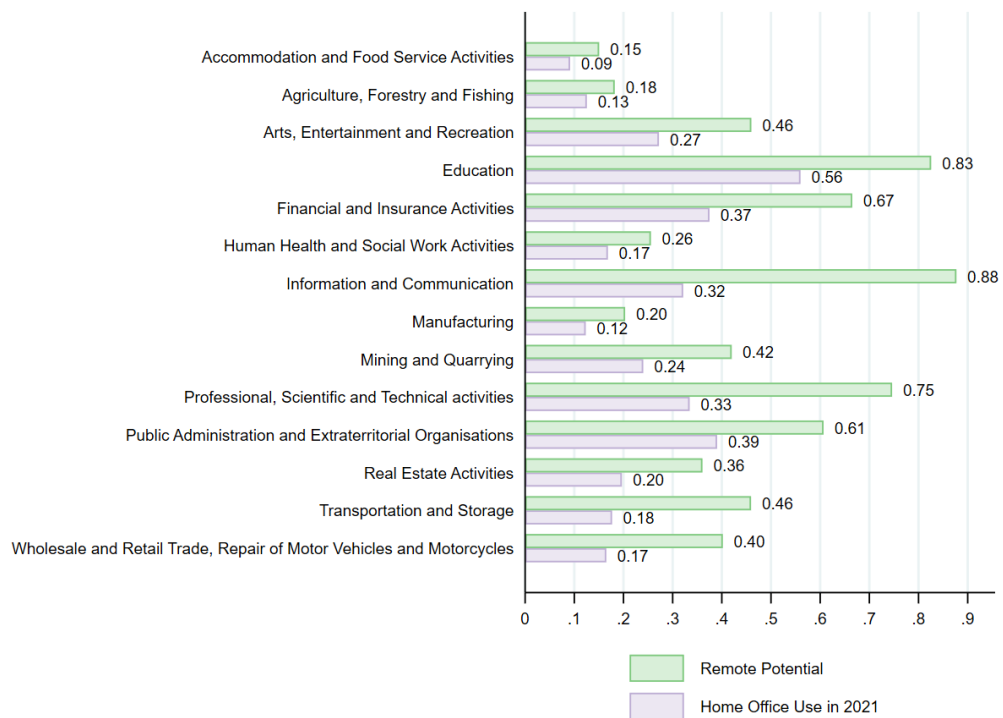
There is a significant variation across Swiss industries. Figure 4 shows the remote potential and

Figure 3: Remote Working Hours in 2019 and 2021



Source: Swiss Labor Market Survey (SAKE) 2019 and 2021, own calculations.

Figure 4: Remote Potentials and Home Office Use in 2021



Source: Swiss Labor Market Survey (SAKE) 2021, own calculations.

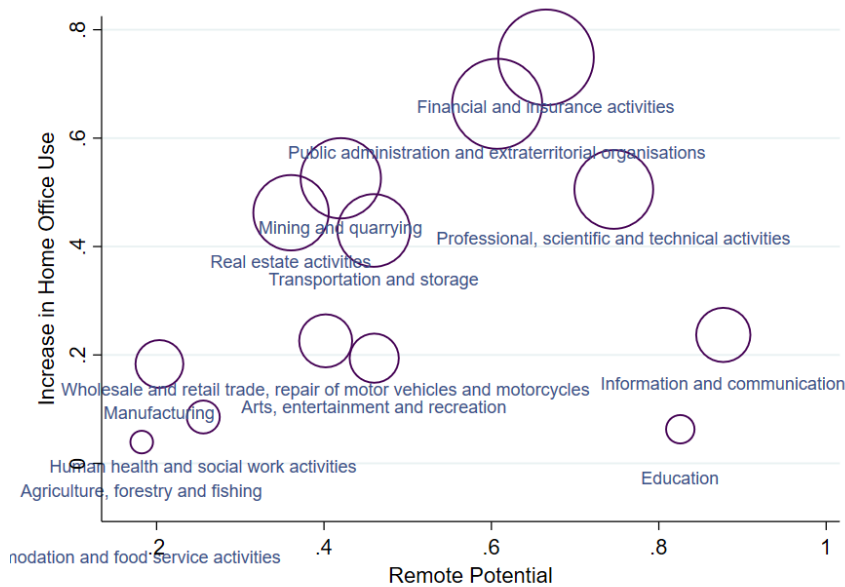
home office use in 2021, where industries are aggregated on the 1-digit Swiss NOGA level. The results offer two stylized facts: First, remote work potentials also exist in industries where activities are predominately performed outside, such as in agriculture, forestry, and fishing. This is likely relating to administrative tasks occurring in all economic sectors. For instance in Germany, half of the labor force in the agriculture and forestry sector state that they frequently collect, research, or document information (Alipour et al., 2021). These are tasks which potentially can be performed from home.

Secondly, a high potential does not automatically imply a high exploitation. For instance, the remote potential is almost 90% in the IC industry. However, only 32% of employees indicate the use of home office, which is approximately 37% of the existing potential - the lowest number across all industries. In comparison, the exploitation is higher in the public sector, education, and in agriculture, forestry, and fishery.

3.3 Adoptability

How fast can industries adopt and exploit remote potentials? Figure 5 sheds light on this question. It shows Swiss industries' remote potentials on the horizontal axis and the growth in the access to remote work between 2019 and 2020 on the vertical axis. This indicates how fast industries are able to exploit remote potentials when necessary.

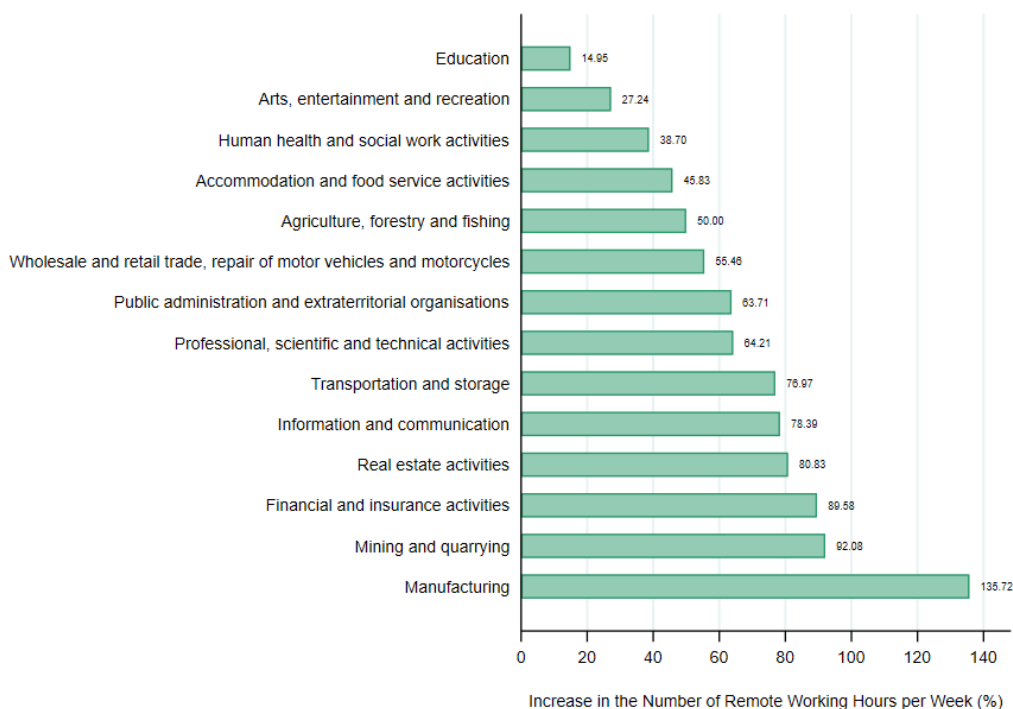
Figure 5: Adoptability of Swiss Industries



Source: Swiss Labor Market Survey (SAKE) 2019-2021, own calculations.

The public administration, extraterritorial organizations, and the finance and insurance industry were most successful in adopting their working environment. Within one year, the shares of

Figure 6: The Increase in Employees' Average Number of Remote Working Hours per Week from 2019 to 2020



Source: Swiss Labor Market Survey (SAKE) 2019 and 2020, own calculations. Averages are conditional on employees working from home.

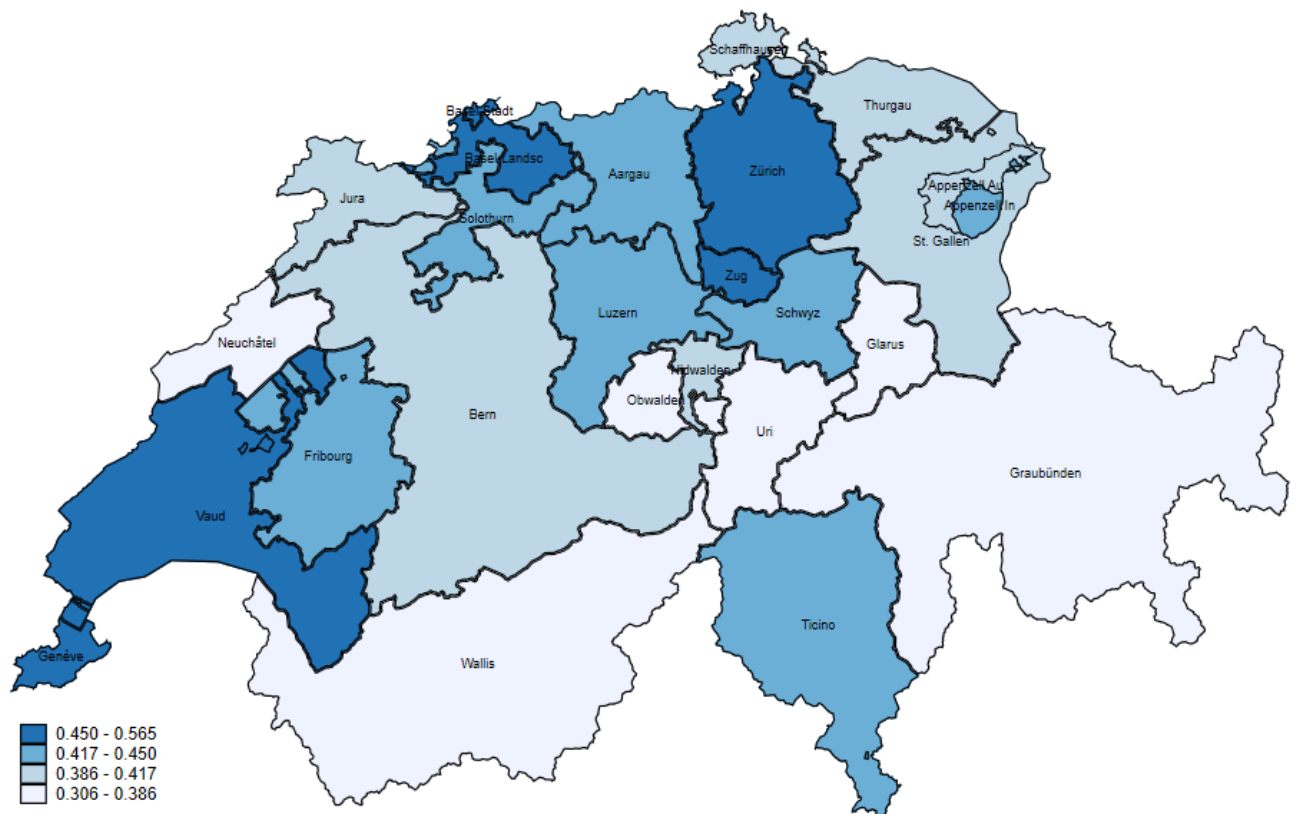
employees with access to remote work increased by 66.3% and 74.9%, respectively. Overall, adoptability is positively associated with remote potentials, however, the correlation coefficient is not significant at conventional levels (p -value = 0.128). This change only relates to an adoption at the extensive margin, that is, whether an employee works from home or not. Therefore, it does not capture continuous changes in the number of remote working hours.

In comparison, Figure 6 shows the relative change in remote working hours before and during the pandemic. On average, the number of hours employees worked from home per week increased by 65.3% between 2019 and 2020. The largest growth rate is observed in the manufacturing sector with an increase of 136%.

3.4 Geographical Variation

Figure 7 shows remote potentials on cantonal level. With 0.572, the potential is highest in Zug, followed by Zurich (0.550) and Geneva (0.535). On the other side, Uri and Obwalden exhibits the lowest remote potentials with values of 0.301 and 0.355, respectively. Looking at Swiss labor market regions, Table 2 presents the corresponding remote potential and the current access to home office. The variation in current home office use is moderate across labor markets and ranges from 0.213 in Bellinzona to 0.281 in Geneve. Comparing potentials with current access, the results show that Lugano is the only regional labor market where less than 50% of the existing potential is exploited. There are no substantial differences between the German-, French-, and Italian-speaking region of Switzerland. However, the potential in the Rhaeto Romanic-speaking region is significantly lower by approximately 10 percentage points, as indicated by Figure 8.

Figure 7: Geographical Variation of Remote Potentials for Swiss Cantons



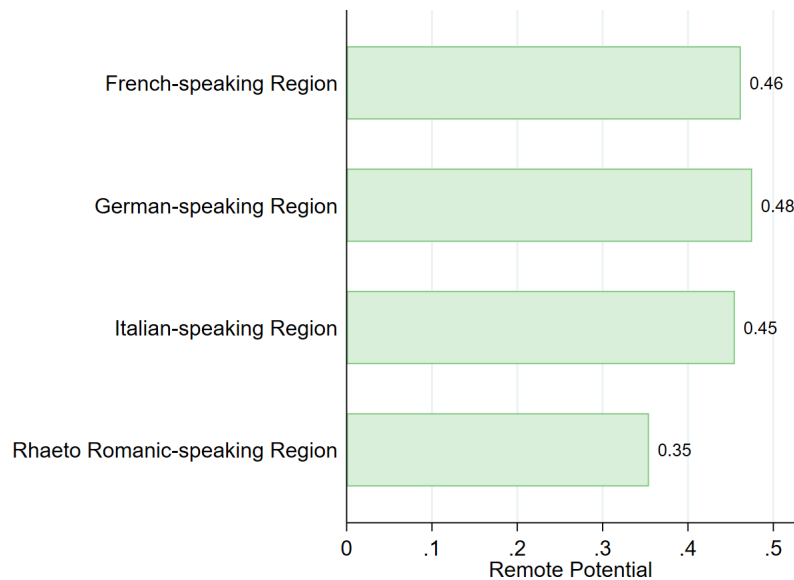
Source: Swiss Labor Market Survey (SAKE) 2021, own calculations.

Table 2: Swiss Labor Market Regions

Swiss Labor Market Region	Remote Potential	Home Office Use
Geneve	0.542	0.281
Lausanne	0.464	0.258
Sion	0.393	0.218
Fribourg	0.426	0.251
Neuchâtel	0.395	0.240
Biel / Bienne	0.428	0.273
Bern	0.451	0.266
Basel	0.503	0.267
Aarau - Olten	0.436	0.243
Zürich	0.536	0.277
Winterthur - Schaffhausen	0.471	0.263
St. Gallen	0.410	0.230
Chur	0.389	0.218
Luzern	0.432	0.240
Bellinzona	0.410	0.213
Lugano	0.501	0.228

Source: Swiss Labor Market Survey (SAKE) 2021, own calculations. For each Swiss labor market region, this table shows the share of employees working from home compared to the remote potential.

Figure 8: Language Regions



Source: Swiss Labor Market Survey (SAKE) 2021, own calculations.

3.5 Employees' Sociodemographic Characteristics

Females are typically employed in jobs with higher remote potentials. Hereby, the gender gap accumulates to approximately 4 percentage points (Table 4). Yet, they are somewhat less likely to actually work from home. The difference is small but statistically significant at the 1 percent level. Even when females get access to remote work, the average number of home office hours per week is 3.8 hours lower than for male employees with access to home office.

Table 4: Gender Differences

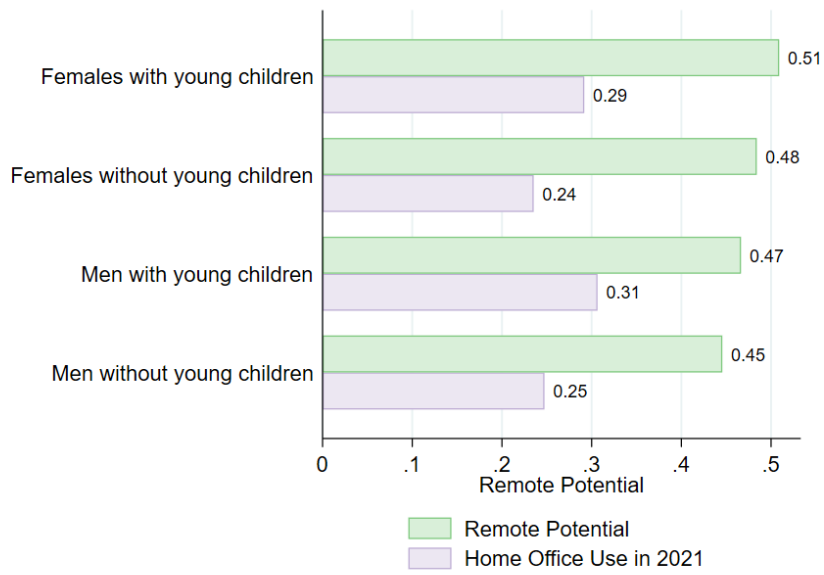
	Male	Female	Difference	N
Remote Potential	0.452 (0.004)	0.491 (0.004)	0.040*** (0.005)	33.427
Home Office Use	0.264 (0.004)	0.251 (0.003)	-0.013*** (0.005)	33.427
Weekly Home Office Hours	15.399 (0.227)	11.570 (0.190)	-3.829*** (0.294)	4.348

Source: Swiss Labor Market Survey (SAKE) 2021, own calculations. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. This table shows the statistical difference between gender for the potential, current home office use, and the average weekly number of remote working hours. All differences are statistically significant on the 1% level.

Overall, it is known that flexible work is particularly beneficial to mothers (Sherman, 2020). Therefore, Figure 9 distinguishes between employees with and without children under the age of 15 years. It visualizes that both mothers and fathers are more likely to work from home when they have young children.

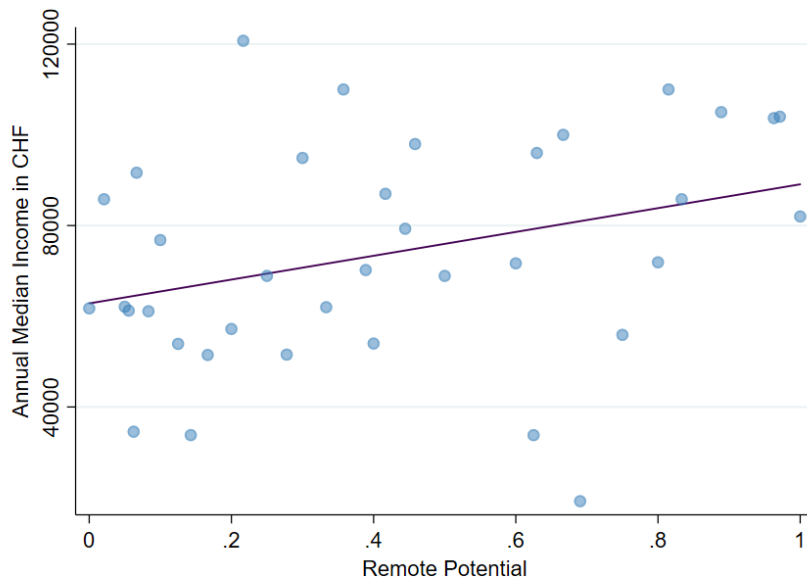
Parents tend to work in jobs with higher remote potentials. However, fathers are still somewhat more likely to work remotely than mothers, even though the remote potential of mothers is largest across all groups. Furthermore, there is a noticeable relation between remote potential and employees' (i) income and (ii) education. In general, jobs which can be performed from home relate to higher average earnings (Figure 10). There is a positive and highly significant association between individuals' gross annual income and the remote potential of their jobs, with a correlation coefficient of 0.257. Similar applies to educational attainment. The higher an individual's education level, the larger the probability that his or her job can be performed from home. For instance, approximately 70% of employees with academic degrees could work from home, compared to 15% of employees with compulsory education.

Figure 9: Remote Potential and Home Office Use by Gender and Children



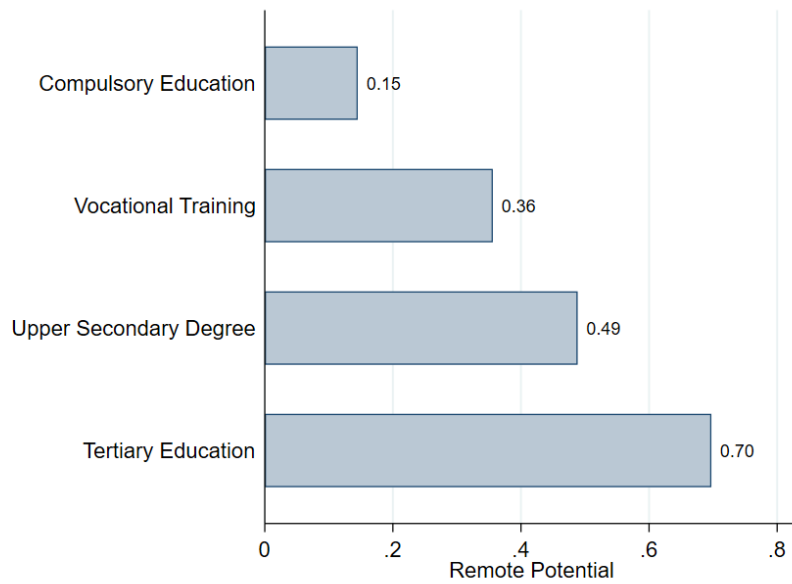
Source: Swiss Labor Market Survey (SAKE) 2021, own calculations. The numbers refer to employees with children who are younger than 15 years.

Figure 10: Median Income by Remote Potentials



Source: Swiss Labor Market Survey (SAKE) 2021, own calculations.

Figure 11: Remote Potential by Employees' Education Level



Source: Swiss Labor Market Survey (SAKE) 2021, own calculations.

4 Discussion and Conclusion

Due to reductions in the current energy supply, Swiss companies consider increasing the access to remote work for their employees. This reduces the use of energy in office buildings and may further contribute to a decrease in energy consumption in the public transportation systems. However, would such a strategy be feasible?

This paper shows to what extent jobs can be performed from home in the current Swiss economy. Thereby, the analysis relies on representative labor force information provided by the Swiss Statistical Office. Overall, the remote potential in the Swiss industry is approximately twice as high as the share of employees currently working from home. Also, there is a significant variation across industries, ranging from approximately 15% in accommodation and food service up to almost 90% in the information and communication (IC) industry.

Furthermore, the paper shows that Swiss industries adopted remote work when required, and the exploited untapped potentials during the COVID-19 pandemic. This led to a temporary increase in remote work by 65% at the mean, which was particularly pronounced in the finance and insurance industry, and in the public administration. Therefore, the results reflect Switzerland's COVID-10 strategy. For instance, Switzerland imposed mandatory home office rules but closed-down schools for 34 school days only, which is substantially below the OECD average of 92 days for secondary schools (OECD, 2021). This is reflected in the relatively low increase of remote work in the educational sector.

Already in 2021, the share of employees working from home was approximately at the same level

as before the pandemic. At first, this seems contradictory to all predictions regarding the lasting transformation of the modern working environment (e.g. Microsoft Corporation, 2021). However, looking at the number of remote working hours, the results also reveal a substantial increase of remote working hours across all industries. The average employee who works from home increased the number of home working hours from 8.00 hours per week in 2019 to 13.44 hours in 2021. This number is still affected by the direct impact of the COVID-19 pandemic. Future research is required to explore lasting effects over time, and also whether the decrease in home office use in 2021 is due to employees' preferences or due to rules imposed by their employers.

The results also indicate an existing gender-gap in the use of home office. In general, females work in jobs with higher remote potentials. Yet, they are less likely to work from home, and if they do so, their number of remote working hours is significantly lower. Existing studies show that flexible working models increase female labor market participation and contributes to the well-being of mothers, which particularly includes the access to home office (Goldin, 2014, 2021; Sherman, 2020). In Switzerland, female labor market participation is a topic of substantial political and economic importance. Consequently, policies addressing the digital transformation of Swiss industries should particularly focus on women's access to remote work.

Where does Switzerland stand in comparison with other German-speaking countries? Dingel and Neiman (2020) estimate that in both Germany and Austria, 37% of all jobs can be performed remotely, which is approximately 10 percentage points below the Swiss level.³ Contrary, the survey-based approach of Alipour et al. (2020) finds that 56% of German employees can perform their jobs from home. However, due to the applied methodology, the results obtained here are more comparable to Dingel and Neiman (2020), implying that in general, the feasibility of home office is higher in Switzerland than in Germany and Austria.

Overall, this paper provides the scientific foundation for further research on potential energy savings due to remote work. By imposing remote work, industries could reduce their demand for electricity and heating in office facilities. Furthermore, it has been shown that particularly in Switzerland, remote work reduces public transportation to a significant extent, thus affecting energy consumption and air pollution (Giovanis, 2018). However, it is questionable whether these savings overcompensate the households' increase in energy consumption, even when taking increased energy-efficient behavior into account.

³Dingel and Neiman (2020) also find an aggregate potential of 0.449 for Switzerland, which is calculated with a 2-digit occupation code and pre-pandemic data. Here, I use the more granular 4-digit classification system and current Swiss labor market data which leads to a similar result of 0.472 as baseline estimate.

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Appendices

A Methodology

Table 5: Remote Potential Exclusion Criteria

An occupation cannot be performed remotely when the average respondent agrees with the following statement:

- Email is used less than once per month
 - Dealing with violent people at least once a week
 - Daily outdoor work
 - Weekly or daily exposure to diseases or infections
 - Weekly or daily exposure to minor burns, bites, or stings
 - Majority of work time is spend on walking or running
 - Majority of work time is spend on wearing common or specialized protective or safety equipment
 - Performance of general physical activities is very important
 - Handling and moving objects is very important
 - Controlling machines and processes (not computers nor vehicles) is very important
 - Operating vehicles, mechanized devices, or equipment is very important
 - Performing for or working directly with the public is very important
 - Repairing and maintaining mechanical or electronic equipment is very important
 - Inspecting equipment, structures, or materials is very important
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