

Meister, Lorenz; Menkhoff, Lukas; Schröder, Carsten

## Conference Paper

# Work from Home, Stock Market Participation, and Inequality

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# Work From Home, Stock Market Participation, and Inequality

Lorenz Meister\*, Lukas Menkhoff†, Carsten Schröder‡

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## Abstract

Stock market participation among working household heads jumped upwards in the year 2020, in Germany by about 25%. A major cause is the required use of work from home (WfH). We show this by repeating a benchmark study with demanding data requests and adding WfH to the explanatory variables. Moreover, we implement an instrumental variables estimation based on industry-specific levels of WfH-capacity. The transmission channels seem to work via increased available time and time flexibility. Moreover, we show that WfH makes the stock market accessible to a broader population, including lower income groups, which may contribute to lower income inequality.

**Keywords:** stock market participation, work from home, inequality

**JEL codes:** D31, G11, G51

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\*DIW Berlin (German Institute for Economic Research), 10108 Berlin, Freie Universität Berlin, Germany, and Harvard University, USA. Email: lmeister@diw.de.

†Humboldt-Universität zu Berlin, DIW Berlin (German Institute for Economic Research), 10108 Berlin, and IFW Kiel, Germany. Email: lmenkhoff@diw.de.

‡DIW Berlin (German Institute for Economic Research), 10108 Berlin, and Freie Universität Berlin, Germany. Email: cschroeder@diw.de.

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# 1 Introduction

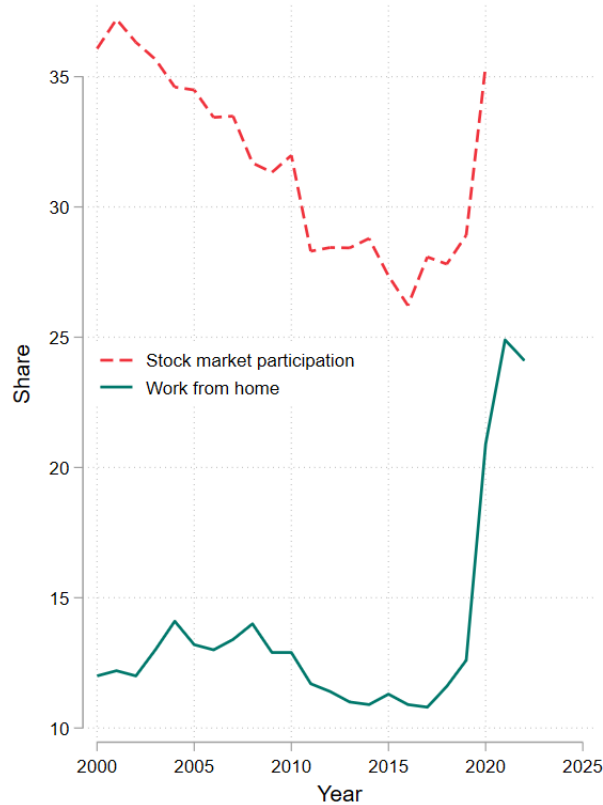
The degree of stock market participation is of interest to policy because it contributes to the dynamics of income inequality in society, among others. One of the drivers of inequality is the systematically higher return on assets that wealthy households earn relative to the average population (Kuhn et al., 2020). A crucial element creating this advantage is the higher stock market participation (SMP) of wealthier households (Bach et al., 2020). In Germany, for example, SMP was on average 17 percent for all adults since 2010, compared to 59 percent among the top 5 percent and only 13 percent for the bottom 50 percent of the wealth distribution.

Given that these numbers hardly change from year to year, it is interesting that SMP increased significantly during the year 2020. We document for Germany in Figure 1 that SMP of the working household heads, i.e. a sub-sample of adults, jumped upwards from 2019 to 2020 from 28 to 35 percent, i.e. by about 25 percent. This increase seems to be persistent, it contributes to an increase in SMP among all adults and also occurred in many other European countries as we show later (see Section 5 on robustness). Such a large jump is extremely rare as conventional determinants of SMP, such as wealth or education, do not change much from year to year. Conspicuously this jump occurred in line with work-from-home (WfH) requirements in 2020 due to contact-reducing policies during the Covid-19 pandemic as Figure 1 shows. This one-time trigger has developed into a permanent "big shift" into WfH at the cost of onsite work (Barrero et al., 2023). Against this background, we ask three questions analyzing the strong increase in SMP: First, is WfH a novel determinant of SMP which contributes to explain the increase of interest? Second, what might be the channel through which WfH increases SMP? Third, who are the new stockholders and what are the distributional implications?

We find for a sample in Germany, being representative for working household heads, and controlling for a comprehensive set of known determinants of SMP, that WfH increased SMP, also contributes to explaining the 2020-jump in SMP. A novel form of the participation cost channel may be at work, as WfH saves commuting time and also, improves time flexibility, thereby easing the engagement with stocks. Potential distributional consequences of SMP

are rarely investigated; the effects here are as follows: those entering the stock market have lower incomes than earlier stock owners, so that SMP increases more among the lower income groups. Thus, WfH provides another relevant determinant of SMP, by relaxing time constraints to engage with stocks, and may contribute to reducing the gap in asset returns between low and high income earners.

Figure 1: Trends in Work from Home and Stock Market Participation



**Notes:** The figure shows time series for stock market participation among working household heads in Germany from the SOEP (dashed red line) and the share of individuals who work from home (solid green line) for the years from 2000 to 2020. There is an abrupt increase in both measures from 2019 to 2020. Source: SOEPv38 and Eurostat.

Reliance on WfH is not new to society but the increased use of remote work was a novel major consequence of contact-reducing policies to fight the Covid-19-pandemic. Staying at home instead of moving to the workplace was either mandated or recommended in many countries, such as Germany, for most of the year 2020. Employees who used WfH saved the commuting time and also had the opportunity to arrange their private affairs more flexibly

than before. This sudden jump in available and flexible time potentially reduced the cost of stock market participation. It allowed individuals to open a portfolio and trade stocks online from home during workdays. Therefore, flexible time usage facilitates SMP, complementing other well-known cost reductions of SMP.

One established mechanism is the reduction of fees, e.g. due to competition from new suppliers with cheaper technologies. Another major channel concerns information, as higher education or financial literacy reduces barriers to entry. In this paper, we introduce a new cost channel, that is a reduction and relaxing of time constraints which makes it easier to participate in the stock market.

To quantify how WfH affects SMP, we make use of the German Socio-Economic Panel study (SOEP) which annually collects detailed individual and household information. This panel study includes information about holdings of risky assets which are a reliable proxy for stock holdings as (used in Figure 1) and proved in more detail in the robustness section below. It also informs about the use of WfH and a standard set of socio-demographic variables being related to stock holdings, such as wealth or education. To analyze the effect of WfH we limit the sample to adults who are working, and to better capture an individual influence on stockholding we focus on household heads as asset holdings are only available at the household level. Considering this set of variables gives a sample of 6,311 adult individuals. This sample has – relative to all adults – better education, higher income, more wealth and thus also a higher degree of SMP.

Our empirical strategy follows Hong et al. (2004), who reveal the positive effect of sociability on SMP in the United States. In their benchmark regressions they control for wealth, income, education, race, age, gender, marital status, and risk tolerance, to analyze a potential effect from their newly introduced indicators of optimism, openness and measures of sociability. We adapt their strategy to our setting with one modification, i.e. in the German context we consider “migration background” instead of (unknown) “race” to proxy for cultural diversity. Coefficients have the expected, mostly significant signs. This pattern is robust to adding a “work-from-home variable” at any specification.

Next, to strengthen a causal interpretation of the positive association between WfH and SMP, we implement an instrumental variable estimation, as applied in this literature, for

example by Hvide et al. (2023). The reason for this approach is that there is selection into WfH which may be very similar to selection into SMP. Thus, the ambition is applying an instrumental variable that is closely related to WfH but does not directly impact SMP. We propose an instrument being based on plausibly exogenous variation once we control for income, wealth, etc., in pre-pandemic “work-from-home capacity,” which is derived from a classification of 100 industry sectors. When applying this IV-approach, there is again a strong positive impact from WfH on SMP.

To say more about how WfH may influence SMP, and to test the hypothesis that WfH has an impact via the increase of available time (due to saved time on commuting) and / or the increase in the flexibility by which time can be used, we conduct various complementary analyses. We find that indicators of commuting distance, commuting time or an increase in leisure time tend to be positively related to SMP but these relations are neither monotonously increasing nor significant, suggesting that the observed increase in SMP is not just caused by saved commuting time due to WfH.

If it is not just the quantity of time gained through WfH, it may be also the quality of time that matters. We find evidence for two channels: first, only a flexible work time arrangement allows working individuals to gain from the advantages of WfH and thus to increase SMP. Second, this effect holds only for working individuals without children, plausibly because working parents are “always” time-constrained so that WfH does not realize its full benefits for SMP.

Revealing potential consequences of increasing SMP on inequality (see Favilukis, 2013), we compare the new entrants into the stock market to those who participate already and those who still do not participate. New entrants are characterized as being in between the two other groups with regards to their wealth, income, level of education, etc. Thus, they contribute to bringing the benefits of SMP to a broader population. Moreover, we see that SMP increases over the whole income distribution, but much stronger for the lower groups, in particular being significant for the bottom 25% income percentile. We also see that this effect only applies to lower income individuals using WfH. While all this cautiously indicates that the WfH-driven increase in SMP contributed to a more equal spreading of stock holdings, our data do not inform about the amounts of assets (or an asset allocation), so that we cannot

draw a more precise conclusion.

**Literature.** There is a large body of research about SMP to which our study is related to. Crucial for our research is to consider main known determinants of limited SMP to put the role of WfH into perspective. Gomes et al. (2021) distinguish four main kinds of determinants, i.e., household preferences, risks, costs, and peer influence.

(i) Conventional levels of risk aversion are not sufficient to explain the observed low level of SMP. Rather, one needs more specifically formed preferences that give particular weight to the frequent downturns of stock returns during their long-term trend of high risk-adjusted returns. Prominent examples are narrow framing (Barberis et al., 2006), ambiguity aversion (Dimmock et al., 2016) or loss aversion (Gomes, 2005) to partially understand most people’s hesitation to hold stocks.

(ii) Regarding risks, the argument is about risks that would make SMP rationally unattractive, such as cases where existing risk of an individual, e.g. from labor income, would be amplified by holding stocks (Benzoni et al., 2007); however, extreme cases are rare, more often risks matter when these increase background risk and thus contribute to limit SMP.

(iii) Costs are often regarded as the main explanation of low SMP. These costs include information costs in a wide sense, i.e. direct financial costs of stock transactions (Bogan, 2008; Hvide et al., 2023), broader participation costs and information costs. Assuming fixed costs of SMP, this explains well that wealth is a main determinant of SMP (e.g. Campbell (2006)). There is moreover strong evidence that higher SMP is driven by financial literacy (Van Rooij et al., 2011), by higher education (Black et al., 2018) or high IQ (Christelis et al., 2010; Grinblatt et al., 2011), three positively correlated variables.

(iv) Finally, peer effects are relevant, as shown for the positive impact of social interaction (Hong et al., 2004), for SMP in the same community (Brown et al., 2008), for neighbors realizing high stock returns (Kaustia and Knüpfer, 2012) and for neighbors having knowledge about stocks (Haliassos et al., 2020). While this short review of four groups of determinants can highlight only a small selection of papers, there is further research that does not easily fall into these categories. SMP is higher when health is better (Rosen and Wu, 2004), when people trust more into others (Guiso et al., 2008), when political preferences are more right-wing (Kaustia and Torstila, 2011), when political uncertainty is low (Agarwal et al., 2022),

and when there is exposure to a great economic depression during youth (Malmendier and Nagel, 2011). Moreover, there is some tentative evidence that SMP may be higher for men and for catholic relative to protestant individuals (Kumar et al., 2011). However, the set of control variables in empirical studies is limited so that it is sometimes unclear to which extent findings reveal causal determinants. For example, Kaustia et al. (2023) discuss this issue regarding the role of religion or the missing and diverse information about risk-tolerance.

We contribute to this literature by covering a set of the most important potential determinants, following the data-demanding research of Hong et al. (2004), including in particular individual risk tolerance as a relevant preference measure, demographic variables addressing background risk, the core individual variables, and a proxy for sociability. On this basis we introduce WfH as a new variable explaining SMP, the channel being via relaxing employees' time constraints. We also show that the positive link between WfH and SMP is robust to the consideration of further variables, and we provide some evidence on channels by which WfH may lead to higher SMP. Finally, we address an issue rarely touched in the literature on SMP, i.e. distributional consequences, and show that WfH increases SMP for the bottom 25% of the income distribution strong enough to be statistically significant. Moreover, we use the Theil Index to measure how within- and between-income inequality changes across stock owners and those who do not own stocks, depending on individuals' WfH-status. We find that income inequality between the groups of stock owners and those who do not own stocks has decreased significantly in the work-from-home population - but not among those who worked onsite. This finding suggests that WfH makes the stock market accessible to a broader population, allowing also lower income groups to benefit from high stock returns.

The paper is structured in five more sections, starting in Section 2 with information about data and in Section 3 informing about methods applied. Section 4 presents results, robustness checks follow in Section 5 and conclusions are provided in Section 6.



## 2 Data

### 2.1 Data base and stock market participation

Our data come from the German Socio-Economic Panel (SOEP) which is an annual survey of German households with about 15,000 households participating in 2020. To analyze the impact of WfH we restrict the sample to household respondents ("household heads") who are working. This results in a sample size of 6,311 observations.

The SOEP fulfills the high data demands of the research design of Hong et al. (2004). Furthermore, it allows additional robustness exercises by considering further variables, and complementary exercises on employees' time use. However, it should be noted that the SOEP data is limited in its measure of individual stock holdings in two ways, i.e. the precise measure of stock holdings and the linkage of stocks to individuals. These limitations require two adjustments which we explain in short, whereas Section 5 on robustness provides the details showing that our procedure does not distort analyses and implications. First, the category coming close to stock holdings asks for the holding of risky assets, i.e. stocks, investment funds, and related vehicles. Fortunately, the share of risky assets containing stocks dominates by far and this share does not change much over a few years (see Section 5). Still, SMP is somewhat overestimated. Second, holdings of stocks are captured at the household level, so that we refer to the household head if we require individual information. Further analyses show that our results also hold for smaller samples only containing one-person households or for sub-samples where asset holdings are available at the individual level (again, see Section 5). An overview of all variable definitions is provided in Appendix Table A.1.

### 2.2 Determinants of stock market participation

The literature documents that stock market participation is robustly linked to a set of individual characteristics, including wealth, income, and education, but also further socio-demographic variables, i.e. age, gender, marital status, living in an urban area, migration background, and the arguably most important preference when it comes to holding risky assets, i.e. risk tolerance. Against this background, Hong et al. (2004) studies the role of so-

ciability on SMP using a wide range of variables. We follow their empirical framework closely, only exchanging migration background for race, because the latter is relevant in the U.S. but is not surveyed in Germany, where the SOEP-survey just asks for a migration background, i.e. when at least one parent was born in another country. Race or migration background may be proxies for cultural differences or language skills (see Gan et al., 2022).

Moreover, we consider variables of “social interaction” in the spirit of Hong et al. (2004) who use: (i) how many close neighbors one knows, (ii) how often neighbors are visited, and (iii) how often one attends religious services. Regarding these three variables, item (iii) is exactly part of the SOEP, but there is no significant relation to SMP in the German data. This is probably because the share of people attending religious services is lower than in the U.S. in general, it is declining over time so that the share is lower due to the data gathering date relative to Hong et al. (2004), and we cover the working population only providing a younger sample than in Hong et al. (2004). Consequently, the main characteristic of those attending religious services is rather their high degree of religiosity than a high degree of sociability, and the former is rather related to less stock holding. Thus, it is not surprising that the respective coefficient remains insignificant in our regressions.

Regarding item (ii), the SOEP survey has a related item, i.e. how often neighbors and friends are visited, that is not significant in our analyses. We note that the coefficient of this item is also much smaller in Hong et al. (2004) Table III than the one on their other items, where item (i) seems the empirically best proxy for sociability. For this first item the SOEP survey offers a close substitute, i.e. how many close friends one has, and this one is significantly positive in our regressions. Thus, we include this item in the main specifications, and document the result with alternative indicators of sociability in the robustness section.

As sociability is a specific aspect of personality, it seems advisable to control for related aspects. Hong et al. (2004) discuss in this respect three directions: they regard risk tolerance (as reverse measure of risk aversion) as particularly important, and this item is part of our data. Then they mention optimism and open-mindedness are further relevant controls, which they need to approximate. Here we have, in addition to risk tolerance,<sup>1</sup> more direct

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<sup>1</sup>Risk tolerance is measured on a scale from 0, i.e. no willingness to take any risk, to 10, i.e. great willingness to take risk (see Dohmen et al., 2011).

self-reported measures, i.e. self-reported optimism with regard to the future, and openness, a measure based on having new ideas, valuing artistic experiences, being imaginative, and thriving for knowledge.

So far, we are well able to replicate the approach of Hong et al. (2004) for more recent data, for a different country and for a differently defined sample population. As our data provide results that are very well comparable to Hong et al. (2004) we are confident to command over a useful dataset on which we can then perform our novel analyses, i.e. integrating the potential determinant of WfH. The survey contains the quite general question: “Do you ever carry out your work activity at home?”

Table 1 provides descriptive statistics for these variables, indicating a largely representative sample of the working adult population in Germany. Column (1) shows the mean values, column (2) the standard deviation, and columns (3) and (4) the minimum and maximum values, respectively. The degree of SMP in this group is 35%, i.e. higher than in the German population on average. There are two reasons for this: first, adults not covered because they do not work are either young, old or have no income and thus are expected to hold stock less often than the working adults. Second, due to data limitations of the SOEP, stock held refer to the household and not to individuals, so that our value of SMP is a bit overestimated. We show in the robustness section that this overestimation does not distort our results. Net wealth is on average 180 thousand Euro, equivalent net household income is about 31,092 Euro, the average years of education are 13.2 (i.e. more than high school which lasts in Germany either 12 or 13 years), average age is 49 years, 49% of the sample are female, 50% are married, 69% live in urban areas, 18% have a migration background, etc. Column (5) shows coefficients of correlation for these variables with SMP which have the expected signs. Table 2 continues the descriptive statistics for sub-groups which we need and discuss later during this research.

Table 1: Descriptive Statistics: Full Sample

	Full sample				
	(1)	(2)	(3)	(4)	(5)
	mean	sd	min	max	corr
SMP	0.35	0.48	0.00	1.00	
Net overall wealth (in mio)	0.18	1.14	-1.84	104	0.09
Equiv. household income	31,092	26,970	10	3,362,196	0.18
Years of education	13.20	2.81	7.00	18.00	0.27
Age	48.70	12.48	18.00	92.00	0.04
Female	0.49	0.50	0.00	1.00	-0.07
Married	0.50	0.50	0.00	1.00	0.07
Urban	0.69	0.46	0.00	1.00	0.06
Migration background	0.18	0.38	0.00	1.00	-0.13
Risk tolerance	0.44	0.50	0.00	1.00	0.03
Sociability	0.52	0.50	0.00	1.00	0.07
Optimism	0.82	0.38	0.00	1.00	0.07
Openness	0.53	0.50	0.00	1.00	-0.01
Observations	6,311				

**Notes:** The table depicts the weighted descriptive statistics for the full sample of household heads who are in the working population in the SOEP in 2020. Average stock market participation, measured as the share of individuals who own stocks, is 35%. Column (5) shows correlations between stock market participation and various individual and demographic characteristics. A positive association can be observed for income, education, and age, while there is a negative relation with being female and having a migration background. The sociability indicator is based on the number of close friends that respondents have.

Table 2: Descriptive Statistics by Stock Owner Groups

	(1)	(2)	(3)	(4)	(5)
	Old owners mean	New owners mean	Non-owners mean	Old vs. New diff	Non vs. New diff
Net Overall Wealth (in mio)	0.33	0.19	0.11	0.30*	-0.29***
Equivalent household income	38,968	32,576	26,755	7,346*	-14,543***
Years of education	14.30	13.55	12.62	0.73***	-1.13***
Age	49.73	46.26	49.09	2.89***	0.96
Female	0.43	0.43	0.53	-0.04	0.09***
Married	0.58	0.50	0.46	0.06**	-0.05*
Urban	0.72	0.72	0.67	0.03	-0.04
Migration background	0.12	0.14	0.22	-0.05**	0.08***
Risk tolerance	0.44	0.46	0.44	0.03	-0.04
Sociability	0.55	0.54	0.50	-0.01	-0.08***
Optimism	0.85	0.86	0.80	0.01	-0.04**
Openness	0.50	0.52	0.55	-0.03	-0.02
Observations	1,802	663	6,578	2,465	7,241

**Notes:** The table depicts the same statistics for various groups: Individuals that owned stocks in 2019 and 2020 (old owners), individuals that did not own stocks in 2019 but owned stocks in 2020 (new owners), and individuals that did not own stocks in any of the two years (non-owners). Columns (4) and (5) then depict differences between these groups, whereby \* indicates significance at 10%, \*\* indicates significance at 5% and \*\*\* indicates significance at 1%.

### 3 Methods

We explore the role of WfH for SMP using OLS and IV estimations. Following Hong et al. (2004) our baseline OLS regression takes the form,

$$SMP_{ik2020} = \alpha + \beta WfH_{i2020} + \gamma SMP_{i2019} + \mu_k + X_{i2020}\delta + \epsilon_{it} \quad (1)$$

In equation (1), the dependent variable  $SMP_{ik2020}$  is a dummy that denotes whether individual  $i$  in federal state  $k$  owned risky assets in 2020. The coefficient of interest,  $\beta$ , reveals how WfH in 2020 alters SMP. Including the prior year’s SMP,  $SMP_{i2019}$ , allows to read the other coefficients with respect to stock market entrants between 2019 and 2020. We include federal state fixed effects,  $\mu_k$ , and control for a vector of individual characteristics,  $X_{i2020}$ , that is log wealth, log income, years of education, age, gender, marital status, living in an urban or rural area, migration background, risk tolerance, sociability, optimism, and openness. We also estimate equation 1 as a probit model and find qualitatively consistent results to the OLS.

In an ideal experiment, individuals would be randomly assigned to working remotely. Such random treatment assignment would yield a coefficient that clearly allows for a causal interpretation. However, we use observational data such that, even after controlling for a large set of individual characteristics and state fixed effects, unobserved factors could determine WfH and SMP at the same time. We address this endogeneity concern by employing an instrumental variables (IV) strategy. Our instrument for WfH is the pre-pandemic work-from-home capacity. The capacity to WfH is an industry-level index provided by Alipour et al. (2023). The authors constructed this index based on an item from the 2018 wave of the German BIBB/BAuA Employment Survey that asks individuals if they can perform their job from home, assuming the employer allows for it. The WfH-capacity is then calculated as the share of respondents that could work from home, aggregated on the NACE industry level. The intuition for this instrument is that individuals’ pre-pandemic capacity to work from home in 2018 (when the WfH-capacity was elicited) is related to actually working from home in 2020.

The first and second stage estimations of our 2SLS-IV-strategy are as follows:

$$WfH_{ik2020} = \alpha + \phi WfHcapacity_{s2018} + \mu_k + X_{i2020}\delta + v_{ik} \quad (2)$$

$$SMP_{ik2020} = \gamma\theta\widehat{WfH}_{i2020} + \rho SMP_{i2019} + \mu_k + X_{i2020}\kappa + \epsilon_{ik} \quad (3)$$

where  $WfH_{is2020}$  denotes if an individual  $i$  in industry  $s$  worked remotely in 2020. The instrument is denoted by  $WfHcapacity_{s2018}$ . The corresponding instrument coefficient  $\phi$  captures the instruments' relevance. The error term is  $v_{ik}$ . In the second stage, the coefficient of interest is  $\theta$  that indicates the causal effect of WfH on SMP, while we continue to control for the first lag of stock ownership, federal state fixed effects, and individual characteristics.

Identification of a causal estimate requires a number of conditions to hold which seem to be fulfilled here. First, the instrument should be exogenous: we assume that the WfH-capacity at the industry level creates some exogenous variation in WfH, conditional on individual controls. Here, a concern could be that on the industry level, average earnings and education are associated with the WfH-capacity, potentially determining WfH and SMP at the same time. We try to rule out this concern by controlling for education, for disposable household income and net wealth, along with other characteristics.

Second, the exclusion restriction implies that the WfH-capacity should affect stock market entries only through WfH. Third, monotonicity requires that there are no defiers (individuals who do not work remotely, because they have a high capacity to work from home). Fourth, the instruments need to be relevant (as confirmed in the results section).

## 4 Results

### 4.1 Main results

We present main results in the following stepwise. First, we repeat the Hong et al. (2004) baseline specification with our data and see that standard results of the literature are reproduced. The respective regression outcome in Table 3, column (1) shows the expected strong association with wealth, income and education; in the interpretation of Hong et al. (2004),

they all contribute to higher SMP. Also other socio-demographic variables matter: SMP is higher for older individuals and those living in urban areas, but lower for women, married respondents, and those with a migration background. Coming to individual preferences, the incidence of SMP is higher for respondents being more risk tolerant, being more sociable, and with a higher degree of optimism, while openness has a small and insignificant coefficient. We also add state fixed effects as Hong et al. (2004) and comparing our results to their closest specification (i.e. Table III, know neighbors, column 3), we find that even coefficient sizes that are directly comparable have sizes of similar magnitude: their urban indicator is 0.033, ours is 0.051, their risk tolerant indicator is 0.0311, ours is 0.024, and finally their sociability indicator is 0.0406, ours is 0.023.

In the next step we add work from home,  $WfH$ , our variable of interest, as additional control. Column (2) shows that  $WfH$  has a highly significant coefficient of 0.070, suggesting that individuals in  $WfH$  participate in the stock market to a 5.7 percentage points higher degree. Relative to column (1), coefficients on education, female and urban decline, which indicates that some of the impact of  $WfH$  was formerly contains in these other variables. In general, the pattern of coefficients does not change much, the R-squared increases a bit, so that  $WfH$  seems to also determine SMP. In the robustness section we support this result by two analyses: first, we show that  $WfH$  also had an effect in earlier years, so that it is not specific to the year 2020. Second, we show that the result holds when we add the use of “online banking” as another variable, so that  $WfH$  does not pick up online banking. However, we lose quite some cases, and thus we keep this analysis in the robustness section.

In column (3) we continue by adding the variable whether the same person held stocks already in the year before. By including the lagged SMP, the other coefficients regard stock market entrants between 2019 and 2020. The result shows that SMP with one lag is of course the by far most important variable in this specification. Accordingly, all other coefficients of the former specification become much smaller, often only half or one third of coefficients in column (2). Reassuringly, the pattern remains the same, only four of the smaller coefficients turn insignificant, i.e. those on age, urban, risk tolerance and optimism.

Finally, we apply the above introduced IV-regression in column (4). Due to some missing values for the NACE industry, by which the  $WfH$ -capacity is matched, we deal with a smaller

Table 3: Main Regression Results

VARIABLES	Main Results			
	(1)	(2)	(3)	(4)
	OLS SMP	OLS SMP	OLS SMP	IV SMP
Work from home		0.070*** (0.015)	0.025** (0.012)	0.127** (0.053)
SMP (first lag)			0.609*** (0.012)	0.605*** (0.012)
Log wealth	0.024*** (0.002)	0.024*** (0.002)	0.008*** (0.002)	0.007*** (0.002)
Log Disposable HH Income	0.148*** (0.012)	0.138*** (0.013)	0.063*** (0.011)	0.049*** (0.012)
Secondary education	0.005 (0.053)	-0.001 (0.048)	-0.017 (0.047)	-0.024 (0.071)
Tertiary education	0.080 (0.054)	0.062 (0.050)	0.011 (0.048)	-0.021 (0.073)
Age	-0.004*** (0.001)	-0.004*** (0.001)	-0.002*** (0.000)	-0.002*** (0.001)
Female	-0.034*** (0.012)	-0.030** (0.013)	-0.021* (0.011)	-0.016 (0.011)
Married	0.004 (0.013)	0.002 (0.014)	0.000 (0.011)	-0.002 (0.011)
Urban	0.051*** (0.014)	0.049*** (0.014)	0.019* (0.011)	0.013 (0.012)
Migration background	-0.123*** (0.015)	-0.123*** (0.016)	-0.065*** (0.014)	-0.054*** (0.014)
Risk tolerance	0.024* (0.012)	0.023* (0.013)	0.005 (0.010)	0.003 (0.011)
Sociability	0.023* (0.012)	0.017 (0.013)	0.016 (0.010)	0.013 (0.010)
Optimism	0.044*** (0.016)	0.050*** (0.017)	0.023* (0.014)	0.024* (0.014)
Openness	-0.031** (0.012)	-0.039*** (0.013)	-0.004 (0.010)	-0.011 (0.011)
State FE	yes	yes	yes	yes
Constant	-1.337*** (0.126)	-1.228*** (0.130)	-0.485*** (0.111)	-0.353*** (0.133)
Observations	5,797	5,377	5,307	5,209
R-squared	0.152	0.153	0.454	0.448

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** The table shows regression results for estimating the main specification from Section 2.3. Column (1) depicts the results of an OLS estimation of stock market participation in 2020 on various individual characteristics. Column (2) adds WfH as an explanatory variable. Column (3) adds stock ownership in 2019, such that other coefficients can be interpreted with respect to entrants between 2019 and 2020. Finally, column (4) shows the coefficients for a 2-stage-least-squares instrumental variables estimation, whereby WfH is instrumented by WfH-capacity, an indicator at the NACE industry level. First stage: A 10-percentage point increase in the WfH-capacity is associated with about a 6-percentage point increase in the likelihood of working from home. The F-statistic is 89, thus we are not concerned about any weak instrument bias.



Table 4: First Stage Results

Instruments	Work from home
WfH-Capacity	0.67*** (0.04)
Constant	-1.27*** (0.14)
Controls	yes
Observations	5,209
F-statistic	56.76
R-squared	0.25
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

**Notes:** The table shows the first stage result that corresponds to the 2SLS-IV specification from Equation 2. WfH-capacity is a relevant instrument. WfH-capacity is defined as the share of employees in each NACE category that indicated in 2018 that they could perform their work from home. An increase of the WfH-capacity by 10 percentage points is associated with 6.7 percentage points higher WfH incidence. The regression controls for log wealth, log income, years of education, age, gender, marital status, urban dummy, migration background, risk aversion, sociability, optimism, openness, and federal state fixed effects, while the respective coefficients are not shown in this table. The second stage is shown in Table 3, column (4).

sample of 5,209 observations (we show in the robustness section that this is not crucial for our results). The first stage reveals that the instrument is significant at the 1%-level. A 10-percentage point increase in the WfH-capacity is associated with about a 6.7-percentage point increase in the likelihood of working from home. The first-stage relationships are illustrated as scatterplots in Appendix Figure A.1. The F-statistic is 57, indicating the relevance of the instrument. The IV-coefficient shows that working from home increases the likelihood for stock market entries between 2019 and 2020 by 12.7 percentage points. This coefficient is larger than the OLS coefficient, possibly because it captures the local average treatment effect (LATE, see Imbens and Angrist (1994)) that concerns only those individuals who are incentivized by high WfH-capacity to WfH, as analogously argued by Hvide et al. (2023).

The coefficients on lagged SMP, wealth, income, age, migration background, and optimism remain similar in size and significant, while the coefficient on “urban” loses its marginal significance. Overall, the results of the IV-approach are not that different from the OLS, but support the main finding that WfH is a major determinant of the increase in SMP in the year 2020.

## 4.2 Transmission channels

An obvious consequence of WfH is the saving of commuting time which reduces the opportunity costs of SMP. While it can be reasonably expected that saving time contributes to increasing SMP, it is less clear whether it is just the quantity of saved time that matters or whether further circumstances may play a role. We find that circumstances seem to be also important, and show this by analyzing both possible channels – quantity of time and circumstances – one after the other.

The time saving due to WfH can be estimated in the survey data available by three proxies, i.e. the change in commuting distance, in commuting time, and the increase in leisure time between 2019 and 2020. We split the total sample, for all three proxies separately, into groups of largely equal size and then estimate the coefficients of WfH each. For example, regarding commuting distance, one third commuted in 2019 up to 6 km one way, another third, commuted 7 to 14 km, and the last third commuted 15 km or more. While we control for all variables as in the benchmark regression, Panel A of Figure 2 shows only the coefficients of interest which do not vary significantly across commute distance categories. Thus, there is no consistent pattern that longer commuting distances would go along with a higher degree of SMP. The same can be seen in Panel A for the two other proxies of time saving: reduced commuting time and increased leisure time are related to a higher degree of SMP, but this is not a clearly increasing relation so that much longer time saving would lead to a much higher degree of SMP.

Thus it may be of interest that WfH does not only reduce commuting time but also provides flexibility in the allocation of time regarding work and private life. For example, cooking, cleaning, shopping etc. is not restricted to the time after work. This also applies to organizing financial affairs. Different from on-site work, there is no direct control by superiors, one can easily use private devices to do financial transactions, one can search for market information without interference with work and there are no colleagues around. While all this applies to those working from home, the ability to make use of this time flexibility will depend on the specific circumstances.

While such circumstances may be person-specific and thus difficult to generalize, we analyze the role of features of the institutional setting and start with work time arrangements.

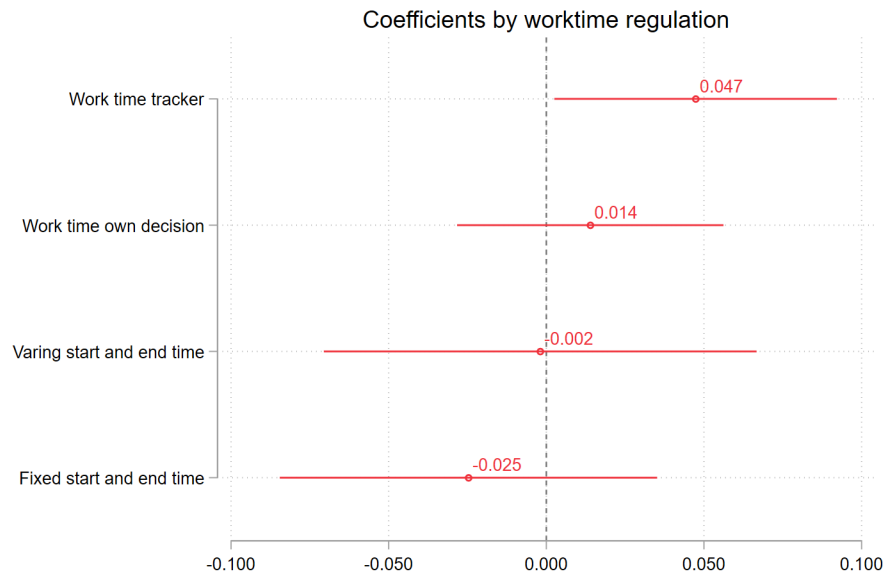
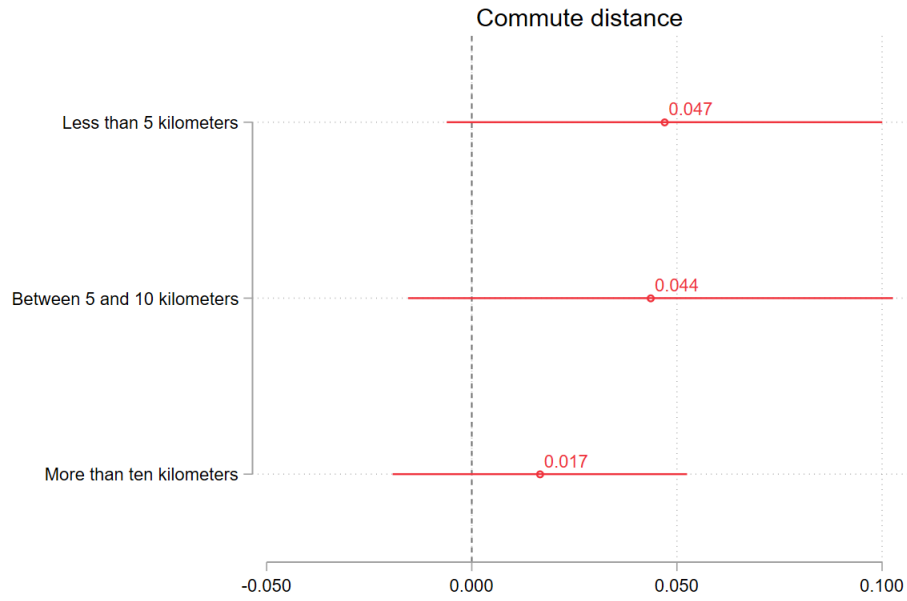


Figure 2: The plot shows coefficients of interest from estimating Equation 1, interacted with different commute distances (Panel A) and work time regulations (Panel B).

The SOEP-survey asks all participants whether any of four alternatives is a proper description of their individual work time arrangement. In two cases, the firm has a strict handle on the employee, i.e. the firm determines “fixed start and end time” of work, or the work defines “varying start and end time” of work. In these cases, WfH does not really improve flexibility much. The extreme opposite case is when the individual decides completely individually about the work time, then WfH cannot improve the situation either. Thus, an increase in time flexibility is primarily expected under the arrangement of a flexible work time where the individual decides to some degree about daily work time, so that in combination with WfH time flexibility clearly improves. Following the procedure introduced above, the respective coefficients are shown in Panel B of Figure 2. Indeed, WfH increases SMP only in combination with a flexible work time, but neither in combination with rigid nor fully autonomous work time arrangements.

Another relevant circumstance of WfH for SMP may be the situation at home, regarding communication and time availability. If one is alone at home or in a large family, this may less support to getting engaged in SMP than in a household with two adults. Indeed, an effect of WfH on SMP is only measurable in two-person households but not in smaller or larger ones, as Panel B shows. The effect of communication may be also recognized when considering sociability, indicated by the frequency of visiting neighbors (as introduced above). If individuals are already quite sociable (visit neighbors at least once a week), WfH may have less effect on SMP than if individuals are less sociable (visit neighbors at most once a month). The respective coefficients are indeed of different size in the expected direction, but none of them is statistically significant, so that we cannot empirically support this channel (see Panel B).

A binding constraint on time and time flexibility is having children at home. The average apartment does not have enough space for one or even two separate office rooms, so that WfH requires a high degree of concentration and discipline by all family members. In such a situation, it seems questionable that time and energy resources are allocated to getting familiar with and eventually buying stocks for the first time. The case is completely different for singles or couples without children because the children-related restrictions do not apply. Consequently, the effect of WfH on SMP is expected to be larger for households without

children at home. This is reflected in our data, as can be seen in Panel B, as there is only a (strong) effect of WfH on SMP in childless households, but a tiny effect otherwise.

Empirical support for this notion comes from the Global Survey of Working Arrangements, where Aksoy et al. (2023) report, that at the world average 11% of the 72 minutes commuting time being saved per week is spent on caregiving (the number for Germany is 8%). The other main categories where the saved time is spent on are on the job (40%) and leisure (34%), the respective numbers for Germany are 31% and 46%. Interestingly, there are great differences on caregiving between groups: if there are children below 14 years in the households, women spend an extra 11.4 minutes on caregiving, men extra 9 minutes. While these calculations cannot be directly added to each other, they indicate that adults with children may spend about 25% of their time saved for their children.

As the effect of childless households on SMP is so strong we show more detail in our standard regression setting. The result in Table 5, columns (1) and (2) contrasts the effects for these two household types. Quite generally, the regression for childless households has coefficients being quite similar to the general sample (see Table 3, column 3). This applies to coefficient sizes as well as to their significance levels, and differences to coefficients of the full sample do not seem to be systematic. The case of households with children is different. Most important for our study, the coefficient for “WfH” is very small, just about one sixth of this coefficient for childless households and insignificant. Another major distinction to childless households is the small coefficient for the variable “female.” Presumably, households with children have a male and a female adult and that these often decide together whether they want to invest into stocks or not, so that a gender effect is not visible anymore.

Columns (3) and (4) of Table 5 show the same regressions as before, but now using the IV-estimation introduced above. Again, the coefficient on WfH is much larger for childless households than for those with children in the same household, so that the former is statistically significant but not the latter. The difference between the two is smaller than in the OLS-regressions, but still differs by a factor of two and thus a large economic margin. Regarding the further variables, earlier patterns by-and-large remain, significance levels may go slightly down due to fewer observations.

Overall, our results suggest that there appear to be at least two channels how WfH effects

SMP. WfH saves time and thus reduces the opportunity costs of SMP. However, this may be rather a necessary and no sufficient condition for SMP. Individual circumstances seem to be important for a decision to enter the stock market, and these circumstances are related to improved time flexibility as indicated by a flexible work time arrangement or a childless household situation.

### 4.3 Distributional consequences of increased work from home

To explore distributional consequences of increased SMP we first compare the characteristics of all new entrants into the stock market in 2020 (“new owners”) relative to those holding stocks already in 2019 (“old owners”), and we compare the entrants also to those never holding stocks (“non-owners”). Table 2 shows that the new owners are with respect to their socio-demographic characteristics between non-owners and old owners. Thus, the increase in SMP does not just come from a more intensive SMP of individuals being similar to earlier stock holders but entrants into the stock market seem to be on average somewhat less well-off.

To further examine the role of WfH for potential distributional effects, we compare groups according to their disposable household income and run for three separate samples, covering the bottom 25%-middle 50%-top 25% of the 2020 income distribution, our standard regressions. Results in Table 6 show that the positive effect of WfH on SMP is strongest in the bottom 25%-group of the income distribution. This result is roughly the same in IV-regressions (see Table B.6 in the Appendix).

Then we take a closer look at stock market entrants across the income distribution. Figure 3 illustrates the result that the wider use of WfH has made the stock market more accessible to individuals with lower incomes. Panels A and B depict income distributions for those who entered the stock market and those who did not. Panel A concerns individuals that work from home and Panel B concerns individuals that work onsite. Panel C displays the difference of the two distributions, for WfH-workers and onsite workers, respectively. The green area denotes the entrance difference for WfH-workers and is clearly larger than the blue area, that represents the difference for onsite workers. This comparison makes clear that especially for incomes below the median (at 1800 EUR), WfH is closely associated with entering the stock market in 2020. For higher income groups, the difference becomes negative, possibly because

Table 5: Households with and without children

VARIABLES	Results by parental status			
	(1) Childless SMP	(2) Parents SMP	(3) Childless IV SMP	(4) Parents IV SMP
Work from home	0.049*** (0.017)	0.003 (0.017)	0.189*** (0.073)	0.080 (0.077)
SMP (first lag)	0.617*** (0.018)	0.605*** (0.018)	0.611*** (0.017)	0.602*** (0.017)
Log wealth	0.005** (0.002)	0.011*** (0.002)	0.003 (0.003)	0.011*** (0.003)
Log Disposable HH Income	0.052*** (0.014)	0.079*** (0.017)	0.039*** (0.015)	0.062*** (0.022)
Secondary education	-0.039 (0.097)	-0.023 (0.061)	-0.039 (0.123)	-0.032 (0.096)
Tertiary education	0.010 (0.098)	-0.007 (0.062)	-0.019 (0.125)	-0.038 (0.100)
Age	-0.002*** (0.001)	-0.002** (0.001)	-0.002*** (0.001)	-0.002*** (0.001)
Female	-0.031** (0.015)	-0.005 (0.016)	-0.025 (0.016)	-0.001 (0.017)
Married	0.004 (0.016)	0.017 (0.018)	-0.002 (0.017)	0.019 (0.018)
Rurality	0.015 (0.017)	0.012 (0.015)	-0.001 (0.020)	0.013 (0.016)
Migration background	-0.060*** (0.021)	-0.064*** (0.019)	-0.041* (0.023)	-0.058*** (0.019)
Risk tolerance	-0.007 (0.015)	0.011 (0.015)	-0.013 (0.016)	0.011 (0.015)
Sociability	0.003 (0.015)	0.012 (0.014)	-0.000 (0.015)	0.009 (0.015)
Optimism	0.031* (0.018)	0.020 (0.021)	0.034* (0.020)	0.020 (0.021)
Openness	-0.003 (0.015)	-0.007 (0.014)	-0.014 (0.016)	-0.011 (0.015)
State FE	yes	yes	yes	yes
Constant	-0.329** (0.162)	-0.682*** (0.180)	-0.206 (0.187)	-0.528** (0.224)
Observations	2,518	2,691	2,465	2,649
R-squared	0.460	0.463	0.450	0.458

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** The table shows the results of estimating the main specification and instrumental variables specification from Section 2.3, for childless households (columns 1 and 3) and for households with children (columns 2 and 4). The coefficients of interest indicate that the positive effect of work from home on stock market participation does not hold for households with children, possibly because the effect of relaxing time constraints when not working on-site is not present for this group.

Table 6: Split by income groups

VARIABLES	Main Results		
	(1) Bottom25income SMP	(2) Middle50income SMP	(3) Top25income SMP
Work from home	0.081** (0.034)	0.008 (0.017)	0.019 (0.021)
SMP (first lag)	0.627*** (0.043)	0.622*** (0.017)	0.581*** (0.022)
Log Wealth	0.006*** (0.002)	0.009*** (0.002)	0.001 (0.005)
Log Disposable HH Income	-0.026 (0.026)	0.074** (0.037)	0.059*** (0.023)
Secondary education	0.020 (0.053)	-0.029 (0.103)	
Tertiary education	0.017 (0.056)	0.008 (0.103)	0.006 (0.022)
Age	-0.001 (0.001)	-0.003*** (0.001)	-0.002** (0.001)
Female	-0.027 (0.022)	-0.015 (0.015)	-0.036 (0.022)
Married	-0.029 (0.023)	-0.009 (0.015)	0.041* (0.022)
Rurality	-0.022 (0.023)	0.027* (0.015)	0.020 (0.024)
Migration background	-0.017 (0.027)	-0.062*** (0.019)	-0.098*** (0.033)
Risk tolerance	0.008 (0.022)	-0.003 (0.014)	0.018 (0.021)
Sociability	0.018 (0.022)	0.005 (0.014)	0.029 (0.020)
Optimism	0.011 (0.028)	0.013 (0.018)	0.051* (0.031)
Openness	0.007 (0.022)	-0.003 (0.014)	-0.011 (0.021)
State FE	yes	yes	yes
Constant	0.303 (0.249)	-0.523 (0.380)	-0.440* (0.244)
Observations	877	2,905	1,525
R-squared	0.383	0.419	0.396

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** The table shows the results for estimating the main specification from Section 2.3 on various income groups: The bottom 25%, middle 50%, and top 25% of the income distribution. Results indicate that there is only a positive and significant association between work from home and stock market participation in the low-income group.



many individuals in this group own already stocks before and could therefore not enter.

To quantify the distributional aspects of WfH and SMP, we measure changes in income inequality across groups based on stock ownership status and WfH. The Theil Index is a suitable measure, as it can be decomposed by population subgroups.

The Theil index for an overall population of size  $i = 1, \dots, I$  is,  $T = \frac{1}{I} \sum_{i=1}^I \frac{y_i}{y} \ln\left(\frac{y_i}{y}\right)$ , with  $y_i > 0$  denoting income, and  $y$  average income. The index decreases if some income is transferred from a rich person to a poor person, while still preserving the order of income ranks. It is important for our analysis that the index can also be broken down in two components, with one component measuring inequalities between groups (e.g., owners and non-owners of stocks). Suppose a population consists of  $g=1, \dots, G$  non-overlapping groups, group size is  $I_g$ , average income in a group is  $\bar{y}_g$ , while  $s_g = \frac{\bar{y}_g I_g}{yI}$  is the share of group  $g$  of total income and  $T_g$  is the Theil index for  $g$ . The Theil index can be re-written as,

$$T = \sum_{g=1}^G s_g T_g + \sum_{g=1}^G s_g \ln\left(\frac{\bar{y}_g}{\bar{y}}\right) \quad (4)$$

Hence, overall inequality in the population is the sum of two components: One component is determined by the group-specific levels of inequality, as captured by the Theil indices  $T_g$ ; and another component is determined by differences in group-specific levels of income,  $\bar{y}_g$ . For example, inequality among all workers is the average inequality among stock-holding and non-stock-holding workers, weighted by the group-specific income shares, plus group-specific average income relative to average income of all employees (again weighted).

We compute the following inequality measures for our sample: (i) inequality for the full sample, (ii) within-inequality for individuals without stocks, (iii) within-inequality for stock owners, and (iv) inequality between stock owners and individuals without stocks. We use SOEP survey weights to obtain indices that are representative for the whole German labor force. As we are especially interested in the jump in SMP from 2019 to 2020 and its distributional effects, we compute the indices for both years and see how they change from one year to the other. We repeat the above calculations for the samples of WfH-workers and onsite workers, respectively. To learn more about the precision of our inequality estimates, we estimate standard errors by the means of a bootstrap procedure, whereby bootstrap weights

Table 7: Changes in income inequality between stock owners

Sample	Type	Theil Indices		
		2019	2020	Diff
Full sample	Overall	.183 (.022)	.168 (.012)	-.015 (0.000)
	Between-group	.015 (.003)	.010 (.002)	-.005 (0.000)
Onsite workers	Overall	.114 (.008)	.116 (.008)	.002 (0.000)
	Between-group	.005 (.001)	.005 (.001)	0.000 (0.000)
WfH-workers	Overall	.252 (.045)	.218 (.027)	-.034 (.001)
	Between-group	.019 (.008)	.008 (.003)	-.011 (0.000)

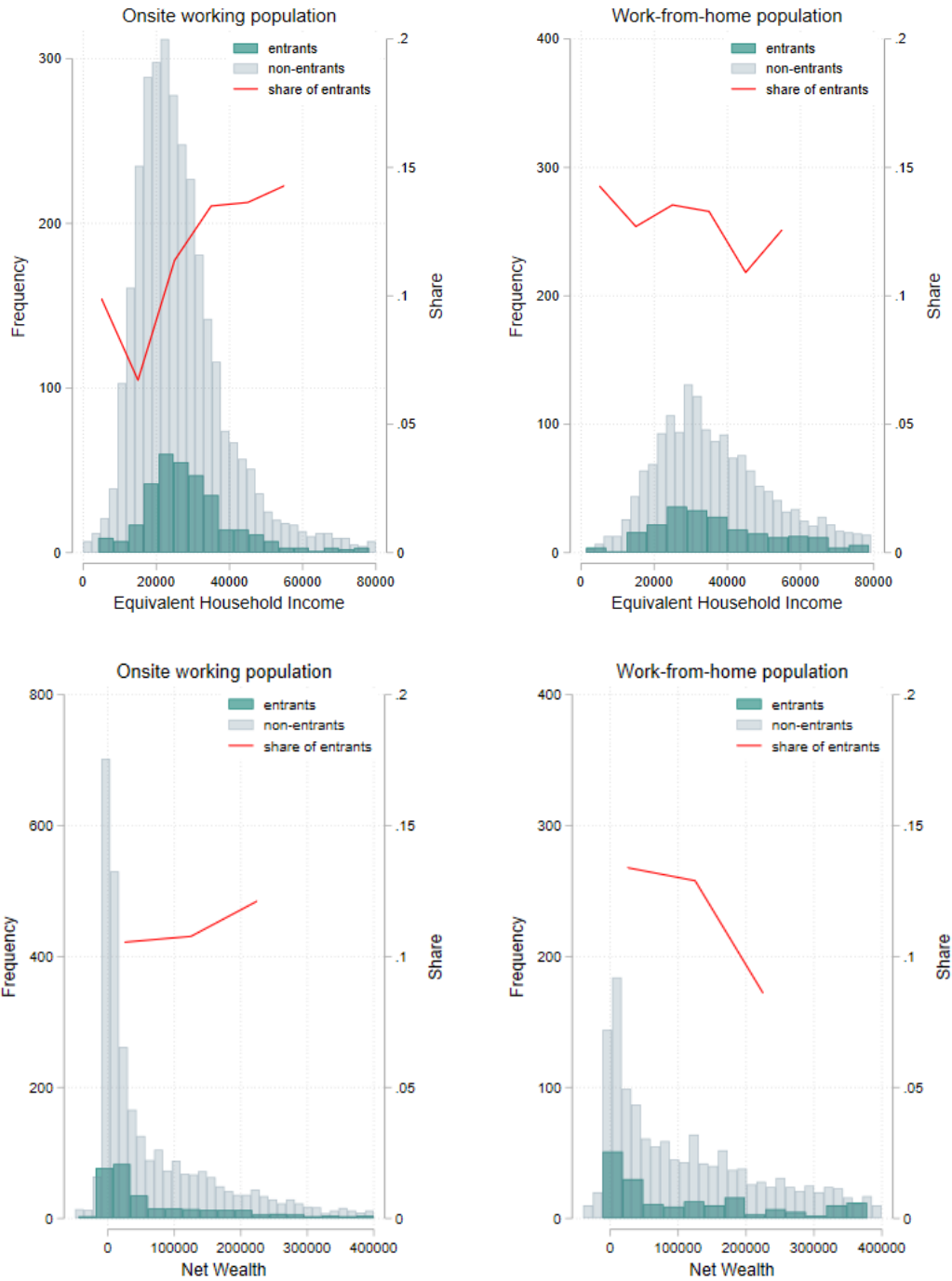
**Note:** Table 7 displays Theil indices, bootstrapped standard errors, stratified across stock owner groups, weighted by survey weights. "Overall" related to Equation 4 and "Between-group" refers to income inequality between the groups of stock owners and those who do not own stocks, which is computed by the second sum of Equation ??.

are stratified by stock ownership status.

Results are shown in Table 7. In the full sample, within- and between-group income inequality has decreased reasonably, while it has only increased within the group of those who do not own stocks. This is first evidence that the income distributions of stock owners and those who do not own stocks have reduced their gap from 2019 to 2020. To investigate the role of WfH, we split the sample in onsite and WfH-workers. Strikingly, between-group inequality has decreased significantly among those who worked from home (about twice as much as in the overall population), while it has even increased slightly among those, who worked onsite.

Overall, we find that the increase in SMP came along with reaching broader parts of the population than before. The specific role of WfH seems noteworthy in this respect because the broadening of stockholders in less well-off parts of the population, here approximated by income, is clearly supported by using WfH. This suggests that lower income groups (without children at home) benefit from the use of WfH in the form of increased SMP.

Figure 3: Income and wealth distributions, by WfH status and stock market entrance



**Notes:** The density plots in Panels A and B depict the income distributions for individuals who entered the stock market in 2020 and those who did not. Panel A depicts the population working from home, Panel B depicts the population working onsite. Panel C depicts the differences between both distributions, for Panel A and B, respectively. The fact that the green area (WfH-workers) is larger than the blue one (onsite workers) indicates that individuals in the lower part of the income distribution were more likely to enter the stock market if working from home. Source: Own calculations based on SOEPv37.

## 5 Robustness

We check the robustness of earlier results in nine directions: (i) We show that the increase in SMP in Germany continues beyond the year 2020, (ii) that the increase in WfH and SMP during the Covid-19-period is not specific to Germany but can be also observed in many other European countries, (iii) that the outcome variable, i.e. SMP of working household heads, is usefully defined, (iv) that results also hold when we run Probit instead of OLS regressions, (v) that WfH contributes to explaining SMP also in earlier years, (vi) that our main results hold when we consider additional potential determinants of SMP, (vii) that main results hold when we use a fixed panel of individuals, (viii) that results on the different impact of WfH for various income groups also holds in IV-regressions, and (ix) that the distributional analysis built on income groups largely holds when we use education as indicator of socio-economic status.

(i) **SMP-increase beyond 2020.** At the time of our analysis the SOEP data are only available until the year 2020. To alleviate concerns that the comovement of WfH and SMP between 2019 and 2020 may be driven by a time-specific unobserved event we use different data to test whether the relation continues. The German “Aktieninstitut” (roughly translated as institute on stock markets or capital markets) conducts an annual survey of the German adult population, reaching until the year 2022, and asks among others whether individuals hold stocks. Figure B.1 plots the respective share of SMP for this survey as well as for the SOEP survey (as shown in Figure 1 above). By-and-large both lines move in parallel, i.e. they decline from 2001 onwards, stabilize during the 2010s, move upwards since 2016, jump in 2020, and remain or even increase thereafter in the survey of the Aktieninstitut. The level of SMP shown by the Aktieninstitut is much lower, almost half only, because it covers also youth, retired individuals and those not working despite being at working age. This also explains why the SMP-increase in 2020 is much smaller (still about 15%), because WfH is mainly relevant for those working which is a subsample of all adults, covering about one third.

(ii) **Our case is not specific to Germany.** Another concern might be that a country-specific unobserved factor could drive the relation of interest. Thus, we also look at

SMP in other European countries by analyzing the HFCS-survey, a project of household surveys in many European countries, coordinated by the European Central Bank, so that items are comparable across countries. The most recent HFCS-waves were conducted in 2017 and 2021, thus enclosing the years 2019-2020. Figure B.2 shows the change in percentage points in WfH and SMP for the participating 20 countries in Europe. While Germany is characterized by relatively strong increases in both dimensions, it fits into a European pattern which can be seen from the plot as well as from the regression line. This is underlined by the information provided in Figure B.3, i.e. the levels of WfH and SMP, separately for the years 2017 and 2020. Again, the positive relation between both dimensions is obvious. Unfortunately, the HFCS survey does not provide enough individual details to replicate our analysis for Germany.

- (iii) **Modifications of SMP variable.** In our main analysis, SMP is based on an item from the SOEP household questionnaire that asks whether the respondent or another household member owned risky assets, such as stocks, funds, bonds, or equity options in the previous calendar year. In order to conduct the analysis at the individual level, we assign ownership to household heads only, and not to other household members. This follows the reasoning that respondents probably know best about their own financial portfolio, and less about other household members'. Fortunately, we have individual information on risky asset ownership from a complementary study, SOEP-COV, that was conducted on a subsample of the SOEP and was tailored towards the Covid-19 pandemic. Due to the small sample size (just 2,651 observations for our main specification), we refrain from using SOEP-COV data for our main analysis. In Table B.1, we show that risky asset ownership largely intersects across participants of the two studies. Specifically, 81% of the sample intersection contains the same information on asset ownership (61% do not own risky assets in both studies, while 21% do own risky assets in both studies). Only the remaining 19% of the sample intersection contain conflicting information on asset ownership, so that the true ownership of risky assets / stocks is between 19% and 40%, and thus probably and expectedly below the 35% measured according to our definition. The lack of knowledge about the 19% can be partly explained by the different timing of the studies: The SOEP asks about ownership

retrospectively, thus covering the whole calendar year, while the SOEP-COV asks about current ownership and was conducted in April.

Therefore, conflicting information could result from respondents who entered or left the stock market in the second half of 2020. Another reason could be that the questions have been formulated in slightly different ways in both studies. Given the high overlap of ownership information in both studies despite these circumstances, we are confident to work with reliable data.

- (iv) **Probit models.** While OLS estimations yield coefficients that are easily interpretable, linear combinations of coefficients can result in probabilities for stock ownership above 100%. We address this potential shortcoming by running a Probit model, which has been oftentimes used in the literature on SMP, both in the main specification (Bogan, 2008; Grinblatt et al., 2012), and as a robustness check (Hong et al., 2004). Table B.2 in the Appendix shows that coefficients have highly similar signs and significance, when replicating the main analysis with Probit and Probit IV specifications.
- (v) **WfH as SMP-determinant before 2020.** There may be some suspicion that the role of WfH regarding SMP may be specific to the year 2020. While it is to be expected ex ante that WfH does not have the same impact as the main determinants of SMP, such as wealth, income or education, it would be reassuring if WfH also plays a role in earlier years. As this variable has not been included in the survey for the years 2015 to 2019, we rely on results from the years 2012 to 2014. Here we repeat in Table B.3 in the Appendix the main specification from Table 3, column (2), as good as possible, i.e. we follow Hong et al. (2004). Unfortunately, a few minor variables are missing due to data limitations. Results show for all years that WfH has a limited but significant positive influence on SMP.
- (vi) **Considering further SMP-determinants.** Our main specification builds on Hong et al. (2004) which we repeat here in Table B.4 in the Appendix, column (1) for convenience. However, more variables could determine SMP; thus, we account for four of them which have been discussed in the literature. First, the use of online banking is a potentially omitted variable, as intuitively, it could be related to both working from

home, and participating in the stock market. The coefficient of online banking is quite large but not significant, while the coefficient on WfH stays very robust to the inclusion of online banking, as column (2) shows. Second, political preferences have been found to be another determinant of SMP, as left-wing voters are less likely to own stocks Kaustia and Torstila (2011). We add a variable that measures political orientation on a scale from 0 (left) to 10 (right), and find in column (3) in line with the literature, that the coefficient for political orientation is significant and implies that a change across the whole political spectrum from left to right is associated with a 5 percentage points higher likelihood of entering the stock market. Again, the coefficient of WfH remains unaffected. Third, we add church attendance, as a measure of sociability or religiosity, as argued by Hong et al. (2004). The coefficient of interest does not change at all, and the control variable is insignificant (column 4), possibly because church attendance is less prevalent in Germany than in the United States. Fourth, health has been regarded as a determinant which may increase the horizon of decision making and thus the willingness to invest into stocks. The result in column (5) shows that health, as measured by the physical component score, a general health measure from the SOEP, has a positive and significant association with SMP, while not changing our coefficient of interest.

- (vii) **Fixed panel of individuals.** To address the concern that results across specifications may not be comparable due to the changing sample size, we repeat the main regressions from Table 3 in Table B.5 in the Appendix for an unchanged sample. The new results are remarkably close to the former ones, indicating that some sample changes due to data availability of specific variables are not crucial in our case.
- (viii) **IV-regressions for income groups.** We repeat the regression shown in Table 6, examining the role of WfH on SMP for individuals in the lower 25%, middle 50% and upper 25% of the income distribution, by using the IV-approach. This confirms the results of OLS-regressions, as shown in Table B.6 in the Appendix.
- (ix) **Education as indicator of socio-economic status.** We show above that the effect of WfH on stock market entrance is driven by lower income groups, and there is no

effect for the top 25% income earners. In order to test if this relation holds for other dimensions of socio-economic status, we now split the sample by educational background; into primary, secondary and tertiary education. The vast majority of our sample has at least a secondary degree (61%) or tertiary degree (32%). Results in Table B.7 in the Appendix show that the effect is driven by individuals with a secondary degree, with a point estimate of 0.025 that is significant at the 5%-level (column 2). The other two educational groups display insignificant coefficients (columns 1 and 3). While the group of primary degree holders is too small to yield reliable estimates, the result on tertiary-educated individuals makes clear there is no effect for the most educated. The same pattern occurs in the IV-estimation. The educational split has thus shown that our findings are driven by two groups that largely intersect and are associated with a similar socio-economic status: lower-income earners and individuals without higher education.

## 6 Conclusion

The observed limited degree of stock market participation (SMP) in basically all countries is a concern for many policy makers as it contributes to a more unequal society. Stock returns are in the long run systematically higher than those of other assets, such as bank deposits. Still, large parts of the population who are reasonably able to hold stocks don't do this. As this reservation is related to lower income (and other dimensions of lower socio-economic status), the lack in SMP increases inequality in society.

It is not easy for policy to change or even address this situation. Thus, it is an interesting event that the Covid-19 pandemic led to enforcing WfH and that we show that this caused, possibly in combination with other changes, a sizeable increase in SMP. WfH means that working individuals save commuting time and that they are more flexible in their allocation between work and leisure. This relaxing of time constraints is a novel aspect of reducing participation costs of SMP. This research enters further new ground by analyzing possible distributional effects of this increase in SMP. While literature is typically silent on SMPs influence on inequality, we can show that the new entrants in the stock market indeed broaden



the basis of stock owners towards middle income groups. Interestingly, the effect of WfH is even more extreme in this respect because WfH supports middle and in particular lower income groups to increase their SMP. It seems desirable to also learn about distributional effects of other determinants of SMP and whether policy could do anything about it.

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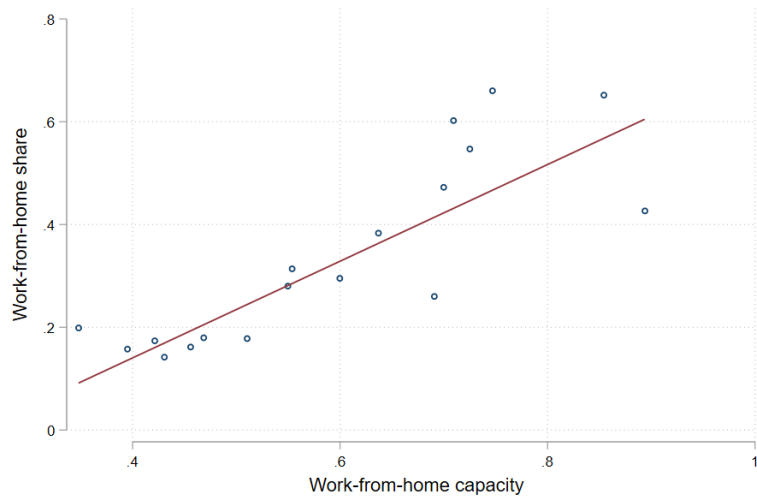
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# A Appendix

Table A.1: Description of variables

<b>Variable</b>	<b>Description</b>
SMP	This variable is equal to one if the household head reports that someone in the household owns risky assets, and zero otherwise.
WfH	This variable is one if the respondent indicates that they work from home, and zero otherwise.
Net overall wealth	Assets minus liabilities.
Years of education	The number of years individuals were in school or university.
Age	Individuals' age in 2020.
Female	Equals one if respondent is female, and zero otherwise.
Married	Equals one if respondent is married, and zero otherwise.
Urban	Equals one if BIK region has at least 100k inhabitants and zero otherwise. BIK regions are a widely used classification, used by administrative authorities.
Migration background	Equals one if at least one parent or respondent themselves was born abroad, and zero otherwise.
Risk tolerance	Based on Likert-scale that elicits willingness to take risks from 0 to 10. Dummy is equal to one if risk tolerance is 6 and above, and zero otherwise.
Sociability	Equals one if number of close friends is 4 or higher, and zero otherwise.
Optimism	Equals one if respondent is rather optimistic, and zero if respondent is rather pessimistic.
Openness	Equals one if respondent is rather open, and zero if respondent is rather not open.

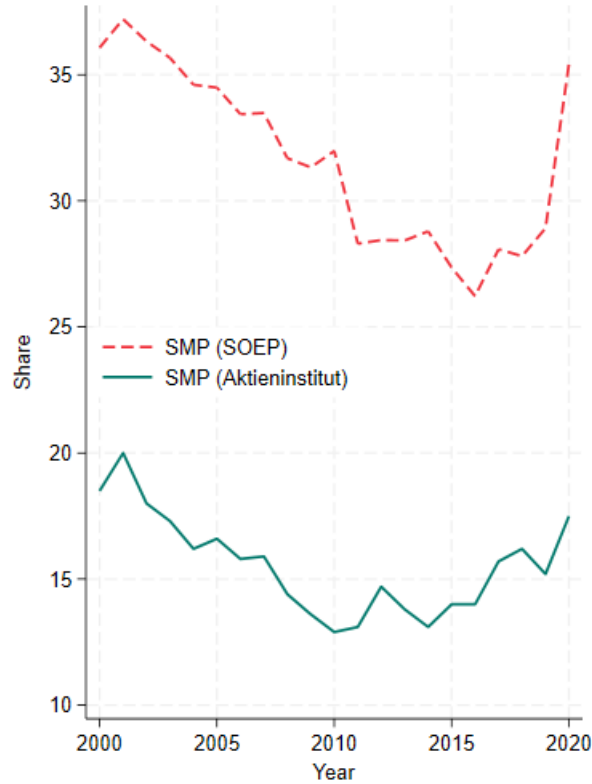
Figure A.1: First stage binned scatterplots



**Notes:** The binscatter depicts the first stage for remote work and the instruments. The plot shows a positive relationship between the work-from-home (WfH) capacity and the share of remote work, whereby bins are formed based on some capacity ranges. The WfH-capacity measures the pre-pandemic share of individuals in a NACE industry, who could work from home, assuming the employer allows it. The positive relationship is intuitive, as the capacity to work from home should be related to actually working from home. Source: Own computations based on SOEPv37.

## B Appendix

Figure B.1: SMP Timeseries



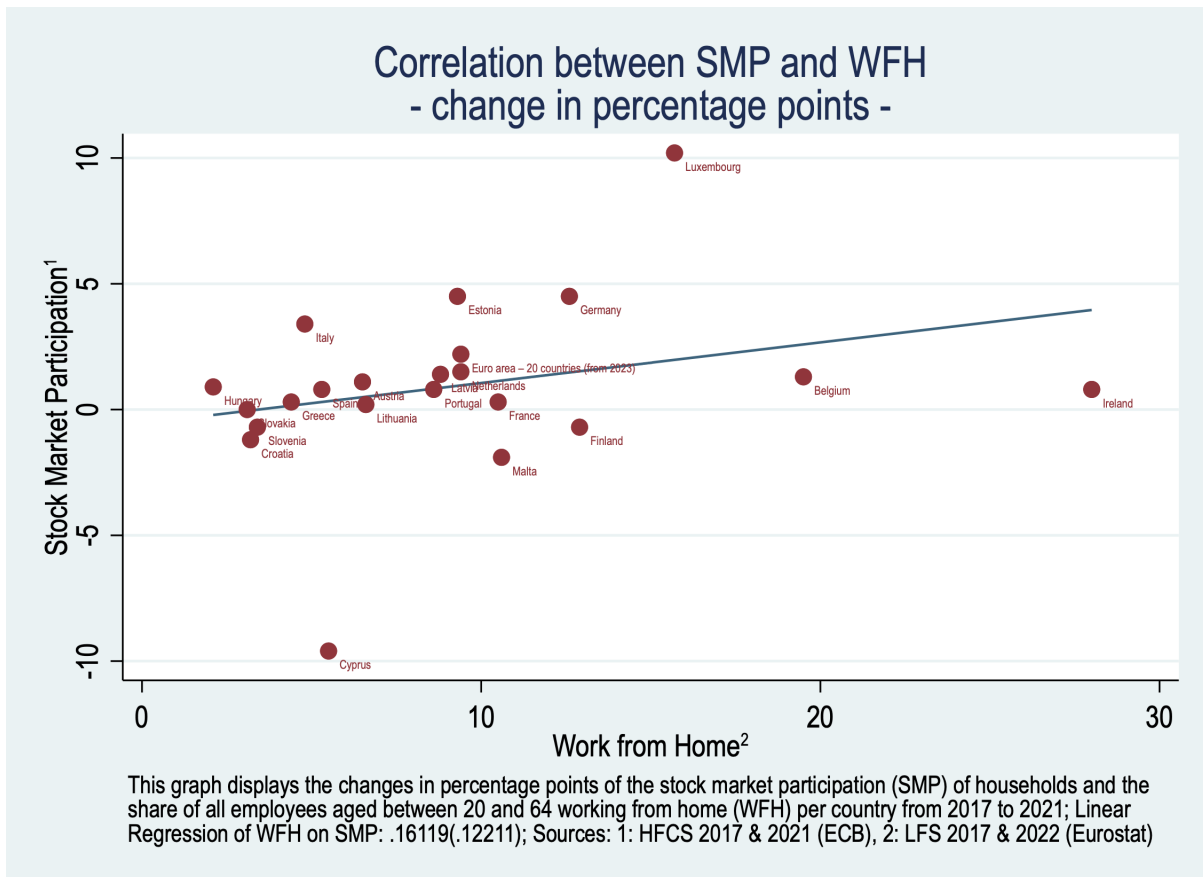
**Notes:** The plot shows time series for SMP. The red dashed line is based on SOEP data and indicates the SMP among working household heads. The green line is based on data from Deutsches Aktieninstitut and indicates the SMP among the whole German population aged 16 or older.

Table B.1: Cross-tabulations

		SOEP-COV (individual)		
		No risky assets	Risky assets	Total
SOEP-CORE (household)	No risky assets	57.18	5.52	62.7
	Risky assets	10.89	26.42	37.3
	Total	68.07	31.93	100

**Notes:** The table shows, how risky asset ownership (“stock market participation”), varies across the main SOEP study, where stock ownership is measured on the household level and then attributed to the respondent only and the SOEP-COV study, where stock ownership is measured on the individual level. The table depicts large overlap of stock ownership, indicating that the measure on the household level approximates individual stock ownership well enough.

Figure B.2: Changes in shares of WfH and SMP across EU countries



**Notes:** The plot shows a positive association between changes in the WfH-share and SMP across EU-countries. Sources: HFCS, ECB, and Eurostat.





Table B.2: Probit estimations

VARIABLES	Main Results with Probit			
	(1) Probit SMP	(2) Probit SMP	(3) Probit SMP	(4) Pr. IV SMP
Remote work		0.154*** (0.036)	0.098** (0.043)	0.494** (0.226)
SMP (first lag),			2.167*** (0.042)	2.155*** (0.063)
Log Wealth	0.099*** (0.008)	0.096*** (0.008)	0.046*** (0.008)	0.042*** (0.009)
Log Income	0.108*** (0.021)	0.106*** (0.023)	0.051** (0.023)	0.017 (0.034)
Years of education	0.062*** (0.006)	0.055*** (0.006)	0.028*** (0.008)	0.002 (0.016)
Age	0.003* (0.001)	0.003* (0.002)	-0.001 (0.002)	0.000 (0.002)
Female	-0.181*** (0.032)	-0.168*** (0.033)	-0.136*** (0.040)	-0.111** (0.047)
Married	-0.254*** (0.034)	-0.267*** (0.035)	-0.179*** (0.043)	-0.219*** (0.047)
Rurality	0.108*** (0.034)	0.099*** (0.035)	0.063 (0.043)	0.041 (0.050)
Migration background	-0.187*** (0.043)	-0.209*** (0.045)	-0.157*** (0.055)	-0.207*** (0.061)
Risk tolerance	0.091*** (0.031)	0.090*** (0.032)	0.040 (0.039)	-0.013 (0.044)
Sociability	0.070** (0.030)	0.063** (0.031)	0.067* (0.038)	0.066 (0.042)
Optimism	0.119*** (0.043)	0.132*** (0.045)	0.086 (0.054)	0.014 (0.059)
Openness	-0.048 (0.031)	-0.061* (0.032)	0.011 (0.039)	-0.033 (0.044)
State FE	yes	yes	yes	yes
Constant	-3.505*** (0.183)	-3.377*** (0.196)	-2.576*** (0.216)	-1.187*** (0.056)
Observations	8,954	8,259	8,243	6,715

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** The table shows the replication of the main results from Table 3, using Probit instead of OLS and Probit-IV instead of IV. A Probit model is commonly used for binary outcomes, such as stock market participation, while we decided to use OLS in the main specification as it allows for a more intuitive interpretation of coefficients. The coefficients' direction and significance are highly similar to the linear model.

Table B.3: Years prior to 2020

Main Results for Previous years			
	(1)	(2)	(3)
VARIABLES	2012	2013	2014
	SMP	SMP	SMP
Remote work	0.024** (0.010)	0.018* (0.011)	0.024** (0.011)
Log Wealth	0.015*** (0.001)	0.015*** (0.001)	0.015*** (0.001)
Log Income	0.029*** (0.004)	0.028*** (0.004)	0.028*** (0.004)
Years of education	0.019*** (0.002)	0.019*** (0.002)	0.020*** (0.002)
Age	0.002*** (0.000)	0.002*** (0.000)	0.001*** (0.000)
Female	-0.059*** (0.008)	-0.056*** (0.008)	-0.058*** (0.009)
Married	-0.053*** (0.009)	-0.055*** (0.009)	-0.064*** (0.010)
Rurality	0.027*** (0.008)	0.022*** (0.008)	0.030*** (0.009)
Migration background	-0.040*** (0.010)	-0.043*** (0.010)	-0.042*** (0.011)
Risk tolerance	0.023*** (0.008)	0.022*** (0.008)	0.014 (0.009)
State FE	yes	yes	yes
Constant	-0.446*** (0.037)	-0.420*** (0.040)	-0.429*** (0.044)
Observations	10,470	9,593	8,508
R-squared	0.101	0.094	0.097

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** The table shows the results for estimating the main specification from Table 3, column (2) for years prior to 2020. The coefficients indicate that the positive association between remote work and stock market participation holds and is significant for years prior to the COVID-19 pandemic, that imposed a shock on remote work.

Table B.4: Adding more control variables

VARIABLES	Main Results with more controls				
	(1)	(2)	(3)	(4)	(5)
	OLS SMP	OLS SMP	OLS SMP	OLS SMP	OLS SMP
Remote work	0.021** (0.009)	0.018* (0.009)	0.021** (0.009)	0.021** (0.009)	0.021** (0.009)
SMP (first lag)	0.707*** (0.010)	0.715*** (0.011)	0.707*** (0.010)	0.707*** (0.010)	0.706*** (0.010)
Log Wealth	0.006*** (0.001)	0.005*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.006*** (0.001)
Log Income	0.010** (0.004)	0.003 (0.004)	0.009** (0.004)	0.010** (0.004)	0.009** (0.004)
Years of education	0.005*** (0.001)	0.005*** (0.002)	0.006*** (0.002)	0.005*** (0.001)	0.005*** (0.002)
Age	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Female	-0.025*** (0.007)	-0.023*** (0.008)	-0.023*** (0.007)	-0.025*** (0.007)	-0.024*** (0.007)
Married	-0.031*** (0.008)	-0.034*** (0.009)	-0.032*** (0.008)	-0.031*** (0.008)	-0.031*** (0.008)
Rurality	0.012 (0.008)	0.009 (0.008)	0.011 (0.008)	0.012 (0.008)	0.010 (0.008)
Migration background	-0.024*** (0.009)	-0.029*** (0.010)	-0.024** (0.009)	-0.024*** (0.009)	-0.024** (0.009)
Risk tolerance	0.009 (0.007)	0.003 (0.008)	0.008 (0.007)	0.009 (0.007)	0.009 (0.007)
Sociability	0.012* (0.007)	0.012* (0.007)	0.011 (0.007)	0.012* (0.007)	0.013* (0.007)
Optimism	0.015 (0.009)	0.005 (0.010)	0.016* (0.009)	0.014 (0.009)	0.012 (0.009)
Openness	0.000 (0.007)	-0.005 (0.007)	-0.001 (0.007)	-0.000 (0.007)	-0.000 (0.007)
State FE	yes	yes	yes	yes	yes
Online banking		0.011 (0.008)			
Political Orientation			0.004* (0.002)		
Church attendance				0.010 (0.010)	
Health					0.002*** (0.000)
Constant	-0.116*** (0.037)	-0.040 (0.041)	-0.136*** (0.041)	-0.116*** (0.037)	-0.196*** (0.042)
Observations	8,243	6,917	7,993	8,218	8,149
R-squared	0.524	0.523	0.524	0.524	0.525

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** The table shows the results for adding more control variables. Column (1) denotes the baseline and is the same as column (3) of Table 3. Column (2) adds the use of online banking, column (3) adds political orientation (left vs. right), column (4) adds church attendance, and column (5) adds health, as measured by a general physical health score that consists of various components. Overall, the coefficient of interest stays very robust to the inclusion of the additional controls.

Table B.5: Main regressions with fixed sample

VARIABLES	Main Results			
	(1)	(2)	(3)	(4)
	OLS SMP	OLS SMP	OLS SMP	IV SMP
Remote work		0.062*** (0.014)	0.023** (0.010)	0.090** (0.042)
SMP (first lag)			0.713*** (0.011)	0.710*** (0.010)
Log Wealth	0.020*** (0.001)	0.020*** (0.001)	0.006*** (0.001)	0.005*** (0.001)
Log Income	0.032*** (0.007)	0.028*** (0.007)	0.007 (0.005)	0.003 (0.006)
Years of education	0.020*** (0.002)	0.016*** (0.002)	0.005*** (0.002)	0.001 (0.003)
Age	0.001*** (0.000)	0.001*** (0.000)	0.000 (0.000)	0.000 (0.000)
Female	-0.055*** (0.011)	-0.052*** (0.011)	-0.024*** (0.008)	-0.021*** (0.008)
Married	-0.083*** (0.012)	-0.085*** (0.012)	-0.034*** (0.009)	-0.037*** (0.009)
Rurality	0.033*** (0.011)	0.028** (0.011)	0.012 (0.008)	0.007 (0.009)
Migration background	-0.061*** (0.012)	-0.061*** (0.012)	-0.031*** (0.010)	-0.031*** (0.010)
Risk tolerance	0.017 (0.011)	0.016 (0.011)	-0.000 (0.008)	-0.001 (0.008)
Sociability	0.011 (0.010)	0.011 (0.010)	0.012 (0.008)	0.012 (0.008)
Optimism	0.028** (0.013)	0.027** (0.013)	0.003 (0.010)	0.003 (0.010)
Openness	-0.024** (0.011)	-0.026** (0.011)	-0.005 (0.008)	-0.007 (0.008)
State FE	yes	yes	yes	yes
Constant	-0.471*** (0.058)	-0.403*** (0.060)	-0.055 (0.042)	0.016 (0.063)
Observations	6,715	6,715	6,715	6,715
R-squared	0.098	0.101	0.524	0.520

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** While the main output in Table 3 is based on a sample that is shrinking with the inclusion of more variables (due to missing values), we re-run the same regression using a fixed sample of 6,715 observations in a complete case analysis. The coefficients are highly similar, indicating that the sample composition does not cause any bias to our analysis.

Table B.6: Split sample on income groups, using the IV specification

Instrumental Variables Results			
VARIABLES	(1)	(2)	(3)
	Bottom25 SMP	Middle50 SMP	Top25 SMP
Remote work	0.203** (0.099)	0.087 (0.063)	0.074 (0.087)
SMP (first lag)	0.732*** (0.025)	0.679*** (0.013)	0.737*** (0.017)
log_wealth	0.005** (0.002)	0.004** (0.002)	0.006 (0.005)
log_income	0.011 (0.008)	0.018 (0.019)	0.011 (0.034)
Years of education	-0.003 (0.005)	0.001 (0.004)	-0.001 (0.005)
Age	0.000 (0.001)	0.000 (0.001)	-0.000 (0.001)
Female	-0.016 (0.021)	-0.014 (0.011)	-0.033* (0.019)
Married	-0.002 (0.019)	-0.042*** (0.011)	-0.052*** (0.019)
Rurality	0.002 (0.018)	0.007 (0.011)	0.017 (0.020)
Migration background	-0.053*** (0.020)	-0.013 (0.014)	-0.086*** (0.024)
Risk tolerance	-0.008 (0.016)	-0.005 (0.011)	0.003 (0.016)
Sociability	0.004 (0.016)	0.009 (0.010)	0.022 (0.016)
Optimism	0.003 (0.020)	0.003 (0.014)	0.005 (0.024)
Openness	-0.002 (0.016)	-0.002 (0.011)	-0.021 (0.017)
State FE	yes	yes	yes
Constant	0.027 (0.089)	-0.107 (0.160)	0.003 (0.258)
Observations	1,249	3,683	1,747
R-squared	0.483	0.456	0.565

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Notes:** Extending Table 6 and contributing to the distributional analysis, this table shows the results for estimating our instrumental variables specification for the subsamples of the lowest 25%, middle 50%, and top 25% of the income distribution, respectively. Confirming the OLS findings, the effect is only positive and significant for the lowest income group.

Table B.7: Effect sizes for individuals of various educational backgrounds

VARIABLES	Main Results					
	(1) primary SMP	(2) secondary SMP	(3) tertiary SMP	(4) primaryIV SMP	(5) secondaryIV SMP	(6) tertiaryIV SMP
Remote work	-0.404 (0.309)	0.025** (0.012)	0.016 (0.012)	-1.407 (1.188)	0.093* (0.055)	0.057 (0.063)
SMP (first lag)	1.280*** (0.311)	0.698*** (0.015)	0.714*** (0.013)	1.051*** (0.274)	0.690*** (0.013)	0.728*** (0.014)
Log Wealth	-0.002 (0.016)	0.005*** (0.001)	0.007*** (0.002)	0.023 (0.021)	0.005*** (0.002)	0.005* (0.003)
Log Income	0.002 (0.066)	0.015*** (0.005)	0.004 (0.006)	-0.062 (0.051)	0.008 (0.007)	-0.002 (0.010)
Years of education	0.079 (0.121)	0.009*** (0.003)	0.002 (0.003)	-0.096 (0.080)	0.005 (0.004)	-0.001 (0.004)
Age	0.003 (0.006)	0.000 (0.000)	-0.001 (0.001)	0.013 (0.008)	0.000 (0.000)	-0.000 (0.001)
Female	0.006 (0.125)	-0.005 (0.009)	-0.053*** (0.012)	0.082 (0.103)	-0.003 (0.010)	-0.052*** (0.014)
Married	-0.003 (0.144)	-0.033*** (0.010)	-0.029** (0.013)	-0.073 (0.151)	-0.034*** (0.010)	-0.040*** (0.015)
Rurality	-0.193 (0.119)	0.011 (0.009)	0.015 (0.013)	-0.236** (0.094)	0.007 (0.010)	0.012 (0.016)
Migration background	-0.056 (0.134)	-0.016 (0.011)	-0.034** (0.017)	-0.229* (0.117)	-0.017 (0.013)	-0.053*** (0.018)
Risk tolerance	-0.158 (0.188)	0.009 (0.009)	0.006 (0.012)	0.001 (0.102)	-0.002 (0.010)	-0.001 (0.013)
Sociability	0.089 (0.105)	0.010 (0.009)	0.015 (0.011)	0.099 (0.086)	0.013 (0.009)	0.010 (0.013)
Optimism	-0.216 (0.211)	0.014 (0.011)	0.019 (0.017)	-0.204 (0.133)	0.007 (0.012)	-0.003 (0.019)
Openness	0.349 (0.213)	0.002 (0.009)	-0.002 (0.012)	0.107 (0.119)	-0.006 (0.010)	-0.009 (0.013)
State FE	yes	yes	yes	yes	yes	yes
Constant	-0.264 (0.989)	-0.197*** (0.053)	-0.034 (0.075)	0.935 (0.698)	-0.085 (0.078)	0.122 (0.103)
Observations	45	4,713	3,485	39	3,968	2,708
R-squared	0.566	0.489	0.534	0.592	0.478	0.549

Robust standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

**Notes:** In this table, we show the results of a split-sample analysis regarding different levels of education. While the lowest educational group is too small (45 and 39 observations) to yield any meaningful coefficients, the table shows that the effect is only significant for individuals with a secondary education, and not for individuals with tertiary (higher) education. This result is in line with the one on various income groups.