Bachelor Thesis – Economics & Business Economics

The effect of the introduction of the minimum wage law in 2015 on actual supplied labor hours from women in former East- and West-Germany.

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Abstract

In 1990, Germany reunited after 28 years of separation. The position of women on the labor market both developed differently in East and West-Germany. By using this historical context and the theory of the backward bending labor supply curve, this paper finds that women in West-Germany increased their supplied labor hours more than women in former East-Germany after the introduction of the minimum wage law in 2015.

I. Introduction

Every year on the 15th of March, Germany celebrates *'Der Tag der Deutsche Einheit'*, the day of the German reunification. A day that stands for unity, brotherhood, and equality after the decades that Germany, as the nation we know it now, was split up into two parts: West-Germany (BRD) and East-Germany (DDR). The day of unification is in stark contrast with the current state of so called 'unity'. In terms of differences in statistics regarding living standards, voting behavior and gender equality between the former East-Germany and West-Germany regions it almost suggests that the border still exists 30 years after the reunification (New York Times, 2020). Female labor force participation in the former East-Germany region was in 2015 still 30 per cent points higher compared with the former West-Germany region (Wyrwich, 2019). For the European Union (EU) is gender equality on the labor market a prominent issue to tackle: The current gender employment gap, where women stay away from the labor force, costs countries in the European Union 370 billion euro per year. Besides this, 3 in 10 women work in sectors with a low financial incentive (compared with 8% for men) like in healthcare, education and social work and they work more part-time (European Union, 2022). This makes women more economically vulnerable than men, but the increasing number of part-timers makes the labor market also more vulnerable for labor supply shortages. Could a policy instrument such as the minimum wage help to stimulate female labor supply in West-Germany? The minimum wage law (MWL) in Germany got to work from 1 January 2015. From then, every employer needed to pay their employee minimum a €8.50 gross wage per hour. Among the six million people who benefitted from the last minimum wage increase of 14.8% in October 2022, most of the beneficiaries were women (Bundesregierung, 2022). Caliendo & Wittbrodt (2022) find that by the minimum wage introduction in Germany, the gender wage gap reduced significantly.

Given the severe impact the introduction of the minimum wage had and still has on women in Germany, is it socially relevant what the minimum wage triggered to female labor hours in both regions, specifically focusing on the role of labor supply in this. Hence, the following main research question follows:

What is the difference in effect of the introduction of the minimum wage law in 2015 on short-term female labor supply between the former East- and West-Germany regions?

Müller & Steiner (2010) find in their empirical model a slight stronger behavioral labor supply adjustment in former East-Germany but unfortunately, they did not differentiate between sex and subsamples in the sexes. Burda (2016) mentions that the MWL induces significant changes in labor supply at the extensive and intensive margin, with the effect being the strongest in West-Germany. Caliendo, Wittbrodt & Schroeder (2019) focus in their paper purely on the total employment effect but mention the need for further research in the effects of the minimum wage on labor supply decisions. This different findings in viewpoints in the literature marks the scientifical relevance to investigate the possible difference in labor supply response after the minimum wage introduction in the former East- and West-German regions.

The minimum wage law (MWL) has been evaluated by a Difference-in-Difference model (DiD) with data provided by the *Deutsches Institut für Wirtschaftsforschung (DIW),* the Social Economic Panel (SOEP). From the results follow that there is a slight positive labor supply response from women in Germany to the introduction of the MWL. The weekly supplied labor hours in West-Germany respond significantly stronger than in East-Germany to the introduction. Common trends can be assumed before the introduction of the MWL. In Section II, some historical context will be given to the characteristics from East-Germans and West-Germans. Besides this, the economic literature behind the MWL in Germany and the backward bending labor supply curve will be discussed. The data will be discussed in Section III and the methodology in Section IV, where the final sample's extraction will be explained, and the empirical model presented. In Section V, the empirical model's results will be presented, which will be discussed in the discussion & conclusion part in Section VI.

II. Literature review

In 1949, World War II ended, and Germany got split up into two states. West-Germany, also known as *Bundesrepublik Deutschland* (BRD) was under control by France, the United Kingdom (UK) and the United States of America (USA). In West-Germany a capitalist-minded government settled, linked to France, the United Kingdom (UK) and the United States (US). East-Germany, officially known as the *Deutsche Demokratische Republik* (DDR), was under control of the Soviet Union (USSR), who settled a socialist government. Both countries developed completely different in terms of social, cultural, and economic context until the German reunification in 1990. The two main explanations are that (i) there were barely travel possibilities because of the *Iron wall*, that

separated the socialist-communistic DDR from the capitalistic oriented BRD, (ii) Because of tension between capitalistic and socialism/communism and the role of media, communication, and propaganda, both states developed their own contrary values.

In the literature is a consensus in a reason for the difference how the state structure influenced each East- and West-Germany towards female labor force participation. Female labor force participation is traditionally higher in the socialistic east than in the capitalistic west. According to Wyrwich (2019), who focused on female labor supply, this has two reasons: (i) the right of participation in the labor market for everybody is a thought that is strongly supported by the socialist and communistic rhetoric, while the capitalistic rhetoric implies a more traditional view and (ii) there is difference in social acceptance to work as a woman, especially in case of motherhood. An example of a proof that the right to participate in the labor market between men and women is the example of the difference in gender wage gap. In the year that the minimum wage got introduced (2015), the gender wage gap in former East-Germany was only 8% while the gap in the west was 23% (DeStatis, 2022). From a policy perspective it is important to say that already in 1949, women in East-Germany got the constitutional right for equal pay, showing the urgence of gender equality of the East-German government (Boelmann, Rauta & Schoenberg, 2021). According to qualitative research from Hoven (2001), where she had deep-dive interviews and written correspondence with women from the federal state Mecklenburg-Vorpommern, a former East-German state. After reunification, many women from her sample of women got unemployed. Van Hoven (2001) finds during interviews that unemployed women in East-Germany are using words that relate with loss of self-esteem and identity. Wyrwich (2019) shows that this gets expressed in a structural higher female participation rate from East-German women over the years.

The second reason for the difference, and according to the literature the strongest argument for the difference is the difference in social acceptance. In a survey among former East and West-German respondents, Adler & Brayfield (1996) find that there is a difference in equalitarian viewpoints in the capitalistic west and the socialistic in gender attitudes two years after the German reunification. West-German women prefer to spend their time at home to care for their children or to care for daily housework. Besides this, men in the household are breadwinners. Grundig (2008) also mentions that East-German women are more sensitive to work more if their availability of

childcare increases, West-German women do not show a significant effect. This may be a sign that this is more a cultural tendency to care for the children than it is a practical necessity. In West-Germany, women got a more centralized position at home to care for the children and to do the housework. Just as more capitalistic Western-European countries, native women stayed away from the labor market which triggered the demand of workers from Southern-Europe, North-Africa, and the Middle East in the most low-wage sectors in the growing economy (Boelmann et al., 2021). This contrasts with the mentality from East-Germany. Trappe, Pollmann-Schult & Schmitt (2015) mention in their research that women needed to be a worker, mother, housewife all in once according to the East-German values. More recent papers do agree with the findings above that the institutional framework of former East- and West-Germany still influence gender norms after the reunification. However, it seems that both regions are starting to converge on each other. Sprengholz, Wieber & Holz (2022) find by conducting Regression Discontinuity Designs (RDD) in different timeframes between 1983 – 2016, that married couples in former West-Germany avoid the situation that the women out-earns men as breadwinner. However, Sprengholz et al. (2022) mention that by the time this clear pattern is getting less over time, and that the change over time is stronger for West-Germany than for East-Germany. Therefore, the willingness to work for women in East-Germany would be more dependent on time restrictions than women in West-Germany. In case of a wage increase, East-German women would therefore be more likely to prefer to choose for time than working more hours. Haan (2005) finds from data between 1999 – 2002 that West-German women have a stronger positive labor supply response in working hours as in labor supply than women in East-Germany after a wage change. Haan (2005) mentioned that it could be explained by the differences in historical background.

The minimum wage effect in East- and West-Germany

The minimum wage law introduction in 2015 preceded by a large discussion in Germany whether the minimum wage had a negative influence on employment and the role of labor supply and demand in this. As one of the firsts, Bredemeier & Juessen (2012) constructed their own econometric model where they tested heterogeneity in gender and marital status with labor market data from 2009. The model distinguishes between gender and marital status. Bredemeier & Juessen (2012) find that the MWL increases supplied labor hours by 3% - 28%, with women notably being the strongest in response. However, the authors addressed the need to further research the MWL

and the labor supply field. In the analysis, differences in effect between former East- and West-Germany were not being taken in consideration. Garloff (2019) conducts a DiD to show that the minimum wage has a slight negative effect on marginal labor hours while there is a positive statistically insignificant effect on total employment in the former East-Germany region. While for Western-Germany, the number of labor hours is positively related to the introduction of the MWL. This indicates that in West-Germany the labor supply response to work more hours would be stronger than in East-Germany, even though the paper did not include differences between and East/West per sex. Later papers do not find statistically significant results in actual labor hours worked. Bonin, Isphording, Krause-Pilatus, Lichter, Pestel & Rinne (2020) & Dustmann, Lindner, Schönberg, Umkehrer & Vom Berge (2021) both show by DiD analyses that there is no effect in short term on the weekly labor hours worked after the introduction of the MWL. Both papers constructed a treatment and control group based on the percentage of workers who earned less than the minimum wage out of 401 districts. In both papers, the highest affected areas are combined in the treatment group, the lowest affected areas are formed the control group. Most East-German states got allocated to the treatment group in both papers. However, eastern and western districts still get mixed up in the experiments. Caliendo & Wittbrodt (2022) have the same approach as the stated papers, however they did control for differences within the sample of women, e.g., married women and female immigrants. For these subsamples no significant effect has been found either.

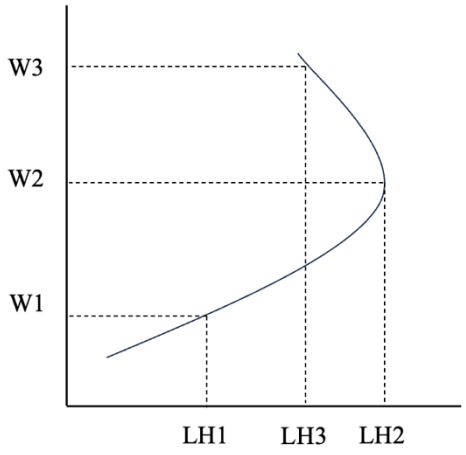
The backward bending labor supply curve

The model where the trade-off between time and working hours is being discussed is in the paper of Mincer (1962) where he explains the backward bending labor supply curve. In supplying labor, an individual has two options to allocate their time: leisure that gives positive utility and work where an individual earns money to satisfy his or her consumption needs. If the substitution effect dominates, an individual is going to work more if the wage increases (Mincer, 1962). The individual is doing this because of the opportunity costs of work are getting higher, and the individual will get a higher utility from the extra consumption. This substitution effect is strictly positive. This implies that if wages increase, the opportunity costs of leisure increase too. This will lead to a shift from leisure to work, since there is a stronger incentive to work. The opportunity costs for leisure are increasing. In case of an income effect, you are willing to give up labor hours

for leisure in case of a wage increase. How strong both effects are, is dependent on behavior and cultural habits, but also life changes such as getting married or getting children. The backward bending labor supply curve is being presented graphically in Figure 1:

Figure 1

The graphical representation of the backward bending labor supply curve



Note: On the X-axis the actual labor hours worked, which represent the labor supply. On the Y-axis, the hourly wage.

Figure 1 can be explained as the balance of domination between the substitution effect and the income effect. In the section from the origin until LH1 on the X-axis and W1 on the Y-axis the substitution effect dominates. This is because someone wants to consume goods in the leisure time someone has. In the second section between LH1 and LH2 on the X-axis and between W1 and W2 on the Y-axis, the income effect is getting stronger, but the substitution effect still dominates. In other words, an individual still has a higher marginal utility to work more if the wage increases, but the opportunity for leisure costs are increasing faster (Rahman, 2013). Individuals are reaching their target income at LH2 on the X-axis and at W2 on the Y-axis. In the section between LH3 and LH2 on the X-axis and between W2 and W3 on the Y-axis, the income effect is getting stronger than the substitution effect. Individuals experience their limits in their working time, and they prefer to have leisure time.

The backward bending labor supply curve in the case from Germany

Earlier in this paper I showed that labor force participation of women in East-Germany is much higher than in West-Germany. Besides this, the pressure on women in former East-Germany is high; a woman needs to be worker, mother, and housewife all in once (Trappe et al., 2015). The paper from Mokthari & Gregory (1993), where they predicted the difference in wage elasticities of labor supply for Soviet emigrants and native women in the US, could be a good reference for my hypothesis. Mokthari & Gregory (1993) find that female labor supply from the USSR show a strong backward bending labor supply curve. Given the high number of labor hours from those Soviet workers, women would work less (the income effect dominates) in case of a wage increase. For female workers in the US, there is a much steeper labor supply curve where the income effect would be much less dominant. If women in East- and West-Germany are indeed still affected by the institutional frameworks in the time before German reunification, it would imply, that there is a more backward bending labor supply curve for East-Germany compared with West-Germany. In other words: in case of a wage increase, the relative substitution effect in West-Germany would thus be more dominant than in East-Germany. The income effect would thus be stronger for women in East-Germany in their consideration to work more. The papers from Sprengholz et al. (2022) & Garloff (2019) show that both regions are converging in labor hours worked by the MWL. Hence, this gives the following hypothesis in this paper:

The introduction of the minimum wage law in 2015 did lead to a stronger increase in labor supply in West-Germany than in East-Germany.

III. Data

The database used comes from the Socio-Economic Panel (SOEP). This German panel dataset is constructed by an annual sample with approximately 32,000 respondents. The survey consists of questions like demographic statistics, well-being, income, and work. The target population is representative for the structure of the German society because random sampling with region clusters is used (SOEP, 2020). Furthermore, the interviewers get the correctness and completeness checked, to maintain the quality of the data. Every year the same questions will be answered. Every year there is an inflow of respondents who have never filled in a survey before and an outflow of

respondents who did not fill in the survey anymore. For this reason, only respondents are being used in the analyses that answered all questions in a single year. Just as Dustmann et al. (2021), Bonin et al. (2020) and Bruttel (2019), I use the SOEP database in the MWL analyses. Since the SOEP data gives insight into the state of origin of every respondent, I have been able to allocate every individual to East- or West-Germany. Obviously, all men in the dataset are being removed. I will use data on *'Bundesland'* - level, i.e., on federal state level. Every individual in the database is linked to their federal state in 2012 (the first year in the data) or the first year the individual is visible in the data if the individual flows in the sample later than 2012. The reason for this is to avoid the issue of an individual moving from the treatment and control group in the timeframe between 2012 - 2017. In the case of moving from East to West or vice versa, it does not mean an immediate change in cultural habits.

The construction of the treatment group is based on the geographical borders between 1949 – 1990. As capital of Germany, Berlin had been split up between East- and West-Germany. Given the geographical location of Berlin deep in the east of Germany and given the fact that there is no data available on ZIP-code or neighborhood level, Berlin will be allocated to the control group consisting of East-German states. In Table A1, the allocation of the federal states is presented with the number of observations per state and per group. The total amount of observations is 41,348, where almost 77% of them are being considered as 'West-Germans', 23% of the total is considered as East-Germans. This comes close to the actual ratio, where a bit more than 80% lived in the West-Germany region in 2018 (Bundesministerium für Wirtschaft und Energie, 2019). Evaluating the literature, I expect a stronger effect in actual weekly supplied labor hours for women in West-Germany compared with women in East-Germany. For this reason, West-German women will be considered as the treatment group, East-German women will be considered as the control group. The descriptive statistics of the two samples are presented in Table 1:

Table 1

Descriptive statistics

	Women in Germany between 2012 - 2017			
	(1)	(2)	(3)	(4)
	All women	Treatment group	Control group	Difference
Women characteristics				
Age	43.64	43.38	44.48	-1.10
Immigrant background (%)	21.02	25.15	7.26	-17.89
Married (%)	56.68	57.88	57.46	0.42
Education years	12.79	12.67	13.18	-0.51
Number of children below 13 years old per individual	0.59	0.60	0.56	0.04
Labor characteristics				
Actual weekly labor hours	31.19	29.94	35.34	-5.40
Desired weekly labor hours	29.46	28.43	32.90	-4.47
Hourly wage (€)	11.99	12.30	10.96	1.34
Unemployed (%)	3.87	4.03	3.36	0.67
Observations	41,348	33,799	9,549	24,250

Note: Summary statistics of all observations in our database. The period is 2012 – 2017. Column 1 reflects the entire population. In column 2 (treatment group) and column 3 (control group) the women between 18 – 65 years old from respectively former West- and East-Germany are presented. Column 4 presents the difference between the two groups, which is treatment group minus control group.

Looking at the labor characteristics, the actual weekly labor hours and the desired weekly labor hours are respectively 5.40 and 4.47 hours less in the control group compared to the treatment group. The hourly wage is as expected (1.34 euro) lower in the control group. As expected, the actual and desired labor hours in East-Germany are higher than in the west. The unemployment rate of 3.36% in the East-Germann sample is slightly lower (0.67% point) than the 4.03% in the West-German sample. The first striking in the demographics is the difference between the percentage of female immigrants in East- and West-Germany. In West-Germany the percentage of immigrants is 17.89% point higher than in East-Germany. According to the data, the group of

immigrants is shaped as being born outside Germany or that at least one of the parents was born outside Germany. This lays in line of what Boelmann et al. (2021) mentioned, that the inflow of workers outside Germany lead to a large group in West-Germany compared to the East. In terms of age, the West-German sample is 1.10 years younger than the East-German sample. The percentage of married women in 0.42% point higher in the West-German sample compared with the East-German sample. The education years per individual in the East-German sample are approximately half a year higher (0.51) compared to the West-German sample. This lays again in line with the findings from Boelmann et al. (2021), that in the DDR education attainment got stimulated by its policies. Finally, the difference in number of children below 13 per individual (0.04 child per individual) is neglectable between the eastern and western sample.

IV. Methodology

Firstly, I will conduct a basic multivariate regression analysis with the panel data. In this regression I want to see what the effect is of the MWL on the weekly labor hours worked in entire Germany. I conduct this regression to have an estimation of the magnitude and/or the confirmation if there is even an effect in the entire country. I will use the following regression equation:

(1) $Y_{it} = \alpha_i + \rho \mathrm{T}_t + \beta_1 \mathrm{X}_{1it} + \beta_2 D_{1it} + \varepsilon_{it}$

Equation 1 represents a regression analysis with individual fixed effects. In an individual fixed effects regression, I control for observable time-invariant variables for every individual. The dependent variable Y_{it} reflects the actual weekly labor hours from individual i in year t. The constant is α_i represents the constant fixed effect for individual i, thus with individual effects integrated, and ε_i is the error term for individual i in year t. The binary treatment is T_t is 1 in the years from and after the intervention (MWL introduction on the 1st of January 2015). There are two time-varying variables that function as control variables: X_{1it} which is the number of children under 13 years old in individual i's household in year t and the binary variable D_{1it} if individual i is married in year t. Secondly, to confirm the main hypothesis that in West-Germany the response in labor hours is indeed stronger than in East-Germany, this paper uses a Difference-in-Difference method (DiD) to estimate the difference in treatment effect between East- and West-Germany. The DiD method assumes that the trend of the control group is being taken as a trend from the treatment group in case the MWL did not get introduced. I will use the following equations for the analyses:

(2) $Y_{it} = \alpha_i + \rho \mathrm{T}_t \cdot \mathrm{M}_i + \beta_1 \mathrm{T}_t + \beta_2 \mathrm{M}_i + \beta_3 \mathrm{X}_{1i} + \beta_4 \mathrm{X}_{2i} + \beta_5 \mathrm{X}_{3i} + \beta_6 D_{1i} + \beta_7 D_{2i} + \varepsilon_{it}$

(3) $Y_{it} = \alpha_i + \mu_t + \rho \mathrm{T}_t \cdot \mathrm{M}_i + \beta_1 \mathrm{X}_{1it} + \beta_2 D_{1it} + \varepsilon_{it}$

Equation 2 represents a DiD method, equation 3 also represents a DiD but then with individual and time fixed effects. The dependent variables Y_{it} now represent the actual weekly labor hours that individual i works in year t. The treatment variable is the interaction term $\mathrm{T}_t \cdot \mathrm{M}_i$. The binary variable M_i is 1 if individual i is allocated in the treatment group (West-Germany), 0 if the individual is in the control group (East-Germany). The interacted binary variable T_t is 1 in the years when the MWL is active, in Germany's case it is 1 in 2015 and later, 0 in a year before 2015. Five control variables are being added in Equation 1. The continuous control variables are: X_{1i}, the number of years of education followed by individual i, X_{2i} is the age from individual i and X_{3i} the number of children under 13 years old individual i has in her household. Two binary dummy variables are being added: D_{1i} is 1 if individual i is being married and D_{2i} is 1 if individual i has a migration background. Someone has a migration background if someone got born outside Germany or if at least one of the parents of individual i was born outside Germany. After adding the individual and time fixed effects, there are two time-varying variables that stay: X_{1it} , the number of children under 13 years old in individual i's household in year t and D_{1it} will be 1 if individual i is married in year t. The time invariant variables X_1, X_2 and D_2 in equation 2 are being removed in equation 3. The variables from the interaction term (T_t and M_i) will also drop. The constant from individual i is a_i and ε_{it} is the error term for individual i in year t.

Part of the robustness is to check that the DiD is a suitable instrument to use; I test for the Parallel Trends Assumption (PTA). The PTA or constant bias assumption holds when the trend of female labor supply hours evolve constant over time in absence of the treatment, the MWL. If the trend of the treatment group shows a different trend from the control group after the intervention, it will be considered as the average treatment effect. This treatment effect is only reliable if the trends from both groups evolved same over time before the treatment, the Parallel Trends Assumption (PTA). The treatment consists of the high impacted group from the intervention. Based on the hypothesis the treatment group is West-Germany. The control group consists of the low-impact group from the intervention, in this case East-Germany.

To give an example of how necessary the PTA is in calculating the treatment effect, I created a graph with the means from the times before and after the introduction of the MWL from both regions. A graphical example is traceable in Figure A6 in the Appendix. The average number of labor hours before 2015 for the control group, East-Germany, is 35.55 hours per week, after the minimum wage law introduction the mean is 35.13 hours per week. The intuition of the PTA would be that the treatment group mean from the treatment group would decline with the same degree. Before the introduction in 2015 the mean is 29.91 hours. After the introduction, the mean is 29.96 hours per week. The average treatment effect would thus be 0.47 in case of no control variables. I will conduct a regression for both regions with year fixed effects. I check if both regions evolved the same before the treatment. Since there are only two years in the regressions, I decide to confirm the findings in two graphs. I will check the evolution of the means and I augmented the model with interactions between years and M_i where I check the leads and lags. If the PTA holds, the leads in the regression are not statistically different from zero, I should find statistically significant p-values in the lags. Finally, I check the normality of the results for the total sample and the control and treatment group separately. I do this by checking if the residuals follow a (i) kernel distribution, (ii) a normal distribution and (iii) if the inverse is normal distributed.

Explanation of the used (control) variables

According to Connolly & Gregory (2002), it is possible that there are possible spill-over effects between labor demand and labor supply in using contractual employment. To avoid this, I use actual weekly labor hours worked. I chose weekly labor hours because the employees' choice of working hours is the most apparent in this variable. In the case of a flexible worker or a part-time worker who works in shifts, the worker has a relative decisive power to accept or reject whether to work a shift or not. In a full-time job, overtime indicates someone's willingness to work more hours. In these cases, the actual labor hours could differ from the contractual labor hours. Desired labor hours may bias our results, since someone's answer could differ on time of the day or mood, and someone could answer with social desirability purposes. The contractual labor hours have been recorded in a contract between the employer and the employee. The only choice from an employee's perspective is accepting this contract or not, which makes this variable more an indicator for labor demand. As a solution an employer could offer the employee extra unregistered

labor hours, so called *black work.* Bruttel (2019) find that the contractual hours decreased among women but that the actual hours worked stayed the same. He mentions that unregistered working labor hours to avoid taxes could drive this. Black (overtime) work is captured in the actual labor hours. Given the diverse groups of people who were affected by a minimum wage law, it is important to try to make a distinction between by adding control variables. The control variables correct for observable differences between the treatment and the control group. The first control variable is education years. Women with more education years are likely to work and earn more compared with women with a lower number of education years. This means that is likely that women with a small number of education years will be affected the most from a minimum wage increase, women with more education years are likely to earn a higher hourly wage.

Bredemeier & Juessen (2012) find in their empirical model that the effect of the minimum wage law the strongest is among married female recipients. Besides this, in the paper from Sprengholz et al. (2022) we saw that married women in West-Germany adapt their supplied labor hours from their husband's income to a much larger extend than East-German women who are married. Wyrwich (2019) mentions that married women participating in the labor market is about 14 percent point higher in East-Germany compared with West-Germany. For this reason, I add the dummy variable if the individual is married to our set of control variables. Furthermore, I add the number of children under 13 years old in the household. Connoly & Gregory (2002) mention the control variable 'number of children' as a strong indicator for a (negative) labor supply response among women. Campa & Serafinelli (2019) find that women in East-Germany reintegrate much better in the labor market than West-German women after motherhood. For this reason, I also add a control variable that reflects the number of children in the household that is below the age of 13 years old. As mentioned before, migrant women in West-Germany stayed away from the labor market which triggered the demand of workers from outside Germany (Boelmann et al., 2021). Many of these migrant families stayed in Germany and they may be culturally different from native women. Bonin et al. (2018) find by a DiD that, women and workers with a non-EU background experienced a negative employment effect compared with men and workers with an EU-background. This could say something about the 'specialty' of this subpopulation of women.

V. Results

The treatment effect of the intervention on whole Germany

In panel A of Table 2, the introduction of the MWL indicates that the intervention has a significant effect on the actual labor hours in whole Germany. The regressions in both columns integrated individual fixed effects. The data in Table 2 reflects the results from Equation 1 with (column 2) and without (column 1) control variables. In column 1 from panel A, the statistically significant estimated effect is that women started to work weekly 0.65 labor hours more. Adding control variables, it led to a slight positive and significant effect of 0.37 weekly labor hours in Germany. It lies in line of expectation that being married and that the number of children under 13 years old in a household have a negative effect on the actual weekly supplied labor hours. Given the impact of the marital status and having young children on female labor supply, I expect that the results in column 2 are the most reliable in the treatment effect in whole Germany. In Table 2, all details are given from the individual fixed effect regression:

Table 2

Regression analyses of the MWL on female labor hours

	Labor hours (A)	
	(1)	(2)
MWL	0.65***	0.37***
	(0.07)	(0.07)
Being married		-0.87***
		(0.24)
Number of children < 13 years		-2.60***
		(0.13)
Constant	31.03***	33.22***
	(0.05)	(0.16)
Individual FE	Y	Y
Observations	37,438	37,438

Note: Multivariate regression analyses with the effect of the minimum wage law on the total labor hours supplied with individual fixed effects. The standard error is being reflected in parentheses. * Includes p-value <0.1, ** includes p-value<0.05 and *** includes p-value<0.01.

The difference in treatment effect of the intervention between East- and West-Germany

The DiD analysis without fixed effects (Equation 2) is situated in panel A in Table 3, the DiD with fixed effects (Equation 3) is situated in panel B in Table 3. Each panel has 2 analyses in each panel, one with (column 2) and one without (column 1) individual and year fixed effects. In panel A, there is positive treatment effect visible of 0.68 hours of the minimum wage in West-Germany compared to East-Germany by a significance level of 10%. It gives the confirmation that the chosen control variables do make sense, also given the fact that all control variables are significant. Again, as expected, being married and the number of children < 13 years have a negative effect on weekly labor hours. The number of education years and having an immigration background do have a positive effect and significant effect. This set of control variables gives more reliability; however, it is possible that there are still time-invariant omitted variables that influence the results. For this reason, individual and time fixed effects are being added in panel B.

In panel B, there is a stronger effect of visible of 0.80-0.89 more actual weekly labor hours supplied from West-German women compared with women in East-Germany. Looking to the time-varying control variables, approximately the same magnitudes are results from the regression from Equation 1 in Table 2, panel B. It does not seem that the values of the variables look unexpected or off from the consensus from the literature review. Adding fixed effects to the analysis does make sense, since the treatment effect is changing from a significance level of < 0.10 to 0.000. Looking at the graph in Figure 2 in the, there is a slight negative response in labor hours in East-Germany. Panel B, column 2, indicates that the relative substitution effect is stronger in West-Germany compared with East-Germany, where the income effect dominates. It seems plausible to accept the hypothesis in this paper. All details of the results are findable in Table 3:

Table 3

Difference-in-Difference analyses of the actual weekly labor hours supplied after the MWL in 2015

	Weekly Labor hours DiD (A)		Weekly Labor hours DiD + FE (B)	
	(1)	(2)	(1)	(2)
MWL * West-Germany	0.47	0.68*	0.89***	0.80***
	(0.30)	(0.28)	(0.17)	(0.17)
MWL	-0.42	-0.36		
	(0.26)	(0.25)		
West-Germany	-5.64***	-5.15***		
	(0.22)	(0.20)		
Being married		-3.72***		-0.92***
		(0.13)		(0.24)
Number of children < 13 years		-3.55***		-2.50***
		(0.07)		(0.13)
Education years		0.84***		
		(0.02)		
Immigration background		0.36**		
		(0.15)		
Age		-0.086***		
		(0.01)		
Constant	35.55***	32.14***	31.91***	33.87***
	(0.19)	(0.44)	(0.59)	(0.60)
Individual FE	N	N	Y	Y
Year FE	N	N	Y	Y
Observations	41,347	41,347	28,054	28,054

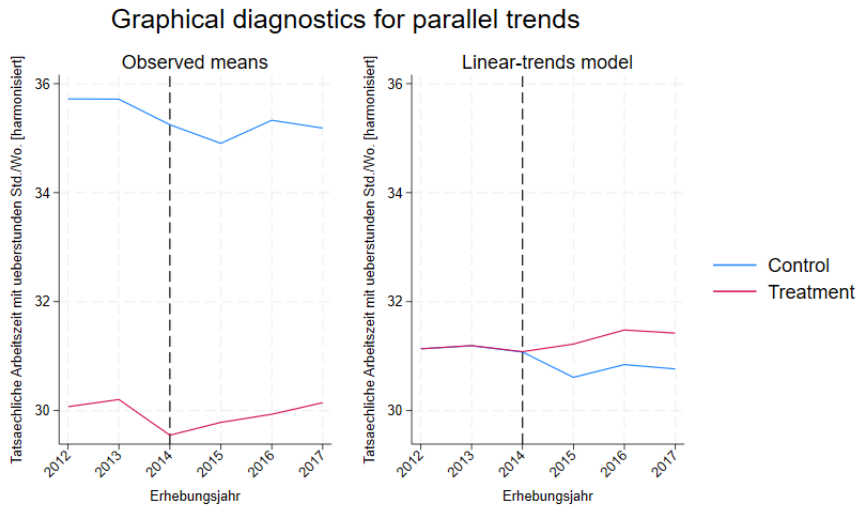
Note: The difference in effect of the MWL for West-Germany compared with East-Germany on actual labor hours worked. In Panel B, individual and time fixed effects are integrated in the regression equations. The standard error is being reflected in parentheses. * Includes p-value <0.1, ** includes p-value<0.05 and *** includes p-value<0.01.

Robustness

Regarding the robustness, I check if the PTA holds. I firstly do this by conducting two regression analyses with time fixed effects for the treatment and control group (Table A3, Appendix). The trends in both regions are approximately similar, but the magnitudes are different, so it is hard a make a conclusion based on only 2 differences and insignificant results in East-Germany. In 2013 compared with 2012, both regions show different numbers: 0.13 (West) vs. -0.02 (East), in 2014 compared with 2013 both regions both show a decrease namely, -0.52 (West) vs. -0.20 (East). A graphical representation of the PTA is presented in Figure 2:

Figure 2

Graphical representation of the Parallel Trends Assumption (PTA)



Note: Graphical representation of the PTA. The blue line represents the control group, East-Germany, the pink line represents the treatment group, West-Germany. The evolution of the means per group is visible in the left panel. The right panel shows the treatment effect in an augmented model, with interactions between the intervention and every year in the sample.

In the right panel, the linear-trends model is presented, where the DiD analysis from Table 3, Panel B, column 1 got augmented with interactions between the treatment and every year in the sample. The variable T_t gets replaced for the years variable. It is plausible that the PTA holds, the interaction between the intervention and the years before the interaction are not statistically significant, the interaction with the years after the intervention are (STATA, n.d.). In Table A2 in

the Appendix, the full table is visible. Both regions follow approximately the parallel path, it gives the indication that the PTA holds.

Finally, I check the normality from the residuals. Regarding the graphical representations in Figures A1-A5 in the Appendix, it follows that the residuals from West-German sample seem normal distributed, for East-Germany I tend to say that the residuals are less normal distributed. In the Kernel distribution in Figure A1, the residuals distribution is presented for the entire sample. There is a slight peak from the right of the middle point, but the main impression is that the normality of the residuals is valid. West as well as East have a peak just on the right from the middle of the distribution. West-Germany (Figure A2, panel A, Appendix) follows an approximate normal distribution, East-Germany (Figure A2, panel B, Appendix) seem to follow the distribution less than the western sample. The residuals for the entire sample also follow the reference line in graphs of the inverse in Figure A3, indicating that the normality of the residuals. Figure A4 gives the impression that West-Germany's residuals are normally distributed, the curve for East-Germany (Figure A5) looks more normal distributed than Figure A2, but it still has a slight deviation from the curve. The reference line lays a bit off the shape from the scatter from East-Germany. In case of normality of the residuals (or the error term ε), the part of the analysis that cannot be explained by the model needs to be normal distributed (RU, n.d.). This implies, that the results are consistent, reliable, and independent. In the case of the normality of the residuals from this paper it can be assumed that the residuals are approximately normally distributed, however, the model is not perfect.

VI. Discussion & Conclusion

This paper finds that the introduction of the MWL had a slight positive effect on female labor supply in Germany, however, there has been a significant difference found between former East- and West-Germany. In West-Germany, women supplied 0.80 - 0.89 hours more compared with women in former East-Germany. This difference could be explained by economic arguments, rooted in historical differences in institutional framework that still influence today's behavior. From historical perspective, the position from women in a household in West-Germany was strongly based on traditional gender viewpoints. In East-Germany labor participation was part of the identity in the time of the socialist institutional framework. This resulted that woman in West-Germany stayed away from the labor market, women in East-Germany had a prominent place on

the labor market. At the same time, the pressure on women in East-Germany is high. This led to a different shape of the labor supply curves between the two regions. According to the theory of the backward bending labor supply curve, the relative power of the income effect versus the substitution effect is increasing in wage rate. When the wage rate gets higher than a target wage, people start to work less (the income effect). According to Mokhtari & Gregory (1993), Soviet women show a backward bending labor supply curve, while women in the US show more steep labor supply curve, where the income effect is much less dominant. This implies for East-Germany with the given wage increase and the high number of labor hours before the intervention that the income effect target income would be stronger compared with West-Germany. The results indeed show that the relative substitution effect is stronger for women in West-Germany. However, there are some important arguments to make that show that this topic needs further scientific research. Firstly, a more sophisticated approach such as a RDD, could be a way to increase the reliability of the results. We see that the proof that PTA hold is lean, so the magnitudes of the treatment effect given in this paper could be different from the effect from the real world. Regarding the Connolly & Gregory (2002) already mentioned that dependent variables that give labor hours, are vulnerable for spill-over effects between labor demand and labor supply. This gives reason for further research; someone can adjust their supplied labor hours based on the labor market. The paper from Mokhtari & Gregory is based on data from more than 30 years ago, do women with a background similar as the Soviets still show the same backward bending labor supply curve? Furthermore, this paper did not investigate the differences per sector. The effect can be different per sector per region in terms of degree of labor intensity. Besides this, in Germany a lot of the power is laid on federal state level. This could be problematic for the analyses in this paper since there could be policies on federal state level that were not being considered and that influence female labor supply decisions differently in both regions. Lastly, it could be interesting to see if the effect found in this paper can also be found in Berlin. Given the special position Berlin had in being split up between two parts, it is possible to conduct this research at micro-level. As mentioned before, a minimum wage law could be a way to increase labor supply among women. It is important to see how policy instruments in Germany lead to different outcomes in its regions. In terms of gender equality, it is important to reduce the gender employment gap and better the position from women on the labor market. We have seen that a minimum wage law could be an instrument to increase labor supply among women in West-Germany. However, how desirable is a MWL if there is barely an effect

in East-Germany? Do the benefits still outweigh the costs? For policymakers it is therefore relevant if drastic policy instruments such as the MWL have the desired effect if culture is sometimes maybe more rooted in people than policymakers want. Even 25 years after the German unification.

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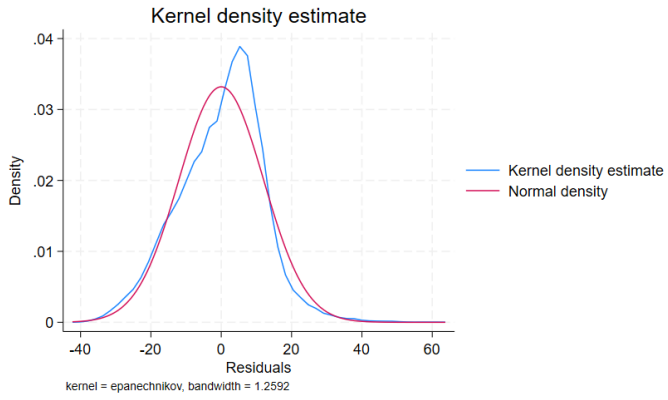
VIII. Appendix

Figure A1

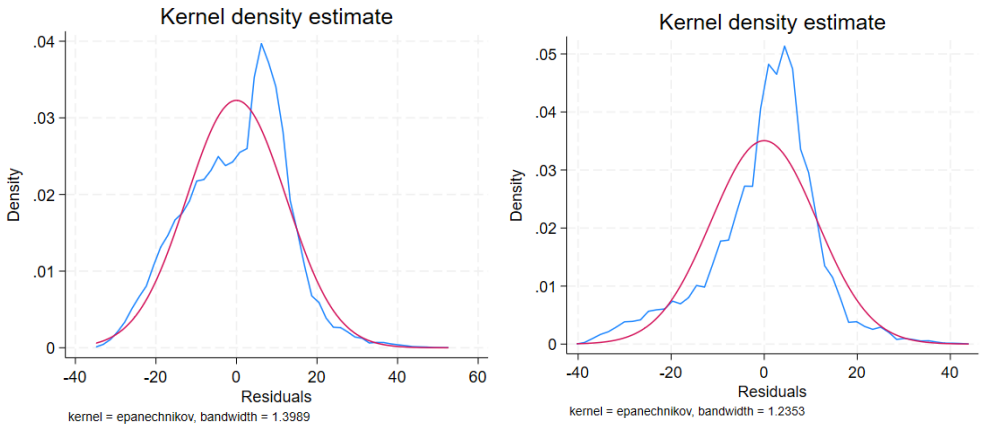
Kernel density curve – Equation 3



Note: The kernel distribution curve which shows the normality of the residuals.

Figure A2

Kernel density curves per region – Equation 3

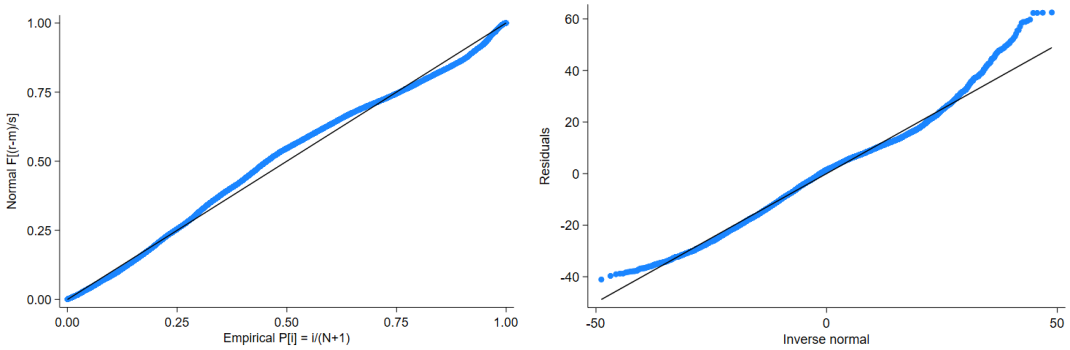


A B

Note: The kernel distribution curve which shows the normality of the residuals. In panel A, the kernel density curve is presented from West-Germany, in panel B, the kernel density curve from East-Germany is presented.

Figure A3

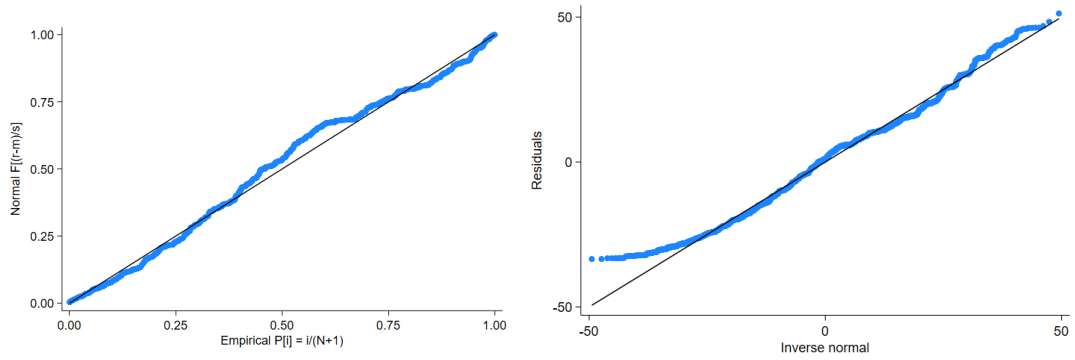
Tests to show the normality of the residuals for the entire sample.



Note: Graphical representation of the normality of the residuals. In Panel A and B, the 45 degrees line represents a normal distribution. The closer the line, the better the fit with a normal distribution.

Figure A4

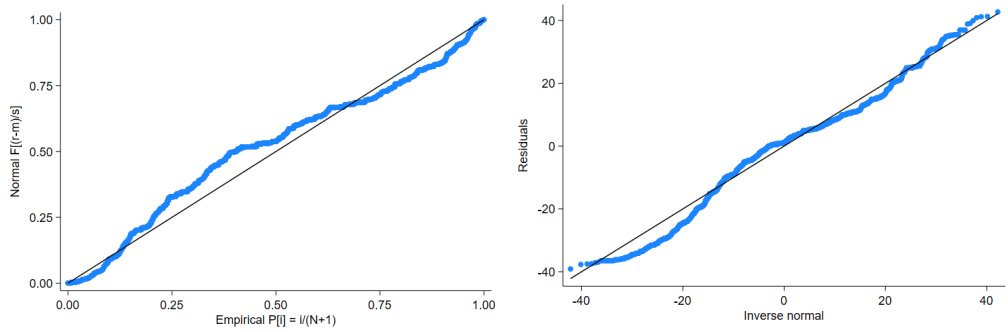
Tests to show the normality of the residuals for West-Germany.



Note: Graphical representation of the normality of the residuals in the West-German sample. In Panel A and B (where the inverse is calculated), represents the 45 degrees line a normal distribution. The closer the line, the better the fit with a normal distribution.

Figure A5

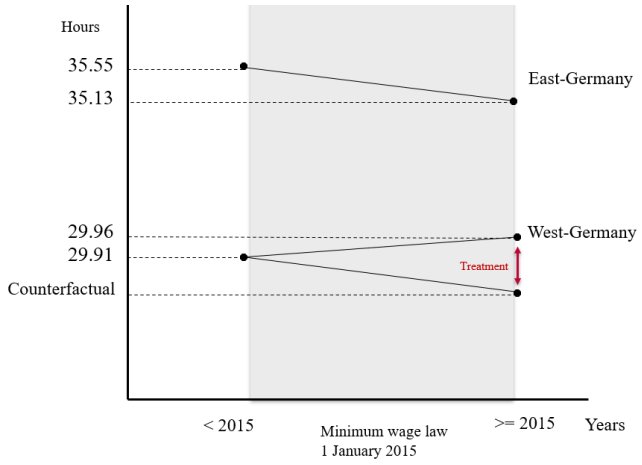
Tests to show the normality of the residuals for East-Germany.



Note: Graphical representation of the normality of the residuals in the East-German sample. In Panel A and B (where the inverse is calculated), represents the 45 degrees line a normal distribution. The closer the line, the better the fit with a normal distribution.

Figure A6

Visual example of the difference-in-difference method



Note: Graphical representation from the means after and before the minimum wage introduction. On the X-axis, the years. On the Y-axis, the actual labor hours are presented. According to the PTA, the predicted treatment effect is marked with the red arrow. See Table 3, Panel A for the related regression.

Table A1

Group allocation of the German federal states with numbers of observations

West-Germany	Obs.	East-Germany	Obs.
Bremen	305	Mecklenburg – Vorpommern	900
Niedersachsen	3,996	Sachsen-Anhalt	1,422
Saarland	361	Berlin	1,563
Baden-Wurttemberg	5,050	Brandenburg	1,503
Hamburg	662	Sachsen	2,557
Bayern	7,020	Thüringen	1,604
Nordrhein-Westfalen	8,152		
Rheinland-Pfalz	1,867		
Hessen	2,962		
Schleswig-Holstein	1,424		
Total observations	31,799		9,549

Note: Group allocation of the German federal states to West-Germany and East-Germany. West-Germany will be the treatment group, East-Germany will be the control group.

Table A2

Parallel Trend Assumption (PTA) test

	(1) Actual labor hours
West-Germany	-1.30*
	(0.79)
2013	0.20
	(0.24)
2014	0.071
	(0.24)
2015	0.45
	(0.30)
2016	0.26
	(0.25)
2017	0.21
	(0.25)
West-Germany * 2013	0.01
	(0.28)
West-Germany * 2014	0.28
	(0.28)
West-Germany * 2015	0.85**
	(0.28)
West-Germany * 2016	0.97**
	(0.28)
West-Germany * 2017	1.27***
	(0.29)
Constant	31.63***
	(0.61)
Observations	28,054

Note: Test of the Parallel Trends Assumption (PTA). In the years with the interaction term, represent the years of 2013 and 2014 the years before the intervention. The standard error is being reflected in parentheses. * Includes p-value <0.1, ** includes p-value<0.05 and *** includes p-value<0.01.

Table A3

Parallel Trend Assumption (PTA) test

	Actual labor hours in the pre-intervention years	
	(A) West-Germany	(B) East-Germany
2013	0.13	-0.02
	(0.29)	(0.20)
2014	-0.52*	-0.20
	(0.27)	(0.21)
Constant	30.07***	35.40***
	(0.20)	(0.14)
Observations	14,192	4,587

Note: Years fixed effects regressions the leads on the actual labor hours worked in the time before the intervention to test for the PTA. In panel A, West-Germany, in panel B, East-Germany. The standard error is being reflected in parentheses. * Includes p-value <0.1, ** includes p-value<0.05 and *** includes p-value<0.01.