The German 'Rosie the Riveter': The Long-Term Effects of Postwar Reconstruction on Female Employment and Family Formation

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During World War II, more than one-half million tons of bombs were dropped in aerial raids on German cities, destroying about forty percent of the total housing stock nationwide.[1] Germany also lost a substantial fraction of its male population during the war combat, which left the postwar reconstruction in the hand of women (Meiners 2011). In 1946, the Allied Control Council launched Command Nr. 3 in postwar Germany to enforce the participation in the rubble removal and reconstruction efforts, especially among women. This mandatory employment law remained in place until 1955 and required all individuals capable of work to register with labor offices for work allocation (Allied Control Authority Germany 1946). In the case of non-registration, the penalty was to lose their right to receive food ration cards. With the passage of the mandatory employment law, therefore, so called "*rubble women*" (in German *Truemmerfrauen*) entered into the labor force and started to work in professions such as construction and manufacturing which were previously closed to them.[2] These *"rubble women"* were similar to the 'Rosie the Riveter' in the U.S., who was the symbol of the employment of American women during WWII, albeit in the German case, the mobilization of women occurred in the postwar reconstruction period.

The historical debate on the impacts of postwar mandatory employment on emancipation of German women is divided. On the one hand, several historians argue that the immediate postwar

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[1] For detailed information on the bombing campaign of AAF during WWII, see Akbulut-Yuksel (2009).
[2] Akbulut-Yuksel, Khamis and Yuksel (2011) provide detailed information on the postwar mandatory employment law in Germany.

period can be seen as "Hour Zero" of the German women's emancipation movement. They find a sustained increased in female labor supply and in the divorce rates (Hoehn 1997). On the other hand, a second strand of historians asserts that the rubble women returned back to their kitchens and became housewives again (Meiners 2011) similar to the 'Rosie the Riveter' in the U.S. (Goldin 1991). Given the substantial underrepresentation of German women in the top rank of management and in the labor market in general, the debate on the effectiveness of the postwar mandatory employment on liberation of German women still keeps its place at the center of public policy and requires scrutiny.

This paper estimates the causal effects of postwar mandatory employment on women's long-term economic and social outcomes in Germany. Our identification strategy exploits the plausibly exogenous city-by-cohort variation in wartime destruction experienced in German cities during WWII which mainly determined the mobilization of the rubble women during the reconstruction period. In cities with higher wartime destruction, rubble women were required to work for a longer time period and more intensively in the rubble removal and reconstruction relative to women residing in less destructed cities. However, only women who were within the mandatory working age (i.e. 15-50 years of age) during the reconstruction period had their long-term employment and marriage outcomes affected by the postwar mandatory employment law. Therefore, we use a difference-in-differences-type strategy in our analysis where the "treatment" variable is an interaction between city-level wartime destruction and a dummy variable for being of working-age during the reconstruction period.

Our paper is closely related to Acemoglu, Author and Lyle (2004) and Goldin (1991) who analyze the short term effects of WWII mobilization on American women's labor supply in 1950, which is also commonly known as the 'Rosie the Riveter' phenomenon in the U.S.. These studies

focus on the short-term effects of WWII mobilization on women's employment and wages; however long-term effects of postwar employment may be quite different than short-term mobilization effects.

This study also contributes to a growing literature on gender impacts of armed conflicts. This strand of literature finds an increase in the employment and self-employment of women during and just after armed conflicts in the developing countries (Shemyakina 2011; Menon and van der Meulen Rodgers 2011). In contrast to these studies, however, in our study, we quantify the long-term effects of postwar mandatory employment on women's labor market and marriage outcomes. Moreover, our analysis combines a detailed novel dataset on the extent of WWII destruction for each German Regional Policy Region (hereafter, "ROR" or "city")[3] with individual-level data from the 1978 German Microcensus which enables us to match the treatment to each individual more accurately and form more plausible control groups. In addition, the availability of postwar city-level data enables us to rigorously investigate potential channels and confounding factors.

We find that rubble women in highly destroyed cities are less likely to work in the future while they have a higher propensity to be married and marry at younger ages. These results survive after we account for the potential changes in the composition of the population, household income and demand for female labor and state-specific policies in postwar Germany.

I. Identification Strategy

Our identification strategy for the causal effects of postwar mandatory employment on the long-term outcomes of German women is a difference-in-differences-type strategy where the "treatment" variable is an interaction between city-level intensity of wartime destruction and a

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[3] The analysis is restricted to former West Germany. Former West Germany was comprised of 38 German Regional Policy Region in 1978, which are similar to MSAs in the U.S..

dummy for being of working-age during the implementation of mandatory employment law. In particular, the proposed estimate of the average treatment effect is given by β in the following baseline city and birth year fixed effects equation:

$$Y_{irt} = \alpha + \beta\,(Destruction_r \times RubbleWomen_{it}) + \delta_r + \gamma_t + \pi'\mathbf{X}_{irt} + \varepsilon_{irt} \qquad (1)$$

where Y_{irt} is the outcome of interest for female i, in city r, born in year t. $Destruction_r$ is the measure of war damage in the city r, which determined the mobilization of the women in the city during the reconstruction. $RubbleWomen_{it}$ is a dummy variable that takes a value of 1 if female i was born between 1920 and 1934 and zero otherwise. δ_r is city-specific fixed effects and γ_t is the birth year fixed effects. $\mathbf{X}_{irt}$ is a vector of individual and household characteristics including a rural dummy, own and spousal education. The standard errors are clustered by the city.

Women born between 1920 and 1934 form the treatment group since they were 21 and older when the mandatory labor law was abolished in 1955; therefore their economic and social outcomes have the potential to be affected by postwar mandatory employment. Moreover, hence these women were between 44 and 58 years of age in 1978, they were likely still active in the labor market at the time of the survey. On the other hand, employment and marriage outcomes of women who entered the labor market after the reconstruction period was completed in the late 1950s would not have been impacted by the mandatory employment law; therefore, women born between 1940 and 1954 are in the control group.

In order to interpret β as the effect of working in the postwar reconstruction, we must assume that had WWII destruction not occurred, the difference in employment and marriage outcomes between the affected cohorts and later birth cohorts would have been the same across cities with varying intensity of the postwar reconstruction. We formally test this identifying assumption in the estimation results section.

II. Data and Descriptive Statistics

As a measure of war destruction, we use residential rubble in m^3 per capita accumulated in German cities by the end of WWII which was reported in a survey undertaken by the German Association of Cities (Kaestner 1949). Moreover, we gathered unique data on city characteristics including prewar average income per capita, city area and population density and postwar female/male ratio, female employment share and per capita war relief payments to assess the potential channels and confounding factors.[4]

The data on individual and household characteristics is from the confidential version of the German Microcensus, which includes 1% of the resident population in former West Germany. We use data from the 1978 Microcensus, which is the first wave that reports respondents' educational attainment, city of residence and whether they were born within the borders of former West Germany and were residing there in 1939. The entire estimation sample consists of women born between 1920 and 1954. We find that about 50 percent of the entire sample is working in 1978 while 80.6 percent is currently married. These women enter into their first marriage at the age of 23.4 on average and had 10.5 years of schooling. Moreover, we find that German cities had 12.9 rubble in m^3 per capita by the end of WWII on average and there were 123 women for every 100 men in 1946.

III. Estimation Results

Table 1 reports the results of estimating Equation (1). Each column is from a separate regression that controls for city and birth year fixed effects along with own and spousal years of schooling. The first row reports the difference-in-differences estimate, β, which shows the effects of mandatory employment law on women's long-term outcomes. The dependent variable in

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[4] For more information on historical data and their sources, see Akbulut-Yuksel, Khamis and Yuksel (2011).

Columns (1) and (2) is female labor force participation.[5] Column (1) reports the negative and significant difference-in-difference estimate of -0.0019, which suggests that rubble women residing in a city with average destruction are 2.5 percentage points less likely to be employed in the future.[6] Hence, women who lived in a heavily destroyed city such as Cologne during WWII, with 25.25 m^3 rubble per capita, were 4 percentage points less likely to work in the long run compared to women who were living in Munich, a less destroyed city with 6.50 m^3 rubble per capita.

Table 1. Effect of Postwar Reconstruction on Female Long-term Outcomes

	Employment		Currently Married		Age at Marriage	
	(1)	(2)	(3)	(4)	(5)	(6)
Rubble per Capita Born 1920-1934	-0.0019***	-0.0027**	0.0013***	0.0012**	-0.0130**	-0.0160**
	(0.0006)	(0.0011)	(0.0005)	(0.0006)	(0.0059)	(0.0074)
Years of Schooling	0.0574***	0.0573***	-0.0552***	-0.0551***	0.1238***	0.288***
	(0.0013)	(0.0013)	(0.0013)	(0.0013)	(0.0120)	(0.0128)
Years of Schooling of Household Head	-0.0301***	-0.0302***	0.0477***	0.0477***	0.2888***	0.1250***
	(0.0011)	(0.0012)	(0.0010)	(0.0010)	(0.0127)	(0.0120)
Female/Male Ratio × Born 1920-1934		-0.0039***		-0.0010		-0.0008
		(0.0013)		(0.0008)		(0.0109)
Female Employment Share × Born 1920-1934		-0.0073***		0.0018		0.0219
		(0.0025)		(0.0012)		(0.0155)
Per Capita War Relief Payments × Born 1920-1934		-0.0047**		-0.0022**		-0.0194
		(0.0021)		(0.0009)		(0.0132)
Migrant Share × Born 1920-1934		0.0035		0.0001		0.0794***
		(0.0032)		(0.0010)		(0.0130)
Refugee Share × Born 1920-1934		0.0032**		-0.0006		-0.0349***
		(0.0015)		(0.0009)		(0.0128)
R^2	0.1596	0.1676	0.0951	0.0965	0.19	0.1909
N	85,976	74,843	86,103	86,103	75,939	75,939

Notes: Standard errors clustered by cities are shown in parentheses. The control group is individuals born between 1940 and 1954.
Each column is from a separate regression which also controls for city and birth year fixed effects and a rural dummy.
In addition, Columns (2), (4) and (6) control for linear state-cohort trends.
Asterisks denote significance levels: * 10 percent level, ** 5 percent level, *** 1 percent level.

In Column (2), we account for potential confounding factors such as postwar city-level female/male ratio, migrant and refugee shares, female employment share and average per capita

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[5] We coded individuals as employed if they report that their main source of income is employment.
[6] This is based on the multiplication of the coefficient estimate of β with the average rubble per capita measure (12.91 m³).

war relief payments distributed after WWII which serve as proxies for the change in the composition of the population, demand for female labor and household income in postwar era, respectively. We interact these city-level variables with being in the affected cohorts and add them as additional controls to the baseline specification. Moreover, we include the interaction of state dummies with birth year dummies in our analysis to account for the potential differences in postwar state-specific policies. After controlling for this wide range of additional covariates, the difference-in-difference estimate for the rubble in m^3 per capita remains to be economically and statistically significant. This lends credence to the interpretation of the difference-in-difference estimate as due to postwar mandatory employment as opposed to omitted variables. [7]

Figure 1: The Effect of Postwar Mandatory Employment on Female Employment by Cohort
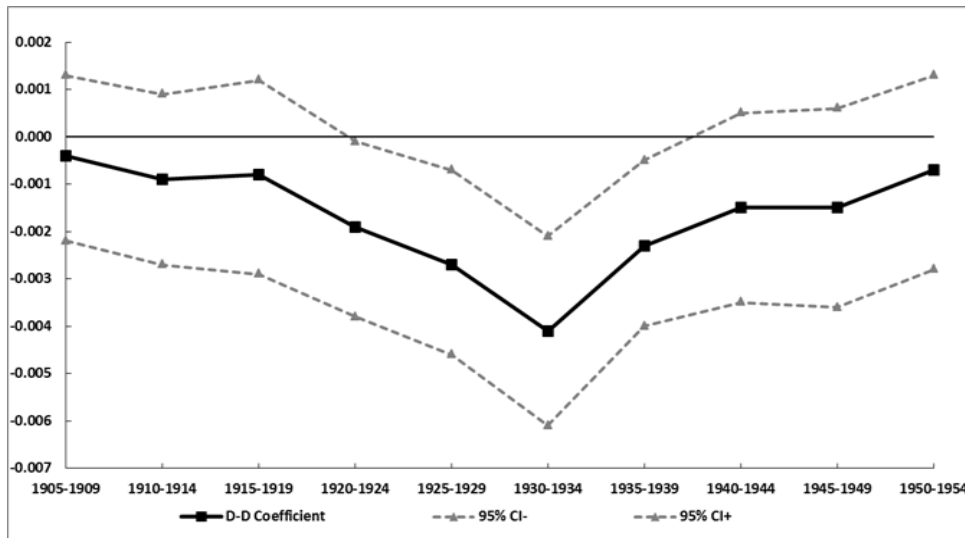
Results presented in Table 1 rest on the parallel trend assumption which suggests that in the absence of postwar reconstruction, the difference in labor force participation and the marriage outcomes between the affected group and the later birth cohorts would have been similar across

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[7] Another confounding factor might be internal migration. However, it is unlikely to be a concern in postwar Germany since Germany has historically low levels (around 0.02) of geographic mobility in comparison to the U.S. and U.K. (Hochstadt 1999). Moreover, historical accounts report that the urban population had reached 80 percent of prewar levels by June 1947, then nearly 90 percent in 1948 (Hochstadt 1999).

cities with varying intensity of the postwar reconstruction. In Figure 1, we formally test this identifying assumption using a cohort specific analysis. Figure 1 shows that working in postwar reconstruction substantially reduced the future employment probability of women born between 1920 and 1934, while it had no effect on labor force participation of earlier and later birth cohorts. This supports the parallel trend assumption and suggests that the estimation results presented in Table 1 are not confounded by the city-specific prewar and postwar cohort trends.

Now, we turn to the estimates of postwar mandatory employment on women's marital status. Columns (3) and (4) report the effect of postwar mandatory employment on the probability of being currently married, which is positive and significant. The difference-in-difference estimate in Column (3) indicates that rubble women in Cologne have almost a 3 percentage points higher probability of being married in 1978 relative to rubble women residing in Munich during WWII. Similar to the employment analysis, in Column (4), we account for the potential confounding factors for the marriage outcome. We find quantitatively and statistically similar results in Column (4) which suggests that our results are robust to inclusion of state-specific cohort trends and postwar city-level characteristics.

Finally, the outcome of interest is the age at first marriage in Columns (5) and (6). We find that postwar mandatory employment led rubble women to marry at younger ages compared to the control cohorts. This suggests that these women who were affected by the postwar mandatory employment law had a limited time to gain experience in the labor market and establish themselves in their professions before they were married and had children. As a consequence, they might have a weaker labor market attachment and a lower probability of going back to work

after child bearing years, which is indeed what we find in the employment analysis in Columns (1) and (2).[8]

IV. Discussion and Conclusion

This paper provides the first causal evidence on the consequences of postwar mandatory employment on German women's long-term economic and social outcomes. Using the 1978 German Microcensus, we find that mandatory employment in reconstruction reduced rubble women's labor force participation in the long run. We also find that these rubble women were more likely to be married and marry at younger ages in the future. Our results therefore indicate that many of rubble women went back to work at home and marry, similar to the working experience of the "Rosie the Riveter" in the U.S. Therefore, these results suggest that the positive effects of the mandatory employment on emancipation of German women were short-lived and underline the importance of persistent training and employment policies to attain permanent gains on female labor force participation in the long run.

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[8] Moreover, we estimate the effects of mandatory employment law on rubble women's fertility. However, these analyses warrant caution since the Microcensus only provides information on the number of children still residing within the same household as their mothers. Hence, children of the rubble women may have already moved out as the rubble women were married earlier and probably had children at younger ages; it is likely that we focus on a selective group in our fertility analysis, which renders statistical inference difficult.

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