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Unequal Unification?
Income Inequality and Unification in 19th Century Italy and Germany

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Abstract

This research provides a comprehensive study of the linkages between unification and related policy choices on income inequality by examining the cases of Italy and Germany in the context of 19th century unification. To conduct this analysis, the study puts forward estimates of income inequality for pre-unification German states using social tables, compiled using primary data, some of which have thus far been unexplored in economic research. The findings suggest that differences in inequality between regions were more pronounced in Italy than in Germany. In seeking explanations for these trends, the study explores linkages between institutional structures, governance frameworks and inequality, connecting the research on federalism with the literature on inequality extraction.

Keywords: Income inequality, unification, federalism, Germany, Italy

JEL codes: N13, N43, E62, H50

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*"When an entire people, such as the Italian, clearly recognizes what it lacks and what it needs to finalize its organization as a nation, then it has taken a first step to reach its goals. I would be delighted if we in Germany were already as advanced in having a clear and precise understanding of what we need and what we will need in the future", Representative Schulze, 1862.*¹

*"I think that my patriotism (...) does not prevent me from admitting that we can in some aspects take a fruitful example of Italy (..) which in more than one aspect has taken some steps ahead of us in the past decades", Assemblyman von Sybel, 1862.*²

*"Another takeaway from The Honorable Lucca, which reflects the entire tenor of his statement, is the following: In Italy we are doing badly, in Germany it is going very well!", Representative Ferraris, 1886.*³

*"As I am always rebuked for citing Germany, as if it were a delict to study and emulate good examples (..)", Representative Lucca, 1886.*⁴

*"Let me also cite (..) the example of Germany. (..)The Statistisches Jahrbuch of the imperial German [statistical] office is accompanied by splendid publications of the statistical offices of the individual States of the Empire and gathers the fruits of this splendid statistical labor", Representative Ferraris, 1886.*⁵

¹From the proceeds of the Prussian House of Representatives: *Stenographische Berichte ueber die Verhandlungen des Preussischen Hauses der Abgeordneten*, 14th session of 25 June 1862.

²ibid. 9th session of 5 June 1862.

³From the proceeds of the Italian House of Representatives: *Atti Parlamentari - Camera dei Deputati*, 16th legislature, Session 1a of 26 November 1886

⁴ibid, Session 1a of 27 November 1886

⁵ibid, Session 1a of 26 November 1886

1 Introduction

As noted by Ziblatt (2004), *"a comparison of nineteenth century Germany and Italy offers a promising opportunity for theory development"* (P. 71). Yet, despite the shared experiences and the mutual awareness of the unification experience highlighted in the above quotes from Germany and Italy, the two cases have seldom been studied in tandem.⁶ This research will analyze possible changes in the distribution of income in Italy and Germany in response to unification and related policy actions in 1861 and 1871, respectively. Specifically, this research will seek to analyze how the unification process and ensuing policy choices may have lead to changes in income inequality as well as inequality extraction from the "core", i.e. Piedmont and Prussia, versus the "periphery", i.e. Southern Italy and South and South-West Germany.

As is the case for a majority of studies of inequality in a historical setting, there is very limited and sometimes no available data to accurately study changes in the distribution of income over time. While some data is available for pre- and post-unification Italy, there is a significant data gap for German states in the mid-19th century prior to unification. This study will seek to close this gap by compiling data for pre-unification Germany on the basis of social tables for Bavaria and Prussia, thereby contributing to the comparative literature on historical global inequality and particularly on inequality extraction ratios, as advanced in the work of Milanovic (2009).

Despite its historical background, this study is geared to be relevant for the inequality literature and for public policy beyond the immediate unification experience of Germany and Italy. By examining effects of changes in inequality extraction among regions and its impact on inequality at the national level, this study can also be relevant for policy makers and scholars with an interest in drivers of inequality and regional economic policy.

⁶With the notable exception of the work of Ziblatt (2004), which studies the respective experiences with regards to a federal versus unitary state system.

2 Unsteady states: The political economy of 19th century unification

Italy and Germany before unification consisted of a fragmented map of states, which was drawn in the late 18th and early 19th century, most notably as a result of the Vienna Peace Congress of 1815 (Ziblatt, 2004). Despite political fragmentation, the states were economically intertwined, especially in Germany, where the custom union, the so-called *Zollverein*, fostered economic integration.

There is an ongoing scholarly debate on the origins of the North-South divide in Italy and whether it predates the unification of Italy. While the traditional view has traced the origins of the divide to before unification and as far back as to medieval times, a more recent strand of research has argued that the North and South were largely on par in the mid-19th century (see Federico, 2007 as well as Ciccarelli and Fenoaltea, 2013). Indeed as Oliviera and Guerriero (2018) argue, the *"present-day divide is also due to the region-specific policies selected between 1861 and 1911 by the elite of the Kingdom of Sardinia, which unified Italy in 1861"*.

As noted at the outset, there are several important parallels between the Italian and German national experiment. One of them is an initial endorsement of federalism. As noted by Ziblatt (2004), Cavour, considered a lead architect of a unified Italy, was highly committed to the idea of a federalist state with a strong role for local governance (Ziblatt, 2004). Yet, despite the initial commitment to federalism, the push for unification from the core states led to conflict with peripheral states, and ultimately to unitary governance structures.

As noted by Ziblatt (2004) and others, the rise of Prussia led to violent resistance by Southern German states in the Austro-Prussian war of 1866, in which Bavaria fought alongside Austria against Prussia. The process of

Italian unification is also marked by violence in rural areas of the South, commonly referred to as *brigantaggio*. Cayli (2017) notes the origins of the brigantaggio as rooted in the discontent over a lack of social justice in the governance of rural areas and limited progress on social and agricultural reforms in the South. Cayli (2017) also argues that the unrest was tackled through a suppressive authority-centered state intervention.

The Austro-Prussian war of 1866 also provides an interesting insight into the interplay between domestic and foreign policy. As argued by Wawro (1995) there is evidence that, above all, the Austro-Prussian war was motivated by a desire of Prussian elites to galvanize public opinion behind a war effort. Wehler (1973) argues that Bismarck's overarching objective in unifying Germany was to perpetuate the privileged position of Prussian elites against the rising tide of the urban bourgeoisie. The war of 1866 also provides another interesting parallel to the Italian unification experience, as the Italian unification experience also critically depended on conflict with the Habsburg empire and on rallying national sentiment behind a war against Austria, albeit in the early days of the unified Italy. As Wawro (1995) notes, pushing back left-leaning political forces and galvanizing the populace was one of the driving forces behind the decision of Vittoria Emmanuelle II to declare war on Austria in 1866.

The war effort did not only fulfill domestic political objectives, but also played an important role in building capacity for the fiscal state (see e.g. Mares and Queralt, 2015), highlighting the important linkages between unification and the rise of the fiscal state. Indeed, fiscal expansion acted as driving factor for the national experiment of unification. As Ziblatt (2004) argues, unification was advanced due to the desire of Prussian and Piedmontese governing elites to "*expand territorial control with the aim of securing greater fiscal resources, more manpower, and more territory - all the hallmarks of "great power" status*" (Ziblatt, 2004, P. 73).

Italy and Germany in the 1860s and 1870s were also similar in terms of the stage of development, being both late-comers to industrialization, particularly Italy. In addition to the many similarities, the unification of Italy and Germany is also well placed to act as a natural experiment of the effects of policy and institutional change on inequality, as it represented a drastic change in institutional and policy frameworks, while keeping other variables, such as structural economic, demographic and external factors constant over the short-term. Indeed, other paradigm shifts such as the sharp acceleration in industrialization as well as the rise of socialist parties, which may have tempered rises in inequality, only fully materialized more than a decade after unification in Germany, specifically in the mid to late 1890s (see Bartels et al., 2021)⁷.

3 Theoretical framework

The preceding analysis of historical similarities of the national experiments in Italy and Germany can provide useful pointers to the study of unification as natural experiment and its impacts on inequality. As mentioned, one of the parallels in the unification experience was the aim to secure greater fiscal resources. The consequent fiscal policy of the new state is likely to have had a marked impact on the distribution of income in the two newly-formed nations. This section will explore this and other avenues through which unification and its aftermath may have altered the distribution of income within the two nations as well as between core and peripheral regions.

3.1 Regional integration

One field of literature that emphasizes the positive effects of unification and greater economic and political integration, particularly in the context of the

⁷For instance, as argued by Bartels et al. (2021) vote shares of the SPD, the socialist party, were less than 10% in the 1870s and 1880s.

European Union, is the scholarship on economic integration. There is a rich body of work on regional convergence, including in the context of the European Union (see for instance Dunford, 1994 or Busemeyer and Tober, 2015). This literature suggests that due to greater economic and political integration, which may facilitate free trade and factor mobility, less-developed areas should grow faster than more-developed ones, as the latter would face declining returns to capital investment, which would unlock capital flows to less-developed regions.

Moreover, unification would favor the diffusion of technology across regions, raising the technology levels of the less-developed areas. Overall, political integration should thus bring economic convergence between regions. There is little evidence that this was the case in either Italy or Germany. The rich body of literature on the North-South divide in Italy documents the opposite, i.e. a lack of convergence between the regions of the North and the South of Italy following unification.

As mentioned in the preceding section, there has been an interesting shift in the scholarship on the North-South divide over the past years. While earlier studies pointed to pre-unification roots of the divide, recent scholarship on wages (Daniele and Malanima, 2017) point to a divergence in the latter part of the 19th century, arguing that conditions in the early days of the Italian Kingdom were largely homogenous across regions and that a divergence between the regions only gained steam in unified Italy. In Germany, regional integration was largely incomplete before WWI, as Germany continued to be characterized by a fragmentation of trade and resource endowments (see Wolf, 2009). The literature on regional integration is thus not well placed to provide insights into changes in the distribution of income in response to unification.

3.2 Unification and federalism

Another starting point is the literature on federalism (see for instance Riker, 1964 and Ziblatt, 2004). Studies on federalism, such as the two aforementioned, commonly see unification and state building as driven by a desire to increase public goods, such as a national trading system and security as well as fiscal expansion. State-building may either lead to a federal state, i.e. a state in which regions retain a certain degree of autonomy, or a unitary state with strongly concentrated political control. Yet, there has been a recent paradigm shift in the study of federalism and its origins. According to earlier work by Riker (1964) and others, a militarily stronger state is expected to annex smaller states to increase market size and territorial and population size. The stronger state may chose to seek a unitary state by force or the threat of force, if their military power is sufficiently superior. Instead, if the state is not sufficiently powerful or may have ideological qualms, it may be more inclined to give concessions and thus agree to a more federal system.

As one of very few studies that analyze the experiences of Italy and Germany jointly, Ziblatt (2004) argues that the unification of the two states does not follow this line of reasoning. Despite the fact that Prussia accounted for 57% of the population and 54% of its public spending and territorial size, the unified German nation followed a federal model. Piedmont on the other hand, had only 6% of the population, 29% of its military and 22% of the territory of the unified Italian state. Nonetheless, Italy adopted a unitary model (Ziblatt, 2004).

To explain the cases of Italy and Germany, Ziblatt (2004) proposes an infrastructural model of federalism that moves beyond military power, arguing that states are formed and/or unified on the basis of the interplay between coercion and compromise. Ziblatt states that federalism is possible if existing states are "highly institutionalized", as only states with a high degree of institutional capacity are able to deliver on the promises of state building,

i.e. greater national security and an efficient fiscal state. Ziblatt (2004) argues that German regions had higher levels of institutional capacity, which enabled a federal model, as desired by German elites. Italian regions, on the other hand, were not endowed with institutions that would allow for a federal approach, despite the desire of the pioneers of the *Risorgimento* to pursue such a model. In referring to the "*sporadic rule*" (P. 84) of the Kingdom of the Two Sicilies over its territories, Ziblatt (2004) cites a number of factors that contributed to this lack of institutional capacity, including a lack of efficient taxation. Indeed, according to Ziblatt (2004), the extractive capacity in terms of a state's fiscal revenue per capita between 1850-1860 was over 32 lire in Piedmont, while only between 14 and 15 lire in the Two Sicilies and the Papal States.

Whether a state is unitary or federal matters for the study of inequality in so far as it changes the concentration of power. In a unitary state model, power is highly concentrated, while in a federal model power and thus policy decision making is more fragmented.

3.3 Unification and extractive institutions

The afore-mentioned reference to extractive capacity and concentration of powers opens up additional pathways for inquiry into the effects of unification on inequality. If indeed the choice of federal or unitary state matters in terms of the concentration of power and institutional capacity for extractive taxation, then such a policy choice and the structure of existing and newly established institutional frameworks may also impact the distribution of income in a newly unified state.

There is a rich body of literature on extractive institutions (see for instance Engerman and Sokoloff, 2000). Engerman and Sokoloff, in analyzing the institutions of Latin America in the 16th to 18th centuries (2000), argue that the stability of an entrenched elite can have disproportionate political

influence and shape institutions. Such institutions *"protected the privileges of the elites and restricted opportunities for the broad mass of the population"* (P. 221). In high inequality settings, elites can set institutional and legal frameworks that give them outsized power to shape laws and policies that further entrench and perpetuate inequality.

A small number of studies analyze extractive institutions in the context of unification of Germany as well as Italy, for instance the work of Oliveira and Guerriero (2018) for Italy and Mares and Queralt (2015) for the case of income taxation in Prussia. Oliveira and Guerriero (2018) propose a theoretical framework to analyze the extractive power and effects of extractive policies on the origins of the present-day North South divide in Italy. With regards to the effects on industrialization in Italy, they find no tangible impact of extraction on industrialization and more broadly economic development, arguing thus that extraction *"cannot be considered the acceptable price for the Italian development (pp.158)."*

3.4 Inequality extraction

To link considerations of extractive institutions to inequality, inequality extraction ratios (IERs) are ideally placed to facilitate the analysis, combining both concepts, inequality and extractive power of elites, within one indicator that is based on the Gini coefficient. As noted by Milanovic (2013), IERs allow for an analysis of extractive/inequality-generating institutions, which is exactly the type of institutions one would expect to find in a post-unification context, characterized by newly concentrated power within a regional elite. As Milanovic (2013) notes, *"the inequality extraction ratio, by capturing how close to the frontier is actual inequality, conveys the information about the relative 'rapaciousness' of the elite"* (pp. 17).

Inequality extraction ratios build on the Inequality Possibility Frontier (IPF) (Milanovic et al., 2010). The IPF is based on the notion that 1 is not

necessarily a feasible maximum Gini, as a realistic lower bound for income in a society is a subsistence minimum, which ensures survival of the poorest share of the population. On the basis of the subsistence minimum, the maximum feasible Gini coefficient can be calculated, assuming that all people live at the subsistence level, except for one individual who controls all remaining resources.

In such a model as elaborated by Milanovic et al. (2010), the IPF can be derived as follows:

$$y_h = \frac{\mu N - sN(1 - \varepsilon)}{\varepsilon N} = \frac{1}{\varepsilon}[\mu - s(1 - \varepsilon)] \quad (1)$$

where y_h denotes the mean income of people in the upper class, s the subsistence minimum, μ overall mean income, N the total number of people and, lastly, ε the share of people belonging to the upper class.

Once this is established for the respective classes within a society, the Gini coefficient can then be defined as:

$$G = \sum_{i=1}^n G_i p_i \pi_i + \frac{1}{\mu} \sum_i^n \sum_{j>i}^n (y_j - y_i) p_i p_j \quad (2)$$

with social classes' mean incomes ordered, as is customary, in an ascending order, with π_i denoting the proportion of income that is made by a given social class, and p_i the share of this respective social class in the population. This formulation assumes that there is no overlap between social classes, i.e. that social classes are well defined.

As noted by Milanovic et al. (2010), for a case with two distinct social classes, a lower and an upper class, this can be simplified to:

$$G = \frac{1}{\mu} \sum_i^n \sum_{j>i}^n (y_j - y_i) p_i p_j \quad (3)$$

On the basis of this simplification, the income of the upper class and the respective population shares can be substituted to derive G^* , the maximum feasible Gini:

$$G^*(\mu) = \frac{1}{\mu} \left\{ \frac{1}{\varepsilon} [\mu - s(1 - \varepsilon)] - s \right\} \varepsilon (1 - \varepsilon) \quad (4)$$

In line with Milanovic et al. (2010), the subsistence minimum can be rewritten as $\mu = \alpha s$, where α denotes the mean income in terms of subsistence. The maximum feasible Gini can thus be written as:

$$G^*(\mu) = \frac{1 - \varepsilon}{\alpha s} s(\alpha - 1) = \frac{\alpha - 1}{\alpha} (1 - \varepsilon) \quad (5)$$

The last step is to analyze the effect of the elite tending towards zero, as mentioned above. If indeed there is only one individual that extracts all income, except for the level of subsistence minimum that ensures survival of the population, then G^* can simply be expressed as:

$$G^*(\mu) = \frac{\alpha - 1}{\alpha} \quad (6)$$

On the basis of this maximum feasible Gini coefficient, the inequality extraction ratio can be calculated as the actual observed Gini divided by the maximum feasible Gini. As noted by Milanovic et al. (2010), this inequality extraction ratio can be a useful tool to measure the extractive power of elites in a largely pre-industrial context. In the context of this study, changes in pre-unification to post-unification inequality extraction ratios can shed light on the impact of unification on inequality and inequality extraction.

3.5 The missing link: From higher extraction to higher overall inequality in the unification context

The above three subsections have outlined the driving factors for unification and identified greater taxation and thus, by extension, extraction from peripheral regions as key explanatory factor, thereby outlining a possible transmission channel for increased inequality. But how does this transition mechanism work? How do we get from higher taxation and extraction to higher overall inequality? This is the very question this subsection will seek to address.

As mentioned in the preceding subsections in line with the work of Ziblatt (2004) and others, unification can be driven by a desire to broaden the tax base and tax previously un- or under-taxed regions. So what happens if a higher-taxed state entity is unified with a lower-taxed entity?

The question can be answered through a simple schematic model of two independent states. For the purpose of this study, these two states will be referred to as Corelandia and Peripheria. In both states, we have a simple society, with three social groups, which have low, medium and high incomes, respectively. The below table depicts a numerical example for the status quo before unification.

Table 1: A simple model of unification and inequality: Pre-unification

Corelandia			Peripheria		
	Income	Share		Income	Share
Group 1 _C	100	0.6	Group 1 _P	120	0.603
Group 2 _C	400	0.3	Group 2 _P	400	0.3
Group 3 _C	800	0.1	Group 3 _P	700	0.097
Per capita Income	260			260	
Gini	0.4154			0.3584	

There are a number of assumptions that are underlying the above table. First, it is assumed that Peripheria has a slightly more equal distribution of income, which is reflected in a lower Gini coefficient of 0.3584, compared to a Gini coefficient of 0.4154 for Corelandia. This is one of the core assumptions of the model that will need to be analyzed for the specific cases of Germany and Italy. The second assumption is that per capita income in the two states is the same. The third assumption is that the two states have a distribution of incomes that is characterized by a declining share of the population for higher incomes. In other words, the social class with low income is larger than the social class with medium incomes, which in turn is larger than the social class with high incomes.

Based on the preceding analysis of inequality extraction ratios, it is also evident from this table that Corelandia has a higher inequality extraction ratio than Peripheria, given that the former has a higher Gini and both have the same level of per capita income. For instance, if the subsistence minimum is 100 units, then the inequality extraction ratio in Corelandia would be 67.5% in Corelandia and 58.2% in Peripheria. The inequality extraction ratio is higher for Corelandia than Peripheria for all levels of the subsistence minimum between 0 and mean income.

The next step of the model is to unify Corelandia and Peripheria into the combined state of Unificadia. To study the effect of an unequal unification that extracts from the peripheral states, there is a need to look at two different scenarios. First, a unified state, in which the periphery is not taxed. The effect of unification can be seen in the below table. To calculate the population shares, it is assumed that the two states have populations of the same size.

The above table shows a number of interesting results. First, as could have been expected, the Gini coefficient for Unificadia is lower than the Gini of Corelandia and higher than in Peripheria. It is important to note,

Table 2: A simple model: Unification without extraction

Unificadia		
	Income	Share
Group 1 _C	100	0.3
Group 1 _P	120	0.302
Group 2 _C and 2 _P	400	0.3
Group 3 _C	700	0.048
Group 3 _P	800	0.05
Per capita Income	260	
Gini	0.3948	

however, that it is not a weighted average of the two. In this case the Gini of Unificadia is 0.395, which is higher than a hypothetical weighted average of the Gini coefficients of pre-unification Corelandia and Peripheria, which would be 0.387. The finding that the combined Gini is not a weighted average carries relevance for studies that seek to calculate the Gini of a larger unit by calculating the weighted average of the contained smaller units. This latter approach would lead to inaccuracies in the estimation of the overall Gini.

The above scenario shows the impact of unification on inequality in the absence of greater extraction from Peripheria. What would the model predict in a setting where there is greater extraction from the periphery? The below table provides some evidence. The assumption underlying this table is that a 10% tax is levied on incomes in Peripheria, following unification. This could either be through an outright increase in taxes (including through a mere harmonization of taxation across the Kingdom, assuming the tax burden was lower before unification) or be levied through other equivalent channels, such as through an unfavorable monetary union, which devalues incomes in the periphery. In the context of the simple model, it is assumed that the receipts of the tax are redistributed to the respective social group

in Corelandia. This redistribution may happen through a number of indirect channels, for instance if the proceeds of the taxation benefit the core rather than the periphery, such as through industrial development and infrastructure investment in the core. The assumption that a redistribution may benefit the respective equivalent social group in Corelandia is a conservative assumption, as in the context of early industrialization it may well be the case that high-income groups benefit disproportionately from the public investment that is financed through greater public spending.

Table 3: A simple model: Unification with extraction (10% tax on Peripheria)

Unificadia		
	Income	Share
Group 1 _P	108	0.302
Group 1 _C	112.069	0.3
Group 2 _P	360	0.15
Group 2 _C	440	0.15
Group 3 _C	630	0.048
Group 3 _P	867.585	0.05
Per capita Income	260	
Gini	0.4134	

As table 3 shows, the Gini coefficient for Unificadia as a whole increases when a tax is levied on the social groups of Peripheria and redistributed to the comparable group in Corelandia. This is a relevant result, as it shows that inequality rises even when redistribution is "class-neutral", i.e. benefits an equivalent social class. Under a regressive tax system or under a scenario in which the high-income class receives a larger than proportionate share of the redistribution, the increase in inequality would be even larger. Once again, the relative higher Gini in the extraction compared to the non-extraction scenario is also reflected in a higher inequality extraction ratio.

Table 4: Impact of unification on inequality

Pre-unified states	Unified state
<i>Without redistribution</i>	
(1) If $G_1 < G_2$	then $G_1 < G_U^* < G_2$
(2) If $G_2 < G_1$	then $G_2 < G_U^* < G_1$
<i>With regressive or "class-neutral" redistribution to State₁</i>	
(3) If $G_1 < G_2$	G_U
(4) If $G_2 < G_1$	then $G_U > G_U^*$
<i>With regressive or "class-neutral" redistribution to State₂</i>	
(5) If $G_1 < G_2$	then $G_U > G_U^*$
(6) If $G_2 < G_1$	G_U
<i>With progressive redistribution to State₁</i>	
(7) If $G_1 < G_2$	G_U
(8) If $G_2 < G_1$	G_U
<i>With progressive redistribution to State₂</i>	
(9) If $G_1 < G_2$	G_U
(10) If $G_2 < G_1$	G_U

Assuming that the subsistence minimum is 100 units, the inequality extraction ratios for the extraction versus the non-extraction scenario are 64.1% and 67.2%, respectively. In other words, in the scenario in which 10% of income is extracted from the periphery, the inequality extraction ratio will rise for the newly unified state as a whole, assuming that inequality in the periphery was lower than in the core before unification.

The model can be generalized beyond this case in which a lower inequality and higher inequality entity are unified. Table 4 above shows the dynamics for different scenarios. As the table indicates, under most scenarios, the Gini coefficient, G_U , will depend on the income distribution and the size of redistribution, not allowing for an *a-priori* analysis of the impact of unification on the Gini coefficient. Under scenarios (4) and (5), however, such an analysis is possible, suggesting that the Gini, G_U , will be higher than the Gini under the non-redistribution scenario, G_U^* . As in the previous example, entities are assumed to have the same level of mean income. The succeeding analysis

will seek to show whether the above model can provide further insights into the unification experience of Italy and Germany. If indeed we are to observe scenario (4) or (5) in either Italy or Germany, the above analysis can help shed light on the dynamics of the Gini in response to unification.

4 Data

To study the hypothesis that inequality increased in response to unification, data is needed for both the pre- and post-unification period in both Italy and Germany. In gathering this data, this study faces two main challenges. First, historical data and in particular pre-20th century data on inequality is scarcely available and the researcher needs to rely on sources other than surveys, which are an important source of inequality data, but are largely unavailable for historical periods. Secondly, the study of impacts of unification raises an additional challenge. Consistent data is only available for the post-unification period, when both Italy and eventually Germany commenced to gather data at the national level. For the pre-unification period, the scholar needs to rely on regional and sub-regional data. As the peripheral regions ceased to exist as independent entities, there is also a greater probability that historical statistical documentation may have been lost.

4.1 Italy

For Italy, a number of existing sources of data are available. For pre-unification Italian regional data, specifically Gini coefficients and inequality extraction ratios, the study by Alfani and Ryckbosch (2016) provides data on Tuscany and Piedmont from 1500-1800, including inequality extraction ratios. The study by Malanima (2016) provides a unique insight on the distribution of income in a Southern Italian city, namely Naples. Malanima's study uses a so-called social table, which will be discussed below in greater detail, to produce a comprehensive overview of incomes across Neapolitan so-

cial and professional classes in 1811. The recent study by Malanima (2020) aggregates inequality extraction ratios for per-unification Italy.

The work by Amendola and Vecchi (2007) provide inequality data for post-unification Italy. Despite the availability of pre- and post-unification data, there has thus far not been an attempt to put the data together to study inequality in the context of Italian unification.

4.2 Germany

While data for Italy is available, albeit scarcely, German data is even harder to come by. The only comprehensive overview of income inequality in post-unification Germany that considers the late 19th century is the study by Bartels (2019), which studies top incomes for Germany from 1871 to 2014, using German tax data to estimate top incomes in unified Germany. A small number of studies has also considered inequality in land ownership (see Cinnirella and Hornung, 2016 and Ziblatt, 2008). Yet, as Bartels et al. (2021) find, there is no positive correlation between the data on inequality in land ownership and income inequality data, which makes the former less useful for the scope of this study.

Inequality data for the pre-unification period is available for a small number of German cities (see Alfani et al., 2020), but thus far not at the regional level. This study will attempt to close this data gap for Germany.

4.2.1 Pre-unification Germany

As mentioned above, while not being a singular state entity, pre-unification Germany was not an assortment of unassociated states, but was characterized by a number of independent states that were economically closely connected through the *Zollverein*, established in 1833. States included the Kingdom of Prussia, the Kingdom of Bavaria, the Kingdom of Hannover and other smaller states. To study inequality in the pre-unification setting, this study will calculate measures of inequality, particularly Gini coefficients, for the

two largest states of pre-unification Germany, the Kingdom of Prussia and the Kingdom of Bavaria.

Why chose Bavaria as comparison with Prussia? First, the Kingdom of Bavaria was the second largest pre-unification German state. But, beyond that, it also provides an ideal counterpoint to Prussia similar to the comparison between Piedmont and the Kingdom of the two Sicilies in the Italian case. Indeed, as Ziblatt (2004) points out, Bismarck considered the status of Bavaria within a unified German state similar to the status of Southern Italy within unified Italy, noting that Bavaria could provide "*the same element of weakness that Southern Italy has created for that state*" (see Ziblatt, 2004, P. 93). In addition, the Kingdom of Bavaria is also an ideal candidate for statistical exploration, as there are primary data sources available, in particular professional censuses, which enable the elaboration of a social table. The same is the case for Prussia, for which detailed professional censuses are also available.

Social tables

Social tables represent a useful instrument to study the distribution of incomes in a pre-industrial society. The work by Milanovic (2009) and Milanovic et al. (2010) explores social tables for a number of countries, including England and Wales for 1801 and 1803, to study trends in global inequality in a historical context. A number of other studies have also used social tables to study inequality, including Malanima (2006) for Naples in 1811 (see Milanovic (2010) for a survey of studies using social tables).

Social tables provide a bottom-up overview of the socio-economic structure of a society on the basis of two main elements: The mean income of a specific professional or social group as well as their share in a society. Social tables can thus be constructed on the basis of income data and a professional/social census. Both of the elements, i.e. income and share of population, can be derived for Prussia and Bavaria. This study provides so-

cial tables for both states, providing insights into the distribution of incomes by deriving Gini coefficients as well as inequality extraction ratios.

Social tables come with three caveats. First, being based on a "bottom up" approach that relies on the accuracy and coverage of the professional census data for the share of the social/professional group in the population, it may have gaps in settings where professional groups are not well defined or fail to capture incomes outside such well defined groups. Secondly, social tables rely on accurate income data for a specific group to calculate the mean income of a respective group. If the range of incomes used to calculate mean incomes is large, there would be large within-group inequality, which a social table constructed using mean incomes would mask. Third and relatedly, social tables also implicitly assume that there are well defined and largely homogenous social groups and that therefore all or most of the inequality within a society comes from the differences in income between the social groups. As Milanovic (2009) highlights, this structure of society can realistically be assumed for pre-industrial societies, where social groups are well defined and within-group differences are small.

In addition to ignoring differences in income within social groups, there is a risk that social tables underreport very low and very high incomes. The former may be the case when professional/social censuses do not adequately capture low income earners such as subsistence farmers or those without any formal income as well as due to the difficulty of measuring these informal and non-monetary sources of income. At the same time, social tables may not capture parts of the very top of the distribution. While detailed data is often available for high incomes of civil service and military leadership, it may not accurately capture high incomes from the market economy, including in commerce and trade.

Bavaria, 1847

Social tables can provide a snapshot view of a society at a particular moment in time. The Kingdom of Bavaria in 1847 was a state characterized by a large rural population and a number of urban centers, particularly the Kingdom's capital, Munich. 1847 is a date with added significance as it was the year before the political upheavals of 1848.

As mentioned above, Bavaria lends itself well to the elaboration of social tables, as there are several sources of data that can be "mined" to construct a social table that captures a large part of the Bavarian population. As stressed in the preceding section, social tables require two main inputs: income data and population shares of social/professional groups. For the Kingdom of Bavaria data sources are available for both. The latter can be derived from the professional census that was conducted in 1847, containing information on the number of individuals within each professional category, including various trades, such as tailor, mechanic, blacksmith, carpenter and mason. The number of individuals on different steps of the military hierarchy can be derived from the military handbook of the Kingdom of Bavaria, albeit only for the year 1860. However, in terms of the hierarchical structure of the military, there would have been little change, as military structures were remarkably consistent across the 19th century and even across countries (Heller, 2005). The source for the number of farmers and agricultural day laborers and domestic workers is from the study by Kocka (1990).

One key implicit choice that is made by using the professional census data, is that the analysis will be based on individuals rather than households, as the census data provides the number of individuals within each category. Accordingly, levels of subsistence and incomes must be calculated with this implicit choice in mind, i.e. must be scaled to the individual rather than a household.

The second major source for the social table, specifically for income data

is Klose and Jungmann-Stadler (2006), which provides mean incomes for the region of Northern Bavaria for 1847. For the purpose of this study, it is assumed that these incomes are representative of the Kingdom as a whole. Incomes for some of the groups, including domestic workers and soldiers, include monetary and non-monetary remuneration, i.e. board and housing. In order to ensure comparability with incomes that do not include additional remuneration, the monetary value of non-monetary incomes are added to monetary incomes. The monetary value is assumed to be subsistence level of board and housing, which was 89 Gulden for a family with three children.

As mentioned above, the implicit choice of analyzing individuals rather than households must be taken into account. Accordingly, the subsistence level for the family of three must be broken down to the individual on the basis of equivalence scales. For the purpose of this study the standard OECD approach to equivalence is used to take into account the differing needs of children as well as potential "economies of scale" within a household. The subsistence level of board and housing for an individual is thus assumed to be 27.8 Gulden per year, which is added to the annual average income of those groups whose total income was made up of monetary and non-monetary remuneration.

By combining the two variables - income and population share - the below social table can be constructed, which provides a snapshot of Bavarian society in the mid-19th century.

There is a number of observations which can be drawn from a glance at the social table. First, the coverage in terms of total population is close to 1.2 million, which is just under the total adult male population of 1.5 million. In other words, the social table covers around 80% of the total adult male population. The remaining 20% are likely to include those not or no longer in the labor force due to age or unemployment, as well as certain groups and professions not captured by the professional census, likely both in the top and

Table 5: Social table - Bavaria, 1847

	Number	%, Pop.	Inc/cap (Gulden)	Inc/cap (\$PPP)	Inc/cap (/mean)
Soldier	79,498	6.756%	55	591.2	0.48
Farm Labourer/Farmer	460,000	39.092%	70	753.0	0.61
Domestic worker/coachman	40,000	3.399%	78	839.3	0.68
Tailor/Shoe maker/Baker/ Linen weaver/Wood turner/ Barrel maker/Clothier/ Mechanic	256,703	21.815%	94	1015.1	0.82
Butcher/Glazier/Hatter Brewer/Furrier/Miller, House painter/Nailer, Plumber	29,228	2.484%	106	1141.3	0.92
Metalworker/Blacksmith/ Dyer/Wagon maker/ Pewterer	198,143	16.839%	132	1421.8	1.14
Sergeant	1,714	0.146%	136	1464.9	1.18
Tanner/Coppersmith, Silk weaver/Book binder	6,219	0.529%	145	1562.0	1.26
Carpenter/Mason/Roofer	53,538	4.550%	205	2211.2	1.78
Teacher	8,633	0.734%	275	2966.3	2.39
First Lieutenant	1,160	0.099%	460	4959.8	3.99
Trade commissar	34,090	2.897%	478	5153.9	4.15
Captain	1,155	0.098%	1048	11302.2	9.10
Clergyman	6308	0.536%	1400	15101.1	12.16
Colonel	211	0.018%	2260	24375.5	19.62
Major General	80	0.007%	5020	54146.3	43.58
Bishop	16	0.001%	8000	86292.1	69.46
Commanding General	28	0.002%	8000	86292.1	69.46
Total	1,176,724	100%	115.2	1242	1

the bottom of the income distribution. Indeed, based on the available data, there are two groups which are likely missing, namely urban day laborers (other than domestic workers and coachmen) as well as certain parts of the Kingdom's civil administration.

Prussia, 1861

Similar to the Kingdom of Bavaria, the Kingdom of Prussia also conducted professional censuses, which provide a comprehensive overview of the share of Prussian citizens employed in various industries. The social table that this study puts forward for pre-unification Prussia is based on the "Prussian Statistics" of 1861/1862 prepared by the Royal Statistical Bureau in Berlin.

The source for the second variable, mean incomes, is harder to come by at the national and regional level. Yet, there is a set of subregional data, which has not been exploited within the economic literature, which can shed light on the income levels of different professions and which this study will explore.

A treasure-trove of information: The "Statistical Representations of Counties" of Prussia

The so-called Statistical Representations of Counties are a unique source of data to study the social, economic and environmental realities of counties in the Kingdom of Prussia in the early 1860s. Despite the rich data and insights that the statistical representations provide, they have been scarcely used. As of early 2021, individual representations have only been cited 16 times in the post-WWII war era. No efforts have thus far been made to derive and calculate data for the Kingdom of Prussia as a whole.

The preamble of the Statistical Representation of the County Moers provides a brief insight into the history and mandate for the statistical documents. According to the preamble, county administrators were advised

in 1859 through a ministerial mandate to compile a statistical representation of their county alongside the census. The structure was recommended to loosely follow a schematic provided to administrators in 1838, which led many counties to compile statistics according to their own outline. Despite these heterogeneous approaches, the majority of statistical representations that are available include a core set of thematic focus areas: 1. A territorial and historical overview; 2. Physiographic conditions; 3. Climatic conditions; 4. Inhabitants; 5. Migratory flows; 6. Marriage and birth statistics; 7. Health and mortality; 8. Housing; 9. Real estate and landed property; 10. Agriculture; 11. Livestock; 12. Commerce and transport; 13. Roads and waterways; 14. Conditions of working population; 15. Poverty alleviation efforts; 16. Police force; 17. Sanitary infrastructure; 18. Religious matters; 19. Education; 20 Civil and criminal justice; 21. Military.

As immediately evident from this exhaustive list of topics, the statistical representations of counties can provide a unique and comprehensive insight into living conditions at the local level in the Prussian empire. The documents contain both narrative explanations as well as detailed statistical tables on the above mentioned themes. It is particularly the former that bear witness to the socio-economic challenges of the Kingdom in the mid-19th century. This is particularly the case for those representations whose authors heavily editorialize, providing insights into the attitudes of county administrators towards their citizens. Interestingly, these views vary widely between counties. While the administrator of Tecklenburg praises the "great assiduity, commendable frugality and capacity for renouncement" of the working classes, the administrator of Muensterberg bemoans the "lack of education" and the "bad habits of the large cities" which have "permeated the countryside" and have led to "naked vulgarity and wantonness" among farmhands and domestic workers.

Of particular interest for the scope of this study is number 14 of the above-mentioned focus areas, i.e. the conditions of the working populations,

which provides wage data for a wide range of professional groups. This study compiles this data to calculate population-weighted mean incomes for professional groups for the Kingdom, based on the data which is available at the county level. Of the Statistical Representations, 24 counties are available for this study, distributed across the Kingdom. The below map shows the availability of statistical representations and their distribution across the empire.

The available regions cover only 6.3% of the population of the Kingdom, but nonetheless provide a balanced representation of income data, given that counties in both the East and West of the Kingdom are represented. By using population weighted averages, this study seeks to provide mean incomes that reflect incomes in the Kingdom as a whole. On the basis of the population-share data sourced from the professional census as well as the income data from the county-level statistical representations, the below social table for Prussia can be constructed (see Table 6).

The social table draws on a number of additional sources besides the professional census of 1863 and the *Statistische Darstellungen*. For the numbers of military personnel per category, the study draws on the 1862 editions of the *Militaerzeitung*, i.e. the military journal, which provides a breakdown of the hierarchical structure of the Prussian military. The total number of soldiers is calculated by subtracting the total number of higher-ranking military personnel from the total number of military personnel that is listed in the professional census. The pay of soldiers is derived from Heller (2005), which provides the relative pay of soldiers in relation to the military hierarchy. The number of pensioned military officers is from Kist (1871). The income of catholic priests, for which no source is available for Prussia, is assumed to be in line with the income of catholic priests in Bavaria. Detailed data on the hierarchy of the Prussian civil service, including pay and number of individuals, is provided by Hermes (1921).

Figure 1: Location of available *Statistical Representations*

Source: Author's elaboration

On the basis of this social table, the Gini coefficient and inequality extraction ratio can be calculated. The Gini coefficient for Prussia in 1863 is 0.34. In line with the methodology by Milanovic (2009), the maximum feasible Gini can be calculated. As in Milanovic (2009) the subsistence minimum is conservatively assumed to be 300 \$PPP.

The Statistical Representations also provide information on the monetary needs for a family of five in the respective regions in 1863. The lowest of the regional estimates of monetary need is used in order to arrive at the most conservative measure of subsistence, assumed to cover only what is truly needed for survival. In line with the equivalence scales for the individual as outlined above, the subsistence minimum is 21.1 German Taler. Accordingly, the conversion rate of \$PPP to Taler is 14.22 to 1. The maximum feasible Gini for Prussia is thus 0.80 and the inequality extraction ratio 41.9%.

Table 6: Social table - Prussia, 1863

	Number	%, Pop.	Inc/cap (Taler)	Inc/cap (\$PPP)	Inc/cap (/mean)
Unemployed	180561	3.1574%	0.0	0.0	0.00
Recipient of alms	330003	5.7706%	21.1	300.0	0.20
Domestic worker	37465	0.6551%	49.4	703.2	0.47
Maid	500532	8.7525%	53.1	754.8	0.50
Soldier	210937	3.6885%	59.9	852.0	0.57
Female day laborer	565705	9.8921%	61.4	872.9	0.58
Farm laborer	558435	9.7650%	68.0	967.1	0.65
Day laborer	1367024	23.9043%	86.2	1226.1	0.82
Factory worker	719908	12.5886%	131.8	1874.9	1.25
Bricklayer/carpenter /shoemaker	560551	9.8020%	138.2	1965.2	1.31
Miner	39456	0.6899%	144.3	2052.8	1.37
Policeman	2603	0.0455%	145.0	2062.2	1.38
Tailor	155269	2.7151%	152.0	2162.4	1.44
Weaver	9519	0.1665%	191.3	2721.1	1.82
Adm. Messenger	329	0.0058%	225.0	3200.0	2.14
Craftsman (Blacksmith /Metal worker)	367538	6.4269%	228.6	3250.9	2.17
Cigarmaker	24697	0.4319%	234.0	3328.0	2.23
Seconde-Lieutenant	7174	0.1254%	300.0	4266.7	2.85
Premier-Lieutenant	1728	0.0302%	350.0	4977.8	3.33
Trader	12521	0.2189%	400.0	5688.9	3.80
Office clerk	89	0.0016%	525.0	7466.7	4.99
Forestry assessor	25	0.0004%	600.0	8533.3	5.71
County secretary	331	0.0058%	650.0	9244.4	6.18
Civil service officer	524	0.0092%	750.0	10666.7	7.13
Catholic priest	3874	0.0677%	798.0	11349.3	7.59
Pensioned Officer	4583	0.0801%	849.1	12075.5	8.08
Teacher	46227	0.8083%	850.0	12088.9	8.08
Police counsel	24	0.0004%	900.0	12800.0	8.56

Table 7: Social table - Prussia, 1863 [continued]

	Number	%, Pop.	Inc/cap (Taler)	Inc/cap (\$PPP)	Inc/cap (/mean)
Mining counsel	10	0.0002%	900.0	12800.0	8.56
Post inspector	26	0.0005%	950.0	13511.1	9.04
Banker	550	0.0096%	1000.0	14222.2	9.51
County administrator	326	0.0057%	1000.0	14222.2	9.51
State/medical counsel	26	0.0005%	1000.0	14222.2	9.51
Councilor of the consistory	17	0.0003%	1050.0	14933.3	9.99
Post counsel	24	0.0004%	1050.0	14933.3	9.99
Forestry inspector	57	0.0010%	1050.0	14933.3	9.99
Captain/Cavalry captain	2126	0.0372%	1100.0	15644.4	10.46
Protestant pastor	6329	0.1107%	1112.0	15815.1	10.58
Counsel	8	0.0001%	1200.0	17066.7	11.41
Mining director	10	0.0002%	1300.0	18488.9	12.36
Chief mining counsel	16	0.0003%	1300.0	18488.9	12.36
Senior civil counsel	52	0.0009%	1300.0	18488.9	12.36
Senior civil servant, Cat.4	268	0.0047%	1300.0	18488.9	12.36
Senior counsel, Cat.3	6	0.0001%	1400.0	19911.1	13.32
Police president	14	0.0002%	1500.0	21333.3	14.27
Chief forester	24	0.0004%	1600.0	22755.6	15.22
Chief post officer	26	0.0005%	1750.0	24888.9	16.65
Major	692	0.0121%	2000.0	28444.4	19.02
Director of the consistory	2	0.0000%	2250.0	32000.0	21.40
Judicial civil servant, Cat.3	51	0.0009%	2400.0	34133.3	22.83
Senior counsel, Cat.2	93	0.0016%	2400.0	34133.3	22.83
Chief mining officer	4	0.0001%	2500.0	35555.6	23.78
Tax administrator	8	0.0001%	3000.0	42666.7	28.53
Senior civil servant, Cat.3	25	0.0004%	3000.0	42666.7	28.53

Table 8: Social table - Prussia, 1863 [continued]

	Number	%, Pop.	Inc/cap (Taler)	Inc/cap (\$PPP)	Inc/cap (/mean)
Colonel	125	0.0022%	3000.0	42666.7	28.53
Senior civil servant, Cat.2	9	0.0002%	3466.7	49303.7	32.97
Ministerial director	11	0.0002%	3500.0	49777.8	33.29
Senior counsel, Cat.1	3	0.0001%	3750.0	53333.3	35.67
Major general	83	0.0015%	4020.0	57173.3	38.24
Undersecretary of state	3	0.0001%	4250.0	60444.4	40.42
Lieutenant general	37	0.0006%	5260.0	74808.9	50.03
Senior civil servant, Cat.1	9	0.0002%	6000.0	85333.3	57.07
Ordnance general	1	0.0000%	7320.0	104106.7	69.62
General	32	0.0006%	7320.0	104106.7	69.62
Government Minister	8	0.0001%	10000.0	142222.2	95.12
General field-marshal	1	0.0000%	16500.0	234666.7	156.94
Total	5,718,744	100%	105.14	1495.3	1.00

Similar to the case of the social table for Bavaria, the social table for Prussia covers only the population that can be accounted for by the available data. As shown in the above social table, the total number of inhabitants that can be mapped for the Kingdom of Prussia are 5.7 million, which compares to a total working age (14-60) male population of 5.3 million. Once again, the social table covers individuals rather than households. Contrary to the Bavarian case, data is available for unemployed and those receiving social assistance, but may not fully account for pensioners as well as certain categories of professions, such as those with income from trade and self-employment.

4.2.2 Post-unification Germany

Similar to the pre-unification setting, data availability for post-unification Germany is limited. Yet, the availability of primary data is greater for post-unification Germany, given the push at a state level to compile more comprehensive data, including for fiscal purposes. As mentioned above, Bartels (2019) provides data on top income shares on the basis of tax data. As highlighted by Bartels (2019), there are a number of studies that use income tax data to analyze aspects of the income distribution in Germany, including the work of Tilly (2010).

The availability of this data depends on the time of adoption of taxes, notably income taxes, which were not uniformly introduced across the Empire, but sequentially at the state level. While the introduction of an income tax in Hessen predates unification, Lippe and Schwarzburg-Sonderhausen, the two last to adopt the tax, only introduced an income tax in 1912 (Mares and Queralt, 2015). Prussia and Bavaria introduced income taxes in 1891 and 1910, respectively. For Prussia before 1891, data on income brackets and respective population shares are available on the basis of fiscal data for the so-called class tax. The data distinguishes between 13 different income brackets with incomes from below 140 Thaler to 900-1000 Thaler. For higher incomes data is available for an additional 48 brackets. The highest bracket of between 1.68 and 1.7 million Thaler contains only 1 individual. This data is compiled in the annex in tables 11 and 12 on the basis of the data contained in the *Journal of the Royal Prussian Statistical Bureau* of 1875⁸.

Another early adopter of income taxes was Saxony, which introduced the income tax in 1874 and also significantly expanded statistical capacity to measure the tax base and gather fiscal data. One such dataset compiled between 1879 and 1894 is income data by income brackets and population shares within such income brackets. Such data enable the calculation of Gini

⁸see *Zeitschrift des Koeniglich Preussischen Statistischen Bureau* (1875)

coefficients and inequality extraction ratios. Table 13 in the annex compiles this data within one table.

Calculating the Gini index on the basis of income brackets comes with a number of common side-effects. One of the primary concerns relates to the possible over-estimation of incomes. This may happen, for instance, in the lowest income bracket, where, if the bottom bracket is very wide, a measure of the mean may overstate incomes. In the case of Prussia, using averages, the income of the lower bracket from 0-140 Thaler, which may include a large number of unemployed or under-employed individuals, may overstate the earnings, when an average income of 70 Thaler is assumed. The same may happen across the income distribution, particularly if brackets are very wide. A possible over-estimation of incomes could in turn lead to an under-estimation of the inequality extraction ratio, as the maximum feasible Gini could be over-estimated.

As mentioned above, a comprehensive income tax was only introduced in Bavaria in 1910. Nonetheless, income tax was levied on a part of society across three (very) broad tax groups, which were further subdivided into income ranges. An overview of this tax income across the three groups for 1890 can be derived from the *Statistical Yearbook of the Kingdom of Bavaria* (1894), as listed in Table 14 in the annex. The first group contains salaried labor, the second income from scientific, artistic labor and income from leased property and mining and the third various pay and pensions. The total coverage is of 560 thousand people. The Gini coefficient of the listed income is 0.34 and the inequality extraction ratio is 37.6%. In order to gain additional insights into the distribution of income in Bavaria in the decade after unification, social tables can also be utilized to calculate measures of inequality. Table 15 in the annex provides a social table for Bavaria based on the Professional census of 1882 contained in the *Statistical Yearbook of the Kingdom of Bavaria* (1894). Incomes of the respective groups are based on data from the 1870s contained in Klose (2002), Kocka (1990) for selected groups of workers,

Zeller (1889) for civil servants and the *Statistical Yearbook of the Kingdom of Bavaria* (1894) for forestry workers. The total coverage is of over 2.7 million individuals. On the basis of income data and population weights contained in the social table, the Gini coefficient is 0.33 and the inequality extraction ratio 38.5%. These values are very close to the above-noted figures for the Gini coefficient and IER calculated on the basis of tax data.

5 Results: *E pluribus inaequalitas?*

It is time to put the evidence together. A first step is to compare the new data for pre-unification Germany contained in the Social tables of Prussia and Bavaria. Table 9 below shows the key data points of Prussia and Bavaria. The findings suggest that differences in the distribution of income, as expressed by the maximum feasible Gini and actual Gini, were small between Prussia and Bavaria. Available data for Italy suggests that differences between states were more pronounced between Italian states (see table 10).

Table 9: Comparing Bavaria and Prussia

	Bavaria, 1847	Prussia, 1863
Subsistence Minimum (LC)	27.813	21.094
Subsistence Minimum (\$PPP)	300	300
Mean income	115.2	105.1
Mean income in \$PPP	1242	1495
Conversion \$PPP/LC (based on subsistence)	10.7865	14.222
Mean income in terms of s (s=300)	4.1411	4.9842
G* - Maximum feasible Gini	0.76	0.80
Actual Gini	0.32	0.33
Inequality Extraction ratio	42.2%	41.9%

Table 10: Inequality Extraction Ratios - Italy

	Tuscany	Piedmont	Naples	Italy
1700	106.3	88.0		
1750	111.3	91.4		
1800		96.1		
1811			53.7	
1861				80.7
1871				74.8
1881				66.9

Source: Malanima, Alfani & A'hearn et al.

Interpreting the results

The simple model of unification and inequality provided a number of pointers for the study of the cases of Italy and Germany. It showed, subject to a number of assumptions, that if a lower inequality peripheral state and a higher inequality core state are unified and income is redistributed from the former to the latter, inequality, as measured by the Gini coefficient, and inequality extraction, as measured by the inequality extraction ratio, will raise for the new nation as a whole.

Can the model shed light on the unification experience of Italy and effects on the distribution of income? Figure 3 and 4 below show the available evidence. Figure 4 draws on the combined inequality extraction ratios for Italy as developed by Malanima (2020). As Figure 3 and 4 show, there is indeed evidence to suggest that a number of assumptions of the model hold for the case of Italian unification. First, the available data for regions suggest that inequality in the Northern regions of Tuscany and Piedmont was indeed higher than for Naples in the South prior to unification.

Secondly, inequality extraction following unification is higher than in the South prior to unification and lower than in the North. It is important to keep in mind that, as the simple model of unification and inequality shows,

the inequality extraction ratio is not the weighted average between various regions. Third, Figures 3 and 4 suggest a sudden increase in inequality extraction ratios in response to unification. This is an important finding that supports the hypothesis that unification increased inequality extraction in Italy.

Is this level of inequality and extraction higher than it would have been in the absence of implicit or explicit redistribution from South to North? To analyze this on the basis of available information on the income distribution of the North and South, a number of assumptions need to be made. Data on Gini coefficients are available for Piedmont and Naples for 1800 and 1811, respectively. Assuming that Gini coefficients for these two are representative of the Gini coefficients of Piedmont and Naples just before unification, a Gini coefficient can be calculated for a simulated union of two regions with the same Gini coefficients and randomly generated distributions of income, thus generating an imaginary Kingdom of Piedmont-Naples. Once again, a key assumption would be equivalence of mean incomes.

For such a simulated union, the post-unification Gini coefficient would be 0.47, which is significantly below the Gini coefficient for unified Italy of around 0.6, as reported by A’hearn et al. (2020). Such a finding would align with scenarios (4) and (5), i.e. suggesting that there may have been redistribution from South to North. Yet, it is imperative to note that such calculations are highly sensitive to assumptions, including on the relative population shares. Further research on the possible size of redistribution is thus needed to complement this “back of the envelope” calculation, ideally on the basis of additional data.

The finding of higher extraction from the South, as measured by the inequality extraction ratios is in line with the work by de Oliveira and Guerriero (2018), who argue that as a result of unification and the ensuing political

Figure 2: Inequality extraction ratios - Italy and regions (1500-1900)

Source: Author's elaboration on the basis of Malanima (2006), Alfani and Ryckbosch (2016), Amendola and Vecchi (2017)

Figure 3: Inequality extraction ratios - Italy (1500-1900)

Source: Author's elaboration on the basis of Malanima (2020), Amendola and Vecchi (2017)

union under the leadership of the North⁹ *"both region-specific tax rates are selected by the Northern elite, who cares less about the Southern citizenry's utility" (pp. 143) and that the "Piedmontese-led ruling class favored the Northern export-oriented farming and manufacturing industry while selecting trade, financial, and fiscal policies and the Northern population when levying the taxes needed to finance the necessary expenses." (pp. 146)*

This observation yields support to the view that taxes raised in the South may have been disproportionally spent on industrialization in the North, thus redistributing income from the South to the North, as Figures 2 and 3 suggest. Indeed, as de Oliveira and Guerriero (2018) highlight, railway investment was heavily concentrated in the North, with the Northern regions of Liguria and Piedmont-Aosta Valley receiving 18 times higher investments in railway than other regions. Such investment was largely backed by resources mobilized from property taxes on land, disproportionally levied on the South (see de Oliveira and Guerriero, 2018). Overall, the analysis advanced in this study suggest that unification did contribute to inequality in the case of Italy.

Figure 4 depicts the findings for Germany, depicting inequality extraction ratios for German states before and after unification. It also shows a composite measure of inequality extraction for post-unification Germany as a whole (dotted line) on the basis of available data for Prussia, Bavaria and Saxony. This composite measure should be taken with caution as it combines different years and heterogenous tax regimes with different tax brackets. Figure 4 suggests that the changes to the distribution of income in response to unification in Germany were much smaller compared to those in Italy.

In analyzing the case of Germany, it is important to consider a key dif-

⁹The political leadership and bureaucracy of Italy following unification was heavily dominated by the North, with 85% of prime ministers between 1861 and 1911 being from the North (see de Oliveira and Guerriero, 2018 as well as Duggan, 2014). Duggan (2014) also notes that prefects of the states were largely Piedmontese and personal acquaintances of the king or the prime-minister.

Figure 4: IERs for pre- and post-unification Germany

Source: Author's elaboration, Note: * indicates calculations based on tax data; combined Germany is a composite measure of tax data of Prussia, Bavaria and Saxony

ference to Italy: Germany adopted a federal state model instead of a unified model, as highlighted in the research by Ziblatt (2004). This difference may have an impact on how financing is channeled from the periphery to the core. In Germany, due to the federal structure, the transmission channel of extraction from periphery to core was less direct than in the case of Italy. In contrast to Italy, as noted by Mares and Queralt (2015), *"the 1870 German constitution limited significantly the ability of the central government to raise direct taxes and left significant fiscal policy authority in the hands of subnational governments"*. The role of the federal government was largely limited to rising fiscal revenue for military spending, which, however, in the context of the 19th century, represented an important fiscal responsibility (Mares and Queralt, 2015). Overall, the findings for Germany suggest that the limited ability of the central government to raise significant revenues from the individual states prevented greater inequality and inequality extraction

in response to unification.

6 Concluding Remarks

As highlighted by the widely reproduced chart by Gornick and Milanovic¹⁰, which shows market inequality alongside inequality after redistributive policy action, inequality can be argued to be a policy choice. This research, which studies the natural experiment of unification, supports this viewpoint by showing the effects of policy choice, implemented in response to unification, on the distribution of income in Germany and Italy. As over a short period of time under review, i.e. a the years before and after unification, market forces are not likely to significantly alter the distribution of income, it is policy choices, which affect income inequality in the short-term.

This research suggests that if policies redistribute from lower inequality regions to higher inequality regions, then inequality will rise in the whole country. The policy implications extend beyond the case of unification. In particular, the research opens up opportunities for a further analysis of unification or "unification-type" scenarios, including of German unification in 1990 as well as regional development beyond the unification context, including research on the European Union. A key policy implication of this research is that policy makers should take into account differences in inequality between regions, not just as a matter of regional but as a matter of national policy on inequality.

This research contributes to the study of inequality by providing new insights into the linkages between unification and related policy choices on inequality and inequality extraction by providing a comparative study of Italy and Germany in the context of 19th century unification, which has previously been unexplored in the literature on inequality. The research also provides new data on inequality for pre- and post-unification Germany, particularly

¹⁰see Gornick and Johnson (2020) for the latest update

Gini coefficients and inequality extraction ratios.

This study also sheds more light on linkages between institutional structures/governance frameworks and the distribution of incomes and inequality. In doing so, it connects the research on federalism with the literature on inequality extraction. Indeed, the study finds evidence to suggest that the federal state system in Germany may have tapered inequality extraction by slowing the extractive power of centralized fiscal policy. Further comparative research on Germany and Italy is needed to analyze in greater depth the effects of state systems on the distribution of income in post-unification Germany and Italy.

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Annex

Table 11: Prussia: Income brackets and Pop. shares, 1874

Income Bracket, Thaler	Number of people	Pop. share, %
0-140	6447431	34.0284%
140-220	2194138	11.5803%
220-300	9231992	48.7248%
300-350	322287	1.7010%
350-400	137013	0.7231%
400-450	121505	0.6413%
450-500	94237	0.4974%
500-550	62517	0.3300%
550-600	59806	0.3156%
600-700	35440	0.1870%
700-800	44046	0.2325%
800-900	29096	0.1536%
900-1000	28138	0.1485%
1000-1200	40639	0.2145%
1200-1400	22539	0.1190%
1400-1600	16286	0.0860%
1600-1800	11041	0.0583%
1800-2000	7825	0.0413%
2000-2400	10814	0.0571%
2400-2800	6692	0.0353%
2800-3200	4994	0.0264%
3200-3600	3476	0.0183%
3600-4000	2564	0.0135%
4000-4800	3052	0.0161%
4800-5600	2018	0.0107%
5600-6400	1195	0.0063%
6400-7200	1336	0.0071%
7200-8400	1054	0.0056%
8400-9600	633	0.0033%
9600-10800	582	0.0031%
10800-12000	425	0.0022%
12000-14000	520	0.0027%

Table 12: Prussia: Income brackets and Pop. shares, 1874 (cont.d)

Income Bracket, Thaler	Number of people	Pop. share, %
14000-16000	317	0.0017%
16000-18000	314	0.0017%
18000-20000	196	0.0010%
20000-24000	308	0.0016%
24000-28000	185	0.0010%
28000-32000	105	0.0006%
32000-36000	86	0.0005%
36000-40000	46	0.0002%
40000-48000	91	0.0005%
48000-56000	53	0.0003%
56000-68000	49	0.0003%
68000-80000	37	0.0002%
80000-100000	24	0.0001%
100000-120000	14	0.0001%
120000-140000	13	0.0001%
140000-160000	3	0.0000%
160000-180000	3	0.0000%
180000-200000	4	0.0000%
200000-220000	2	0.0000%
240000-260000	10	0.0001%
260000-280000	2	0.0000%
300000-320000	1	0.0000%
380000-400000	1	0.0000%
480000-500000	1	0.0000%
500000-520000	1	0.0000%
600000-620000	3	0.0000%
700000-720000	1	0.0000%
1680000-1700000	1	0.0000%
Total	18947202	100%

Table 13: Saxony: Income brackets and Pop. shares, 1879

Income Bracket (Mark)	Number of people	Pop. share, %
0-300	77060	7.1039%
300-800	751626	69.2902%
800-950	57164	5.2698%
950-1100	39662	3.6563%
1100-1250	28142	2.5943%
1250-1400	17787	1.6397%
1400-1600	22507	2.0749%
1600-1900	20149	1.8575%
1900-2200	14362	1.3240%
2200-2500	10481	0.9662%
2500-2800	7104	0.6549%
2800-3300	9714	0.8955%
3300-4800	13215	1.2183%
4800-9600	10857	1.0009%
9600-26000	4091	0.3771%
26000-54000	592	0.0546%
54000-100000	170	0.0157%
100000-200000	50	0.0046%
200000-300000	12	0.0011%
300000-500000	4	0.0004%
500000-1000000	2	0.0002%
Total	1084751	100%

Table 14: Bavaria: Tax Groups and Pop. shares, 1882

Tax Group	Mean Income (Mark)	Number of people	Pop. share, %
Cat 2 - Step I	175	11982	2.1390%
Cat 1 - Step I	219	39349	7.0244%
Cat 1 - Step II	328.5	47535	8.4857%
Cat 2 - Step II	425	1603	0.2862%
Cat 3 - Step I	510	278585	49.7314%
Cat 1 - Step III	511	64521	11.5179%
Cat 2 - Step III	575	977	0.1744%
Cat 1 - Step IV	657	37995	6.7827%
Cat 2 - Step IV	750	1005	0.1794%
Cat 2 - Step V	925	778	0.1389%
Cat 2 - Step VI	1200	986	0.1760%
Cat 3 - Step II	1275	36862	6.5804%
Cat 2 - Step VII	1725	1347	0.2405%
Cat 3 - Step III	1790	15198	2.7131%
Cat 3 - Step IV	2225	4952	0.8840%
Cat 2 - Step VIII	2575	972	0.1735%
Cat 3 - Step V	2575	2614	0.4666%
Cat 3 - Step VI	2925	2572	0.4591%
Cat 3 - Step V	3275	2200	0.3927%
Cat 2 - Step IX	3675	548	0.0978%
Cat 3 - Step VI	3850	2956	0.5277%
Cat 2 - Step X	4675	292	0.0521%
Cat 3 - Step VII	4675	1784	0.3185%
Cat 2 - Step XI	5550	203	0.0362%
Cat 3 - Step VIII	5550	847	0.1512%
Cat 2 - Step XII	6500	111	0.0198%
Cat 3 - Step IX	7250	766	0.1367%
Cat 2 - Step XIII	8600	158	0.0282%
Cat 3 - Step X	10250	259	0.0462%
Cat 2 - Step XIV	11100	23	0.0041%
Cat 2 - Step XV	13800	16	0.0029%
Cat 3 - Step XI	13800	81	0.0145%
Cat 2 - Step XVI	18300	11	0.0020%
Cat 3 - Step XII	19200	51	0.0091%
Cat 2 - Step XVII	25500	3	0.0005%
Cat 3 - Step XIII	26400	17	0.0030%
Cat 2 - Step XVIII	30000	3	0.0005%
Cat 3 - Step XIV	30000	17	0.0030%
Total	687.04	560179	100%

Table 15: Bavaria: Social Table, 1882

	Income (Mark)	Number of people	Pop. share, %
Unemployed	0.0	274749	10.1055%
Military service	73.0	121890	4.4832%
Maid	124.0	22590	0.8309%
Food industry	301.6	84192	3.0966%
Mining	313.9	13769	0.5064%
Mining industry	313.9	40123	1.4758%
Misc Industry	313.9	3306	0.1216%
Female Agric. Worker	328.5	50255	1.8484%
Agric./Day Laborer	359.5	1035486	38.0860%
Forestry	368.3	12924	0.4754%
Domestic worker	438.0	95977	3.5301%
Transportation	500.1	39207	1.4421%
Engine fitter	545.0	28165	1.0359%
Textile industry	545.0	61362	2.2569%
Chemical industry	572.0	10890	0.4005%
Paper industry	572.0	21305	0.7836%
Male Agric. Worker	584.0	407347	14.9825%
Clothing industry/Tailor/Hatmaker	619.0	139651	5.1365%
Assistant Teacher	663.0	1446	0.0532%
Metalworker	670.8	54606	2.0085%
Substitute Teacher	774.0	1729	0.0636%
Wood industry	805.0	61403	2.2585%
Printing	980.7	6853	0.2521%
Teacher	1236.0	12296	0.4523%
Construction	1277.5	100468	3.6953%
Surveyor/Inspector	1565.0	256	0.0094%
Civil servant	1366.9	3631	0.1336%
Insurance/Bank	2040.0	781	0.0287%
Financial administration	2297.2	2126	0.0782%
Judicial civil servant	2643.8	2723	0.1002%
Misc. Councils	2890.0	1491	0.0548%
High school teacher	3182.0	4869	0.1791%
University professor	3784.0	647	0.0238%
Higher civil service	4746.2	150	0.0055%
Ministerial council	7290.0	20	0.0007%
Higher civil service	7920.0	27	0.0010%
Government commissioner	10800.0	99	0.0036%
President of supreme court	12600.0	1	0.0000%
Total	436.3	2718683	100%