## A Electronic Appendix for Kenneth Scheve and David Stasavage's "The Conscription of Wealth: Mass Warfare and the Demand for Progressive Taxation"

## A.1 Data Description for Marginal Tax Rates

United States - We use the top marginal tax rate as reported in Joint Committee on Taxation<sup>1</sup> for the years 1913-1970 and Kennan<sup>2</sup> for 1862-1872. In both cases the rates presented are statutory top marginal tax rates, and these include any surtax. In order to estimate marginal tax rates at the 90th, 99th, and 99.9th percentiles of the income distribution we use the information in Piketty and Saez<sup>3</sup> on the total number of tax units. McCubbin and Scheuren<sup>4</sup> provide information on the number of individuals with income above specific levels. We have used rates in 1914 for pre-war and 1918 for post-war World War I.<sup>5</sup>

United Kingdom - For the top rate during the period between the inception of the income tax in 1799 and 1919 we refer to the standard rate of income tax as reported in Mitchell<sup>6</sup> and to super tax rates as reported by Mallett and George.<sup>7</sup> For the period between 1920 and 2002 we use data on the top marginal tax rate on wage income provided by Anthony Atkinson and Andrew Leigh.<sup>8</sup> In order to provide an estimate of marginal tax rates facing individuals at the 90th, 99th, and 99.9th percentiles we used Atkinson<sup>9</sup>, who provides an estimate of the total number of tax units, and Mallett and George<sup>10</sup>, who provide information on marginal rates for income tax and super tax, as well as information on the number of individuals earning income above specific levels. We have used rates for 1913/1914 for pre-war and 1918/1919 for post-World War I.

<sup>&</sup>lt;sup>1</sup>U.S. Congress 2001.

<sup>&</sup>lt;sup>2</sup>Kennan 1910.

<sup>&</sup>lt;sup>3</sup>Piketty and Saez 2007.

<sup>&</sup>lt;sup>4</sup>McCubbin and Scheuren 1989.

<sup>&</sup>lt;sup>5</sup> As described in the paper, the analysis reported in Table 2 selects the pre-war and post-war years for each country that constitute troughs and peaks in rates near the beginning and end of the war.

<sup>&</sup>lt;sup>6</sup>Mitchell 1988.

<sup>&</sup>lt;sup>7</sup>Mallett and George 1929, 399.

<sup>&</sup>lt;sup>8</sup>Atkinson and Leigh 2007.

<sup>&</sup>lt;sup>9</sup>Atkinson 2007.

 $<sup>^{10}\</sup>mathrm{Mallett}$  and George 1929.

Netherlands -For the top rate Salverda and Atkinson<sup>11</sup> report effective top share tax rates for the period following the establishment of the modern Dutch income tax 1914-1999. We use the series for the effective tax rate on the top 0.05% income group. For the period prior to 1914 we rely on Seligman<sup>12</sup> and Kennan<sup>13</sup> who suggest a top rate of 3.2% on business (including salaried income) for this period. For tax rates at the 90th, 99th, and 99.9th percentiles we use the data in Salverda and Atkinson.<sup>14</sup> It should be noted that the rates they report are for effective tax rates for all individuals at or above a specific point in the income distribution, a measure that differs from one reporting the marginal rate faced by an individual at a specific point in the income distribution. We have used rates for 1914 for pre-war and 1921 for post-World War I.

Japan - Moriguchi and Saez<sup>15</sup> report statutory top marginal tax rates for Japan for all years 1886-2005. In order to estimate marginal rates facing individuals at the 90th, 99th, and 99.9th percentiles prior to and following World War I we use data from Shiomi<sup>16</sup> who reports marginal tax rates in 1914 and 1918, the total number of taxpaying families, and a breakdown of the number of taxpaying families by income level. We have referred only to rates on Class III income.

Canada - Saez and Veall<sup>17</sup> report a top marginal tax rate series for the period 1920-2000 calculated by taking the income for someone at a given threshold and then calculating tax liability by consulting the income tax schedule applicable in the given year. We use the maximum rate reported for each year (column 10). For 1917-1920 we refer to the top statutory marginal tax rate reported in Perry.<sup>18</sup> For the pre and post-World War I comparison of marginal tax rates at the 90th, 99th and 99.9th percentile, rates are zero in the pre-war period due to the absence of a federal income tax. For the post-war rates we use the rates for 1920 reported in Saez and Veall for each of these income levels.

<sup>&</sup>lt;sup>11</sup>Salverda and Atkinson 2007, 455.

<sup>&</sup>lt;sup>12</sup>Seligman 1908, 79.

<sup>&</sup>lt;sup>13</sup>Kennan 1910, 135-45.

<sup>&</sup>lt;sup>14</sup>Salverda and Atkinson 2007, 455.

<sup>&</sup>lt;sup>15</sup>Moriguchi and Saez 2007, tab. A0.

<sup>&</sup>lt;sup>16</sup>Shiomi 1957.

<sup>&</sup>lt;sup>17</sup>Saez and Veall 2007, 301.

<sup>&</sup>lt;sup>18</sup>Perry 1955, chap. 10.

Sweden - Roine and Waldenström<sup>19</sup> report top share tax rates for the years 1903-2004 including both the state (national) income tax and the communal (local) income tax. We use their series for the highest marginal tax rate. We also use their series for the marginal tax rates facing individuals at the 90th, 99th, and 99.9th percentiles of the income distribution. Sweden had no income tax prior to 1903. We used rates in place in 1911 for pre-World War I and 1920 for post-World War I.

France - For purposes of measuring the top marginal tax rate in France Piketty<sup>20</sup> provides full schedules showing marginal income tax rates for France for the years 1915 to 1998. He also reports a series for the top marginal tax rate that takes into account surcharges (majorations), including those levied only on certain types of households, such as those without children.<sup>21</sup> His goal is to consider the marginal tax rate faced by the household in the most unfavorable position. Our goal is slightly different in that we seek exclusively to measure the marginal tax rate faced by the richest households. In addition, we also face some uncertainty whether any surcharges of the sort reported by Piketty for France have been taken into account in the other country series that we use. In order to maximize the likelihood of inter-country comparability, we constructed a top rate series for France based exclusively on the top marginal rates (barèmes d'imposition) reported in Piketty.<sup>22</sup> The main difference between the two series is that focusing exclusively on the barèmes d'imposition results in a lower tax rate for the period immediately after World War I and for World War II. As a result, our choice here would if anything bias our results against finding a significant effect of war mobilization on tax progressivity. In order to obtain an estimate of the marginal tax rate faced by individuals at the 90th, 99th, and 99.9th percentiles prior to and following World War I we used the tax schedules reported by Piketty, his figures for the total number of tax units<sup>23</sup>, as well as his figures for the number of tax units by income threshold.<sup>24</sup> For the pre-WWI rate we have used the earliest available rate (1915) and the rate in 1920 for the

<sup>&</sup>lt;sup>19</sup>Roine and Waldenström 2008.

 $<sup>^{20}\</sup>mathrm{Piketty}$  2001, chap. 4.

<sup>&</sup>lt;sup>21</sup>Ibid., 325, 566.

<sup>&</sup>lt;sup>22</sup>Ibid., tabs. 4-1–4-5.

<sup>&</sup>lt;sup>23</sup>Ibid., 566, tab. A1.

<sup>&</sup>lt;sup>24</sup>Ibid., 566, tab. A-2, col. 1.

post-war rate, the year in which a very sizeable increase in income taxation was implemented as part of a package to finance war debts.

**Spain** - Alvaredo and Saez<sup>25</sup> report top statutory marginal income tax rates for Spain for 1933-1973 onwards. Prior to this date Spain did not have a national income tax, implying that pre and post World War I rates were set at the same level (zero).

## A.2 Interrupted Time Series Analysis, 1900-1930

In this section we report an analysis of the determinants of top marginal tax rates over the 1900-1930 period in which we allow for heterogeneity in the effect of mass mobilization across the cases. This approach allows for differences in the tax systems that might make comparisons across countries misleading.

For this analysis, we define the variable *Top Rate* equal to the highest marginal tax rate for a country in a given year. This variable is set equal to zero for years in which a country did not yet have an income tax. The key independent variable is *WWI Mobilization* which is set equal to 0 in each year before the country enters the war and 1 thereafter.<sup>26</sup> In some specifications, we include controls for levels of economic development, the representation of left parties in the legislature, and the extent of the franchise. The variable *GDP per capita* is equal to gross domestic product divided by the population.<sup>27</sup> The variable *Left Seat Share* is equal to the percent of seats in the national legislature held by a Left party in a given year.<sup>28</sup>

 $<sup>^{25}</sup>$ Alvaredo and Saez 2007, tab. F1.

<sup>&</sup>lt;sup>26</sup>For Canada, France, and the UK, the entry year is 1914 and for the US, it is 1917.

<sup>&</sup>lt;sup>27</sup>The source for the gross domestic product data is Angus Maddison, "Historical Statistics of the World Economy," <a href="http://www.ggdc.net/maddison/">http://www.ggdc.net/maddison/</a>. Accessed 15 May 2010. The source for the population data is Correlates of War Project, National Material Capabilities Data, Version 3.0, 2005.

<sup>&</sup>lt;sup>28</sup> As this variable is used elsewhere in the paper for all eight countries in our sample, this footnote describes the sources and coding for all eight cases. We adopt a relatively strict definition of a "Left" party that generally includes Socialists, Social Democratic, and Communist parties only. For France, Netherlands, Sweden, and UK, the source for this data is Flora 1983. French parties of the left include the Socialist Party, Independent Socialist Party, Socialists, Communist Party, and the United Socialist Party. Dutch parties of the left include the Social Democratic League, Social Democratic Workers, Socialist Party, Dutch Labour Party, Communist Party, Revolutionary Socialist Party, and the Pacifist Socialist Party. Swedish left parties include Social Democrats, Left Socialists, Communists, Hoglund Communists, Socialists, and Kilborn Communists. Left parties in the UK include Independent Labour Party, Labour Party, National Labour, Communist Party, and Social Democratic and Labour Party. For Canada, the source for this data is Mackie and Rose 1991. The Canadian Labour Party is coded a left party but the Candian Liberal Party is not. For Japan, the source for this data before 1945 is Scalapino 1968 and after 1945 is Mackie and Rose 1991. The Japanese Socialist Party is coded as a left party. For Spain, the source for this data is Caramani 2000. Spanish left parties include the

The definition of the variable % Electorate varies across the four participant countries and as such is only used in the individual country analyses. For France and the UK, it is equal to the percent of the enfranchised population defined by age and sex that is eligible to vote.<sup>29</sup> For the US, % Electorate is equal to the percent of adults 21 years of age or older that are eligible by law to vote.<sup>30</sup> For Canada, % Electorate is equal to the percent of the total population that is registered to vote.<sup>31</sup>

The Top Rate series for each country is modeled as:

$$TopRate_t = \alpha + \beta WWI_t + \gamma \mathbf{X}_t + \varepsilon_t$$

where t indexes year;  $Top\ Rate$  is the top tax rate measure; WWI is the key measure of war mobilization,  $WWI\ Mobilization$ ;  $X_t$  is a vector of control variables and is excluded in the initial regression for each country;  $\alpha$ ,  $\beta$ , and  $\gamma$  are parameters to be estimated; and  $\epsilon_t$  is the error term. We report Newey-West standard errors to account for serial autocorrelation.<sup>32</sup> The initial specifications that exclude the control variables are essentially difference-in-means tests before and after the start of the war. The specifications that include the control variables make this same comparison but adjust for before and after differences in the top rate that are a function of levels of economic development, the representation of Left parties in the legislature, and the extent of the franchise.

Table A1 reports the ordinary least square estimates for this analysis for each country. In the specifications without control variables, the estimated coefficient for the variable WWI Mobilization ( $\beta$ ) is positive, statistically significant, and ranges in magnitude between 35.5 for France and 45.7 for the US. This confirms the before and after differences apparent in Figure 1 in the paper. Participant countries raised their top marginal tax rates during the

Socialists and the Communists. Following Bartolini's classification, the Democratic party is not coded as a left party and therefore the US is always coded a zero.

<sup>&</sup>lt;sup>29</sup>The source of this data is Flora 1983.

<sup>&</sup>lt;sup>30</sup>The source for this data is Rusk 2001, 50.

<sup>&</sup>lt;sup>31</sup>The source for this data is Elections Canada, "A History of the Vote in Canada," "Appendix, Voter Turnout Since Confederation," 2007, available at <a href="http://www.elections.ca/">http://www.elections.ca/</a>>. Accessed 15 May 2010.

<sup>&</sup>lt;sup>32</sup>The results reported assume a single-period lag in the calculation of the Newey-West standard errors though they are robust to longer lag structures.

war and kept them at higher levels throughout the decade that followed. The resulting average increase was quite large—around 40 percentage points.

A strength of this initial analysis is that the comparisons are within countries and not threatened by unobserved country differences. A weakness of the analysis is that for it to be a reliable estimate of the effect of the war, one must assume that top income tax rates would have remained approximately the same had each country not participated.

We can relax this assumption somewhat by including time-varying control variables for levels of economic development, the representation of left parties in the legislature, and the extent of the franchise. Table A1 reports these results for each of our four cases. Inclusion of the control variables has a substantial effect on the magnitude of the estimates for Canada, the UK, and the US, but in all four cases the differences in top rates after entry into the war are positive and statistically significant at least at the 0.10 level.<sup>33</sup>

For Canada, the available GDP per capita data does not start until 1920 and so this variable is omitted from the analysis. The estimates for Left Seat Share and % Electorate are not statistically significant, but their inclusion reduces the estimate for WWI Mobilization to 23.2 with a standard error of 12.5 (p-value is 0.075). For France, all three control variables are available, but none of the coefficient estimates for these measures are statistically significant and their inclusion has no impact on the estimated effect of WWI Mobilization (34.9 with a standard error of 6.7 and p-value equal to 0.000). For the UK, again all three controls are available. In this case, there is some evidence of the expected positive correlation between the percent of the electorate enfranchised and the level of the top income tax. The estimate for % Electorate is 1.0 with a standard error of 0.4 indicating that a 1 percentage point increase in the eligible electorate is associated with a 1 percentage point increase in the tax rate. This is a relatively large and substantively meaningful estimate. The inclusion of the control variables results in a coefficient estimate for WWI Mobilization of 19.7 with a

<sup>&</sup>lt;sup>33</sup>It is worth noting that further inclusion of the *Revenue to GDP* variable discussed in the paper generates somewhat mixed results. With this measure added to the single country analyses for 1900 to 1930, war mobilization is significantly associate with a higher top rate in France and the U.S. but not in Canada and the U.K. It is again worth noting that inclusion of the revenue variable does not significantly influence the pooled estimates in Table 1 in the paper.

standard error of 10.3 (p-value is equal to 0.067). Finally, given that our coding of *Left Seat Share* is constant throughout for the US, this variable cannot be included in the US analysis. For the specification with control variables for the US, the coefficient estimate for *WWI Mobilization* increases to 83.7 and is precisely estimated.

Overall the evidence in Table A1 indicates that there remain, consistent with our argument, significant differences in top income tax rates before and after mass mobilization for the First World War controlling for levels of economic development, the representation of Left parties in the legislature, and the extent of the franchise. The weak results with respect to the extent of the franchise are undoubtedly explained by the fact that in all four war participants a large fraction of the adult male population had the right to vote well before the onset of the war. The results with regard to Left parties are more surprising given the common assessment that the aftermath of World War I was associated with the rise of the Left.<sup>34</sup>

## A.3 Interrupted Time Series Analysis, 1850-1970

In this section, we analyze the impact of mass warfare on progressive taxation for the period 1850 to 1970 and allow for heterogeneity in the effect of mass mobilization across the cases. We model the top rate of income taxation for the four countries in our sample that have experienced wars that required mass mobilization and for which we have data for nearly the entire 120 year period.

To select these cases, we construct a variable indicating whether or not a country engaged in mass warfare between 1850 to 1970. We constructed the variable *War Mobilization* equal to 1 if in a particular year, the country was engaged in an interstate war and at least 2 percent of the population was serving in the military and equal to 0 otherwise.<sup>35</sup> The merits of this measure and the alternatives that we examined are discussed in the main text of the paper.

<sup>&</sup>lt;sup>34</sup>Our results regarding the absence of an effect of partisanship on top tax rates parallel those of Atkinson and Leigh 2007.

<sup>&</sup>lt;sup>35</sup>Our data for incidents of war comes from the Militarized Interstate Dispute Data, Version 3.0 2003. Our data on mobilization is from the Correlates of War Project, National Material Capabilities Data, Version 3.0 2005.

For our eight countries, six—Canada, France, Japan, the Netherlands, UK, and the US—experience mass interstate wars and two do not—Spain and Sweden. Our series for Canada is missing both mobilization data and *GDP per capita* data before 1920, and so we omit it from our individual country time series analysis. Similarly, the Netherlands has missing data problems that prevent an ideal time series analysis.

The dependent variable for this analysis is the *Top Rate* variable described above. The main independent variable is *War Mobilization* and the control variables are *GDP per capita*, *Left Seat Share*, and *% Electorate* as defined above.

The *Top Rate* series for each country is modeled as:

$$TopRate_{t} = \rho TopRate_{t-1} + \alpha + \beta WarMobilization_{t} + \gamma X_{t} + \theta T + \varepsilon_{t}$$

where t indexes year;  $Top\ Rate$  is the top tax rate measure;  $War\ Mobilization$  is the key measure of participation in mass warfare;  $X_t$  is a vector of control variables and is excluded in the initial regression for each country; T is a linear trend variable;  $\rho, \alpha, \beta, \gamma$ , and  $\theta$  are parameters to be estimated; and  $\epsilon_t$  is the error term. Note that because some countries experience more than one case of mass warfare in this analysis, our modeling strategy has changed in at least two important ways. First, rather than coding mass mobilization in terms of before and after, the variable  $War\ Mobilization$  is simply equal to one for mass mobilization war years and zero otherwise. Second, we include a lagged dependent variable to model the dynamics for the top rate series as an autoregressive process in which current realizations of the top rate variable depend on past realizations. These two changes in the specification are important for interpreting the results. Any shift in top rate taxation due to mass mobilization from war has a long run impact that is a function of precisely how responsive current values of the top rate are to past realizations.

Table A2 reports the ordinary least square estimates for the analysis for each country. Across all eight specifications, the coefficient for the variable War Mobilization ( $\beta$ ) is positive and in all but one—Japan in the specification without controls—statistically significant.<sup>36</sup>

<sup>&</sup>lt;sup>36</sup>Note that in specifications which also add the variable Revenue to GDP, the positive coefficient estimate

These results are consistent with the main claim of the paper that mass warfare raises the demand for progressive income taxation. The estimate of  $\beta$  divided by one minus the coefficient on the lagged dependent variable yields the implied long-run effect of war mobilization on top tax rates. In the specifications with control variables, this estimate is equal to 53.8, 21.6, 108.3, and 74.1 for Canada, Japan, the UK, and the US respectively. Although there is significant variation in the magnitude of these estimates across countries, the substantive size of the estimated effects is quite large. At least for these cases, it appears that mass warfare matters a lot for how progressive the tax system is and that these effects persist. It is particularly interesting that we observe this effect, though somewhat smaller in magnitude, for Japan which would not conventionally be described as democratic for the years in which it experienced mass warfare.<sup>37</sup>

The results for the control variables are generally negative. There is little evidence in the individual country time series that GDP per capita, Left Seat Share, and % Electorate are systematically related to the top tax rate measure. Two partial exceptions to this generalization are the estimate for % Electorate for France and the estimate for Left Seat Share for Japan. The estimated coefficient for % Electorate for France is equal to 0.345 with a standard error of .191 and p-value equal to 0.074 and the estimate for Left Seat Share for Japan is 0.114 with a standard error of 0.068 and p-value equal to 0.099. Each of these estimates is suggestive of the expected impact of the expansion of the franchise and political representation of the Left on progressive taxation.

Overall, the evidence in Table A2 resonates strongly with our analysis of the First World War and with the pooled analysis in the text. Examining the record of income taxation from 1850-1970 suggests that countries that experience wars that require mass mobilization increase their top income tax rates substantially, and this response has long run consequences for the progressivity of the tax system. There is much less evidence consistent with the usual

for War Mobilization remains for all four countries.

<sup>&</sup>lt;sup>37</sup>The smaller magnitude but significant effect for Japan is consistent with the main argument of the paper that mobilization for mass warfare increases tax progressivity generally but is also consistent with the possibility that this effect may be greater in democracies, a possibility for which the test discussed in the paper does not find evidence for but for which the paper suggests merits further research.

claim that expansion of the franchise and the rise of Left parties have driven progressive income taxation over the long run. As we pointed out in the discussion of the First World War results, the country time series analysis has the advantage of allowing heterogeneity in the impact of war on taxation but relies heavily on assumptions about how well we can project what would have happened to tax rates in the absence of mass warfare. In this long run analysis, we rely on the assumption of an autoregressive process with a single lag, a linear time trend, and our control variables. The analysis in the text pooling the data from all eight of our cases including information from countries that did not participate in mass warfare in the same years as others to construct an alternative set of comparisons for estimating the effect of war mobilization.

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	Canada		France		UK		US	
WWI Mobilization	42.012	23.162	35.529	34.915	41.246	19.694	45.740	83.667
	(8.500)	(12.512)	(6.692)	(6.749)	(4.763)	(10.295)	(8.104)	(9.393)
	0.000	0.075	0.000	0.000	0.000	0.067	0.000	0.000
GDP per capita				2.906		-0.699		-14.459
				(10.168)		(5.317)		(8.175)
				0.777		0.896		0.088
Left Seat Share		-21.236		-0.183		-0.052		
		(32.364)		(0.606)		(0.212)		
		0.517		0.765		0.807		
$\%\ Electorate$		1.936		1.455		1.046		-0.570
		(1.435)		(1.166)		(0.436)		(0.222)
		0.188		0.223		0.024		0.016
Observations	31	31	31	31	31	31	31	31

Table A-1: World War I and Progressive Income Taxation, 1900-1930, Individual Country Estimates. The Table reports the results of OLS regressions for the variable *Top Rate* on the indicator variable for mass mobilization in World War I, *WWI Mobilization*, and various control variables for the years 1900-1930. The table reports the OLS coefficient estimates for each variable, their Newey-West standard errors in parentheses, and p-values. A constant term is included in each regression but not reported in the table.

	France		Japan		UK		US	
$Top \ Rate_{t-1}$	0.923	0.925	0.827	0.730	0.963	0.952	0.912	0.922
	(0.036)	(0.037)	(0.052)	(0.067)	(0.015)	(0.022)	(0.034)	(0.048)
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$War\ Mobilization$	6.364	4.036	2.740	5.823	4.831	5.198	4.938	5.780
	(1.614)	(1.780)	(2.392)	(2.830)	(0.923)	(1.020)	(2.786)	(2.864)
	0.000	0.025	0.255	0.042	0.000	0.000	0.079	0.046
$GDP\ per\ capita$		0.253		-0.304		-0.373		-0.774
		(0.482)		(0.445)		(0.532)		(0.496)
		0.601		0.496		0.485		0.122
Left Seat Share		0.036		0.114		0.030		
		(0.058)		(0.068)		(0.037)		
		0.530		0.099		0.414		
$\%\ Electorate$		0.345				0.010		0.004
		(0.191)				(0.038)		(0.078)
		0.074				0.799		0.959
Year	0.051	0.017	0.151	0.233	0.039	0.046	0.076	0.136
	(0.028)	(0.043)	(0.046)	(0.065)	(0.017)	(0.058)	(0.036)	(0.058)
	0.069	0.687	0.001	0.001	0.021	0.428	0.036	0.020
S.E.R.	5.222	4.709	4.681	4.811	2.720	2.736	6.980	6.966
Observations	121	116	111	101	121	121	121	121

Table A-2: War Mobilization and Progressive Income Taxation, 1850-1970, Individual Country Estimates. The Table reports the results of OLS regressions for the variable *Top Rate* on its lagged value, the indicator variable for mass mobilization in war, *War Mobilization*, a year trend, and various control variables for the years 1850-1970. The table reports the OLS coefficient estimates for each variable, their standard errors in parentheses, and p-values. A constant term is included in each regression but not reported in the table.