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A Wealth Tax on the Rich to Bring Down Public Debt? Revenue and Distributional Effects of a Capital Levy in Germany

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Appendix A. Imputation of the top wealth distribution

Whereas the SOEP survey contains few observations above €5 million of net wealth per person, the *manager magazin* (2007) list of the 300 richest Germans starts at a personal net wealth of €300 million. We assume this list represents the very top tail of the German wealth distribution and combine the two data sources to model the whole wealth distribution. To this end, we impute the wealth distribution between the highest level of wealth reliably observed in the SOEP and the lowest level of wealth contained in the *manager magazin* list.[1]

Following usual practice,[2] we estimate the unobserved top tail of the wealth distribution on the basis of the Pareto distribution that has density function

$$(1) \qquad f(x) = \begin{cases} \dfrac{\alpha}{x_{\min}} \left(\dfrac{x_{\min}}{x} \right)^{\alpha+1} & x \geq x_{\min} \\ 0 & x < x_{\min} \end{cases}$$

The coefficient α determines the shape of the Pareto distribution. The wealth level $x_{\min}$ is the lower bound of the part of the wealth distribution that we want to estimate. The coefficient α can be estimated by a linear regression of log wealth ($\ln W$), on the log of the number of people with wealth above $x_{\min}$, which is equal to the s rank of $\ln W$ in the wealth distribution:[3]

$$(2) \qquad \ln W = \beta \ln r + \varepsilon$$

[1]See Davies (1993) for a similar approach.
[2]See, for example, Davies and Shorrocks (2000).
[3]See Davies and Shorrocks (2000) or Cowell (2011).

where $\ln r$ is the log rank and ε is an approximisation error. Equation (2) is estimated on the sample of people with personal net wealth of at least €300 million. The Pareto coefficient α can then be estimated by

$$\hat{\alpha} = -\frac{1}{\hat{\beta}} \tag{3}$$

where $\hat{\beta}$ is the ordinary least squares (OLS) estimate from equation (2).[4] Plugging $\hat{\alpha}$ into the density function (1), we can simulate the top tail of the wealth distribution, which represents the distribution of the 300 richest people in Germany.

To simulate the wealth distribution between $x_{\min}$ and the highest level of personal net wealth observed in the SOEP, which amounts to about €5 million, we impute artificial observations using the Pareto density (1) and $\hat{\alpha}$. Since the imputed artificial observations represent 90,000 individuals whereas the deleted SOEP observations above €5 million represent only 40,000, we adjust the weights of the SOEP cases starting from €5 million, assuming that personal wealth somewhat below this level is also Pareto distributed. The original sum of weights is achieved at a personal net wealth of €2 million. There are about 60 observations with personal net wealth of between €2 million and €5 million in the SOEP. To test whether the estimated Pareto distribution is not rejected in the representative part of the SOEP, we have re-estimated $\hat{\alpha}$ for the richest individuals in the SOEP and checked whether the estimated coefficient lies in the confidence interval (see below).

The big fortunes reported in the *manager magazin* (2007) list of the 300 richest Germans are often owned by families rather than single individuals. While for some of these cases the list also contains information on the number of family members, for others we have to make assumptions about family size to estimate the level of individual family members' wealth. To check whether the estimated coefficients of the Pareto distribution are sensitive to different assumptions about family size (n), Table A1 shows the estimated coefficients for alternative values. In column 4, we show estimation results under the assumption of four people per family, which is most plausible in our opinion. If a person's wealth falls under €300 million because of the splitting procedure, he or she is dropped from the estimation sample to avoid confounding the comparison of estimation results by family size.

[4]For a derivation, see Levy and Solomon (1997), for example.

TABLE A1

Estimated parameters of the Pareto distribution

	Family size					*SOEP 'top 100'*
	n=1	*n=2*	*n=3*	*n=4*	*n=10*	
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
$\hat{\beta}$	–0.85	–0.81	–0.78	–0.74	–0.68	–0.71
	[–0.90;–0.81]	[–0.86;–0.76]	[–0.83;–0.73]	[–0.79;–0.70]	[–0.70;–0.66]	[–0.75;–0.68]
$\hat{\alpha} = -1/\hat{\beta}$	1.17	1.23	1.29	1.34	1.47	1.40
	[1.12;1.24]	[1.16;1.31]	[1.21;1.38]	[1.27;1.43]	[1.42;1.52]	[1.33;1.47]
R^2	0.97	0.96	0.96	0.96	0.98	0.99
No. of obs.	355	409	405	404	443	109

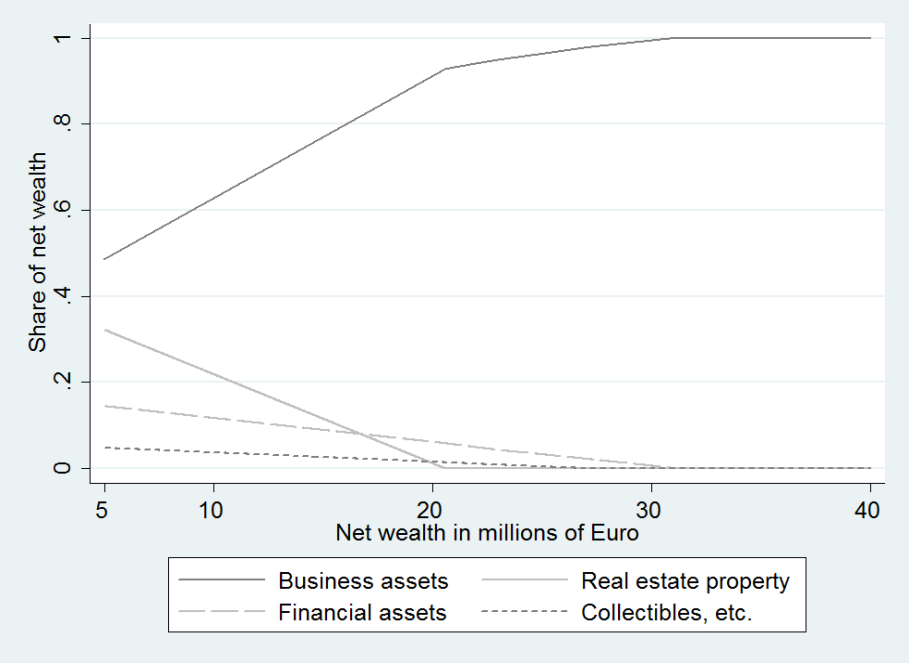
Note: Bootstrapped 95 per cent confidence intervals are given in square brackets. Note that the confidence intervals of $\hat{\alpha}$ are asymmetric due to the non-linear transformation.

The more family members are assumed, the smaller the wealth concentration is at the top and the larger $\hat{\alpha}$ is. The last column of Table A1 shows the result for the 'top 100' SOEP cases, who have net personal wealth of at least €1.5 million, which is quite near to the starting point of our assumed Pareto distribution. In the SOEP sample, wealth can be assigned to every person in the household. The estimated coefficient of 1.40 from the SOEP sample lies in the confidence interval of n=4 as well as the one for n=10, whereas the estimated coefficients under the assumption of fewer than four family members are significantly different and less suitable for the simulation of net personal wealth at the top of the distribution. We consider it reasonable to assume that the spouses have a claim to an equal share of the family wealth each. Under this assumption, the estimated Pareto coefficient for n=2 would not differ significantly from our benchmark estimate for n=1. If there were further 'shareholders' of the family wealth, n=4 might be a suitable assumption and is the one we use in our approach. The Pareto coefficient estimated under this assumption differs significantly from our benchmark estimate, where n=1.

The wealth components for the imputed cases – in particular, business property, real-estate property, financial assets and other assets (for example, collectibles) – are derived on the basis of a system of share equations as a function of the log of net wealth. This system is estimated on the subsample of individuals with net wealth of at least €1 million in the SOEP. Figure A1 shows estimated shares of wealth components in the imputed range of the wealth distribution. These estimates imply that the share of business property including shares is increasing in total net wealth and converges towards 1. At a level of net wealth of about €30 million, the predicted business share becomes 1, which is partly an implication of the specification of the share equation.

FIGURE A1

Predicted shares of wealth components for the imputed cases



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Appendix B

TABLE B1

Assets and liabilities of households in Germany according to national and financial accounts statistics, end of 2007

Assets	*€bn*	*%*	*Liabilities*	*€bn*	*%*
Fixed assets	5,463	50.5	Loan and other liabilities[b]	1,530	14.1
Dwellings	3,432	31.7	Consumer loans	198	1.8
Land underlying dwellings	1,483	13.7	Mortgage loans	1,037	9.6
Other buildings	379	3.5	Entrepreneurial loans	286	2.6
Land underlying other buildings	46	0.4	Other liabilities	9	0.1
Other fixed assets[a]	124	1.1			
Financial assets[b]	4,424	40.9			
Currency and deposits	1,575	14.5			
Currency and transferable deposits	630	5.8			
Savings deposits and certificates	945	8.7			
Mutual funds shares	508	4.7			
Claims on insurance corporations[c]	1,227	11.3			
Short-term claims	81	0.7			
Longer-term claims	1,146	10.6			
– with life insurance companies	718	6.6			
– with health insurance schemes	135	1.2			
– with pension funds	293	2.7			
Company pension commitments	255	2.4			
Securities	859	7.9	Net wealth	9,296	85.9
Bonds, money market papers	315	2.9	*Net wealth less consumer durables, company pension commitments, claims with health insurance schemes, currency and transferable deposits, consumer loans*	*7,242*	*66.9*
Shares	356	3.3			
Other equity	188	1.7			
Consumer durables of households	939	8.7			
Total	10,826	100.0	Total	10,826	100.0

[a]Machinery and equipment, cultivated assets and intangible fixed assets.
[b]Excluding non-profit institutions serving households.
[c]Including private pension funds as well as occupational pension schemes and supplementary pension funds, including accumulated interest-bearing surplus shares with insurance corporations.
Source: Federal Statistical Office, national accounts; Deutsche Bundesbank, financial accounts.