Estimating the value of land from Prussian wealth tax data

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Introduction: The basic problem

One of the most vexing problems in estimating national wealth is valuing the land: One survey of national wealth estimates for 19 countries found that in 8 cases no estimate of land value was even made, and only one of the remaining eleven appeared to use market prices to value the land.[1] Since this last was Yugoslavia in 1953, where urban land prices stood at only 1/5 of their 1938 level relative to building costs, and agricultural land prices only 1/3 relative to crop prices (Vinski 1959, p. 166n), these cannot have been free-market prices. In the countries surveyed, when an estimate was made, that estimate was forced to use indirect methods such as a ratio to other assets or valuation by "experts." In other words, in the 11 cases in which a land value was actually reported, it was more or less a guess.

What accounts for this state of affairs? The first and simplest answer is that market price data usually do not exist. Faced with high costs and owner resistance, no one collects systematic data on land prices.[2] The second problem is that land has value other than in production: it may confer prestige or political power, or be a badge of success, for example. Moreover, it is often difficult to separate the value of land from that of the structures on it. Otherwise identical properties of different sizes might sell for different unit values if there are transactions costs to engrossing or parcellization and imperfections in the credit markets or markets for labour and other inputs. Rights attached to the land, such as fishing, hunting, but above all water rights, also are capitalized into the price, as can be externalities resulting from location.

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[1] Goldsmith, Saunders, and van der Weide 1959, pp. 24-29.

[2] "The need to obtain basic data either in terms of market values, or in terms that can be converted to market values, imposes perhaps the most difficult restraint on wealth data collections." (Kendrick 1967, p.61.)

Earlier studies of national wealth, facing the same problems, used such indirect methods as capitalizing net yields, extrapolating insurance valuations or face amounts of mortgages, and the so-called "de Foville method," which involved using data on inheritances and estimating the length of a generation and the share of land owned by non-physical legal persons which never went through probate.[3] A principal problem of these indirect methods is that they usually give widely divergent results for the same country or area, because of the problems enumerated above.

When different people use the same or different methods, the assumptions they have to make often lead to sharply differing estimates. Antal Bodor (1927, p. 34) cites three estimates for the value of land in Hungary: 10 billion crowns in 1885 by Béla Földes, 8 billion by Sándor Wekerle in 1896, and Frigyes Fellner's average of 15.7 billion ca. 1900.[4] Here the ratio of the high and the low estimates is nearly 2:1; since the dates of Fellner's and Wekerle's estimates are so close together this cannot be the result of an increase in land prices. A similar ratio held for Germany: Hoffmann's (1965) estimate of the value of agricultural land (including forests) in 1913 was 73 billion marks, but Helfferich's (1917, p. 110) only 40 billion, for the same year.

In an agrarian society, ownership of land is the principal determinant of wealth and status, and in such a society land is normally the primary component of national wealth. For both social and economic reasons, therefore, interest in the ownership of land is very strong. The landowners' own interest typically is to limit information about the extent and value of their holdings, a goal which – given their socio-political power – they can usually realize. Without direct evidence of the value of land, to estimate its value therefore normally requires an indirect approach. Typical approaches are to use an appropriate multiplier to "gross up" land taxes (tax value), to capitalize the value of the (estimated) yield or rent from land (yield value), to extrapolate mortgage valuations of some properties to cover all land (credit value), or to apply the de Foville (1883)

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[3] For example, if a generation was 30 years, then 1/30 of land owned by persons would be inherited in a given year. If non-physical legal persons owned half the land, then its total value would be 30 times inheritances times 2.

[4] Fellner estimated his credit value for 1893, his yield value as the average for 1893-1901, and the de Foville value as the average for 1899-1903. Fellner 1905, pp. 7 - 12.

method: Assume that a generation is ***x*** years, then multiply the value of all land changing hands through inheritance in a given year by ***x***, figure out from that an average value for land and then assume that average also applies to land held by non-physical legal entities. The sum of the two is then the value of land in the area under consideration.

A principal drawback of using indirect methods is that they often give widely varying results, even when being estimated by the same person: For example, Friedrich Fellner used two or three different methods to estimate the value of land in Austria and Hungary, then took their mean as his point estimate. His figures looked as follows:

Country	Tax Value	Yield Value	Credit Value	de Foville Value	Max/min
Hungary, 1892	6143			8382	1.36
Hungary, ca. 1900		14,507	12,320	20,327	1.65
Hungary,s 1913	18,559		18,849	22,048	1.19

Sources: Hungary, 1892: Fellner 1893, p. 62. Value in forint.

Hungary ca. 1900: Fellner 1905, pp. 7-12. Values in crowns; 2 crowns = 1 forint.

Hungary 1913: Fellner 1923, pp.4-6.

Published estimates of national wealth

There have been two major waves of publication of estimates of national wealth in recent times. The first began in Europe around the turn of the century and continued on until the 1930s. Mostly German scholars, or scholars writing in German, published individual monographs, but also in such statistical journals as *Metron* and the *Zeitschrift des Internationalen Statistischen Instituts* [Journal of the International Statistical Institute]. The modern wave followed the work of Simon Kuznets, beginning in the mid-1950s; its major outlet was the series of volumes of essays *Income and Wealth*, which later became a quarterly journal, *The Review of Income and Wealth*, although many individual monographs were also published.

For Germany including Prussia, the first partial guesses about national wealth appear to be those of Krug (1805), followed by Dieterici (1846). To my knowledge, Adolf Wagner (1903)

was the first to publish comprehensive statistics on German national income and wealth derived from tax statistics, but the best-known and most often cited early work is that of Helfferich (1917, first published 1913). There were also apparently estimates of national wealth by scholars named Ballod and Steinmann-Bucher, but they appear to be unavailable in Canada.

The most influential post-war book on German income and wealth is Hoffmann (1965). Besides being the basis of Goldsmith's (1976) previously-cited work, an entire cottage industry has grown up in Germany aimed at reworking Hoffmann's sometimes ill-documented and obscurely-worked-out estimates of all sorts of economic data besides those of national wealth. Because much of Prussia disappeared into Poland after World War I, and even more after World War II, I will not be referring in my study to national wealth estimates for the post-war territory of Germany.

1.Evaluation of land prices

Because the literature is so voluminous, I will confine myself to Prussia, and further only to those works which I have found most useful. As previously mentioned, the Prussian Statistical Office compiled, using nearly *two million* individual observations from the data on land sales collected by the local cadastral offices, a set of comprehensive tables of the distribution of prices in various regions and based on size and tax criteria (PSL 1917). Using annual data published in the Prussian Statistical Yearbook, Walter Rothkegel (1910a, 1910b) claimed that the land tax data no longer had any relation to selling prices. He appeared to confuse the size of the multiple (price/tax) with its variance; but even government officials close to the land market argued that the connection between the two had been broken (SC 1906).[1] I think I have demonstrated conclusively (Eddie 1993) that tax valuation was an excellent proxy for market price of land, even in 1913, despite all the economic changes that had occurred in the previous half century. *Land tax assessments can therefore be used as proxies for land value, especially if one confines oneself to smaller regions*.

None of the works on land prices have used what we would consider standard modern

[1] A self-serving argument, since the Settlement Commission was trying to persuade higher officials not to be bound by the tax assessments in approving special purchases.

statistical techniques (regression, analysis of variance, etc.). Some of the most careful of what I would call mainly crosstab analyses are Sarrazin (1897) and his direct successor Chrzanowski (1914), who saw relatively low prices in the province of Posen as a result of low yields, often as not the result of poor technique. As yields and market opportunities increased, so did land prices. Evert (1902) already pointed out the great geographical disparities in land values, with differences of greater than 4:1 in value per hectare between the lowest and highest regions of Prussia. Despite these disparities, a later study found that *although there were large disparities in price per hectare, average price per mark of tax assessment hardly varied* from West to East in Prussia (PSL 1915, p. 1), implying that buyers of land adjusted for quality, just as one would expect. I intend to check this claim against my data, but if the result is correct, it would be very useful for estimating values in those ridings for which I will not be able to find the records of individual transactions.[2]

A frequent claim in the literature is that small properties cost more per hectare than large ones (Kollmann 1895, Chrzanowski 1914). This is usually attributed simply to greater demand for small properties, with an implication of imperfection in capital or labour markets as the cause (PSL 1917, p. iii). Regression analysis (using a dummy variable for size) on the pilot riding for this project, however, showed a premium of nearly 20% paid for properties larger than 100 hectares (Eddie 1997)[3]. Since knightly properties (*Rittergüter*), which entitled their owner to a seat in the local or provincial assembly, were typically large, this variable could have simply been a proxy for the price paid for political influence. In the present paper I include both a dummy variable for *Rittergut* and another for large property. The results (see below) are that a considerable premium was paid for the political influence, but the premium paid per hectare for a large property accounted for an even greater increase in the price. Note that my data show a premium, not a discount, contrary to the beliefs of contemporary observers. My guess is that smaller properties appeared to command a premium because they typically sold for a higher average price per hectare, but that was a composition effect: these properties usually contained

[2] Other data are not so useful: foreclosure auctions, for example, are a poor source of data (Christophe 1910).

[3] Reprinted in Komlos and Eddie 1997.

much higher shares of land types that sold at high prices per hectare (especially ploughland), while large properties had much larger shares of lower-valued land (forest, waste, moor). Because the regression analysis controls for these effects, the true nature of the price emerges: a premium for a large property, *ceteris paribus*.

Some price data can also be gleaned from the Prussian government's purchases of land to parcel out to German small farmers, as part of its anti-Polish demographic policy (SC 1887-1918). Most works on this issue aver that the government overpaid (Belgard 1907, Tonnies 1923, Landau and Tomaszewski 1986); even the very agency that did the buying thought that was the case (SC 1907). The most reasoned case against this view can be found in Chlapowski (1913), in which he argued that they did not overpay for the properties, but they did botch the administration and parcellization, which therefore cost much more than they should have.[4] I have also made the case (Eddie 1993) that general overpayment is unlikely to have been the case, but the data on private transactions in land offer the opportunity to settle this question definitively.

The only study to my knowledge ever to use the data from the Prussian wealth tax records was a dissertation on land prices in the district of Minden-Ravensburg written at the University of Gießen (Hopmann 1929), and the only one to use the data from the land tax cadastre volumes a dissertation at the University of Jena on agricultural development in middle Silesia (Boenisch 1894). Hopmann analyzed 3474 individual transactions, for properties with and without buildings, using the included tax assessment data to classify properties by size and quality of land. Hopmann also found price per hectare greater for smaller properties, a fact he attributed primarily to a higher share of buildings and movable inventory in the value of the property as a whole for smaller properties compared to larger ones (p. 45). Because of the form the summary price data take in PSL 1917, I will ultimately be using a variant of Hopmann's technique to infer prices in those ridings for which I do not find the original data.

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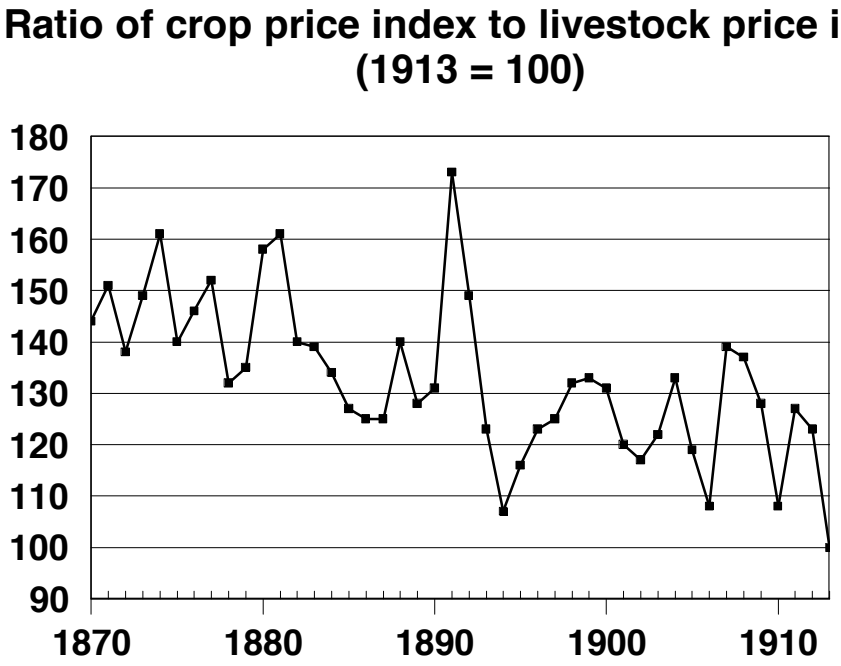
[4] Schultz-Klinken (1973, p. 205) quotes a report from Max Sering, a very influential agricultural economist, to the government in 1915 that the Settlement Commission "had worked outstandingly, but expensively."

Estimating land values from actual market prices

Indirect methods to estimate the value of land have to do, as pointed out above, when direct evidence in the form of reliable data on land prices is not available. Prussia after 1893 is an exception to that rule: As part of the tax reform enacted in that year, Prussia introduced a wealth tax which applied to land as well as to other assets. The cadastral offices in each riding (*Kreis*), which were responsible for the land tax, were also charged with the duty of gathering data on land purchases for purposes of the wealth tax. On a pre-printed form sent out from the Ministry of Finance, the cadastral office had to report details of each sale of land occurring within its territory. The data included the price paid, whether the sale was between relatives or a forced auction;[5] the area and taxable net yield (*Grundsteuerreinertrag*) of each type of land in the property; the taxable value of buildings on the property; the existence and condition of inventory, standing crop or wood; and whether or not there was an inn or "industrial establishment" such as a brick works or starch factory on the premises. The cadastral officers used their knowledge of the local market to make adjustments to the raw sale price, if warranted, for such things as a discount for a relative or the value of an inn to arrive at a "net price" *(Reinpreis*) for the property. This was obviously the value to be used in determining any wealth tax liability.

The data recorded by the cadastral office include nearly everything that could determine the price of land in the local area. It is particularly fortunate that they include the area and tax assessment of each type of land, for the tax assessments had not changed since the 1860s, but agricultural prices had. The taxable net yield was the income a given piece of land could be

[5] *Zwangsversteigerung*. Such could occur in cases of mortgage foreclosure or non-payment of taxes, for example.



Source: Jacobs and Richter 1937

expected to yield under normal management, based on its quality and primary use,[6] and the prices of farm produce in the local area. Since the price of field crops relative to livestock had trended down at least since 1870 (see chart 1), we would expect that – *ceteris paribus* – the price of pasture land would have risen relative to the price of ploughland, for example.

Basic procedure

Originally conceived as part of ongoing work on the distribution of landed wealth in Prussia, this project took on a life of its own with the discovery of the existence of detailed data on individual property transactions. Where at first the question was "how rich were the great landlords?" it has now become "How valuable was the land, and how does this compare to earlier estimates of its value?" Goldsmith (1976, p. 155) shows a near sextupling of the value of land in

[6] In Angerburg riding, our case study area, there were 8 quality grades of ploughland, meadow, and woodland; 7 of pasture; 5 of garden; and 2 of water and moorland. Unproductive land, farmyards, roads and pathways, and lands devoted to public uses were not taxed.

Germany between 1850 and 1913, and an increase of 2.3 times between 1895 and 1913 alone. My data will allow a direct comparison to these latter two dates. Goldsmith himself points out (1976, p. 154) that in the estimates of Hoffmann (1965) on whom he relies, "the margin of error is undoubtedly largest in absolute terms ... in those of agricultural land and buildings."

The data collected for the wealth tax allow us to use a hedonic regression to estimate the coefficients of the determinants of net price of the land. The tax assessment values (net yield: *Grundsteuerreinertrag*) of the various land types – ploughland, meadow, pasture, woodland, etc. – make up the "characteristics" which are the principal independent variables in the regression, which takes the form of

Deflated net price = f (Ploughtax, Meadowtax, Woodtax, ..., Shift parameters, Trend)

The shift parameters are included to allow us to remove the value of buildings, as well as the political value of a knightly estate, from the price paid for a landed property. The trend in land prices relative to other prices must be included because although the prices paid are all deflated to 1913 marks and the estimate is for the 1913 value of the land, there are observations from other years in the data set. Deflation by a general price index to marks of 1913 purchasing power does not necessarily capture the trend in land prices, which can move more than, or contrary to, the movement in the general price level.

The coefficients of the "characteristics," the tax values of the various types of land, since they represent the number of marks paid per Thaler of tax valuation of each type of land, can then be multiplied times the total tax value of each type of land in a given region (from the land tax assessments: *Grund- und Gebäudesteuer-Veranlagung*); the sum of these products is then the estimate of the market value of agricultural and forest land *per se* in that district. Details of the procedure will be further elaborated in the section on estimates from the pilot riding presented below.

The case study riding

The riding of Angerburg in East Prussia (today W gorzewo in Poland) lay about 100 km S.E. of the city of Königsberg (today Kaliningrad, an exclave of Russia). Besides being remote, it was also poor, with taxable value of land per hectare under 54% of the average of the seven

eastern provinces (the so-called "core provinces" of Prussia), as the following table shows:

Table 2: Taxable yields by administrative district (*Regierungsbezirk*)

Province	*Administrative District*	*Area (ha.)**	*Taxable Net Yield (Marks)*	*Taxable Net Yield per 100 hectares*
East Prussia				
	Königsberg	2,043,827	1,766,560	86.4
	Gumbinnen	1,531,651	1,120,666	73.2
Riding of Angerburg		89,765	60,379	67.3
West Prussia				
	Danzig	764,517	839,768	109.8
	Marienwerder	1,698,232	1,309,951	77.1
Brandenburg				
	Potsdam	1,985,848	2,314,966	116.6
	Frankfurt/Oder	1,841,582	2,041,581	110.9
Pomerania				
	Stettin	1,159,224	1,494,058	128.9
	Köslin	1,363,832	884,603	64.9
	Stralsund	43,609	81,426	186.7
Posen				
	Posen	1,690,305	1,572,970	93.1
	Bromberg	1,109,752	1,064,879	96.0
Silesia				
	Breslau	1,293,954	2,664,329	205.9
	Liegnitz	1,306,986	1,864,492	142.7
	Oppeln	1,268,261	1,698,304	133.9
Province of Saxony				
	Magdeburg	1,090,468	2,604,949	238.9
	Merseburg	965,345	2,987,463	309.5
	Erfurt	335,117	815,824	243.4
Overall for seven provinces		21,492,511	27,126,790	126.2

* All land potentially subject to tax, whether it was taxed or tax-free (e.g., lands owned by the Prussian state were tax-free, but they would become taxable if sold to a private owner).

Source: *Grund- und Gebäudesteuer-Veranlagung*, various issues.

The regressions were run using several different combinations of independent variables. To remove the effects of trend and such things as the value of buildings built into the price, the following variables were common to all regressions, but their coefficients were not used directly in the subsequent calculations, as explained above:

BLDGVAL: The taxable value of all buildings on the property, expressed in marks.

TBVTAX:: The (Year - 1913) x BLDGVAL (trend variable for the taxable value of buildings)

TGSRE: The (Year - 1913) x TOTALGSRE (trend variable for total taxable value of the property)

DKNIGHT: Dummy =1 if the property was a knightly estate (*Rittergut*), 0 otherwise.

DSIZEHA: Dummy = 1 if the property was >100 Ha., 0 otherwise. Multiplied times the number of hectares in the property, so the coefficient has the units marks/hectare.

NB: Since the base year for the value calculations was to be 1913, 1913=0 in the trend variables above. Initial regressions also used similar trend variables for DKNIGHT and DSIZEHA, but because these variables always produced insignificant coefficients, they were dropped from the final regressions.

The table which follows contains a representative subset of the regressions used to establish the price coefficients used in the subsequent calculations of market value of land. The dependent variable was the net price (i.e., after adjustment for such things as the discount for sale to a relative) deflated by the Jacobs-Richter wholesale price index to values in constant 1913 marks. The most obvious feature of these regressions is their tight "fit" to the data: Adjusted R-square values between 0.97 and 0.98 in all cases. On this criterion one would be hard put to choose among the various formulations: the simple regression using only total area or total tax assessment (plus the variables common to all regressions) to explain the net price paid fits as well as the more complex one using the information on taxable value of each individual type of land in the property.

The choice of model used does affect the calculation of land value, even if it seems to have

only trivial influence on R^2 (see Table 3); the choice will thus depend on other criteria.

TABLE 3 Alternative models of price regressions

	Regression Number				
Variable	I	II	III	IV	V
BLDGVAL	181.7	137.8	115.11	112.8	115.36
Std. Error	6.001	11.78	12.60	12.43	12.46
TBVTAX	-11.37	-6.796	-5.407	-5.332	-5.510
Std. Error	0.3979	0.8158	0.8572	0.8523	0.8539
DKNIGHT	22246	20309	17625	22942	22391
Std. Error	2947	3182	3199	3435	3466
DSIZEHA	40.98	125.97	109.8	101.3	101.6
Std. Error	12.66	11.28	11.53	11.92	11.99
TGSRE	3.671	-1.625	-3.190	-3.203	-3.061
Std. Error	0.3943	0.9616	1.018	1.008	1.012
TOTALHA	261.5				
Std. Error	20.69				
TOTALTAX		122.8			
Std. Error		13.89			
PLGDNTAX			155.8	146.75	146.6
Std. Error			16.64	16.72	16.87
MEADTAX			121.0	119.29	115.4
Std. Error			18.22	18.74	18.78
PASTAX			192.64	221.76	218.51
Std. Error			56.19	56.29	56.58
WOODTAX			636.86	796.1	761.5
Std. Error			120.8	130.0	130.3
WATRTAX				-1401.4	
Std. Error				401.8	
MOORTAX				3988	
Std. Error				3031	
WATRHA					-435.8
Std. Error					157.4
MOORHA					1075
Std. Error					789
UNTAXDHA				2690	2486
Std. Error				1059	1062
Adj. RSQ	0.978	0.974	0.975	0.976	0.978

In those models where they are included, note that the relative value of ploughland + garden to pasture has fallen, as our earlier look at the trend in the crop/livestock price ratio suggested it would: By 1913, an 1860s tax thaler's worth of land devoted to animal husbandry was worth more than an 1860s tax thaler's worth of cropland. Note also that areas of water appear to have become a nuisance, rather than an asset, since the coefficient for water is negative and significant.[7]

The value of including the trend variables and shift parameters is apparent from Table 3, which also sorts out the issue of the extra value of large properties: In addition to the premium of about 100 marks per hectare which a property in excess of 100 hectares commanded, the prospective purchasers also paid about 22,000 marks more if it were designated a knightly estate, which entitled its owner to a seat in the local or provincial legislature. The coefficient for the tax value of buildings is, as expected, positive and highly significant; the trend variables also all have very significant coefficients. By including these variables in the regressions we separate the value of these components from the value of the land *per se*, so the coefficients for the various land types more closely estimate the "pure" value of the land.

Using these latter coefficients to estimate the value of land in Angerburg riding in the various formulations of the price-determination model produces the results shown in the following table:

[7] This is similar to the situation in many urban areas, where the existence of a swimming pool actually *reduces* the value of the property on which it is located.

Table 4: Value estimate for 1913 in 1913 Marks

Land type and size or tax value	*Total for the riding**	Regr. I	Regr. II	Regr. III	Regr. IV	Regr. V
PLGDNTax	111324			17.34	16.34	16.32
PLGDNHa	*41123*					
MEADTax	47761			5.78	5.70	5.51
MEADHa	*13297*					
PASTax	6666			1.28	1.48	1.46
PASHa	*7943*					
WOODTax	10764			6.86	8.57	8.20
WOODHa	*14646*					
WTRTax	4609				-6.46	
WATRHa	*12651*					-5.51
MOORTax	12				0.05	
MOORHa	*51*					0.01
UNTAXEDHa**	*562*				1.51	1.40
WasteHa	38					
FarmyardHa	524					
OTHERHa	*613*					
TotalHa	89729	23.46				
TotalTax	181135		22.24			
Land Value Estimate (millions of 1913 marks)		**23.46**	**22.24**	**31.26**	**27.18**	**27.38**
Addition for knightly estates:		0.29	0.26	0.23	0.3	0.29
Addition for over 100 ha:		1.88	5.78	5.04	4.65	4.66
Grand total		**25.63**	**28.29**	**36.53**	**32.13**	**32.33**

* In Thalers or Hectares, as appropriate

** This is the sum of Waste and Farmyard

One interesting feature of the value estimates is that the simplest models, where price is assumed to be determined only by either total area or total tax value,[8] produce the lowest estimates for total value of the land. The higher values of the more detailed estimates demonstrate the value of using the hedonic regression estimations.

Some final remarks: According to the data of Table 2, Angerburg accounted for only 0.22% of the total assessed value of the seven core provinces. Suppose we take the estimate from regression V, and focus on its value of 27.38 million marks. If, as quoted above, the price paid per mark of tax assessment hardly varied across Prussia, this would imply that the farm and forest land of the seven core provinces was worth about 12 billion marks (27.38/.0022258 = 12.3 billion) . Later, more detailed work, will put this rough guess to the test.

In 1907 there existed 13 knightly estates in the riding of Angerburg, where properties of 100 hectares or more covered 45,896 hectares, or just over half the land in the riding.[9] Assuming the same values in 1913 and making the adjustments implied by the regression coefficients for the knightly estate and size dummies, we would add the amounts shown in the second- and third-last rows of Table 4 to get the adjusted, or "Grand Total" of the last row. Except for the estimates from the data of the very first regression, this adds 5 or 6 million marks to the total. For the more detailed regressions (numbers IV and V), which are the more preferable estimates to use, these adjustments add 18%, a not inconsequential amount, to the estimates of "raw" or "pure" land values.

[8] Plus, of course, the trend and shift variables common to all the regressions.

[9] Calculated from data appearing in Ellerholz (Ost-Preussen 1907), pp. 326-335.

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