



# John Komlos und Francesco Cinnirella: European Heights in the Early 18th Century

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# European Heights in the Early 18<sup>th</sup> Century

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Abstract: We estimate the height of various European populations in the first half of the 18<sup>th</sup> century. English and Irish male heights are estimated at c. 65 inches (165 cm), and c. 66 inches (168 cm) respectively. These values are below those obtained from the only other sample available for the period pertaining to British and Irish men, namely those of runaway indentured and convict servants in colonial North America, whose height is estimated as between 66.4 and 67.0 inches (168,7 and 170,2 cm). At c. 64.5 inches (164 cm) Saxon, German and Scotch military heights appear to be near the bottom of the European height distribution in this period. The English were about as tall as Bohemians and French, but shorter than the Irish and Hungarians. A large decline in English heights is evident among the birth cohorts of 1725-29, suggesting that the subsistence crisis of this period must have had a substantial lasting impact on the nutritional status of the cohort born during a time of nutritional deprivation.

## **Introduction**

Evidence on human physical stature is rare for the early 18<sup>th</sup> century. There are two exceptions, however. The French army was the first to record systematically the height of soldiers beginning with 1716 (Komlos et al. 2003), and the Saxon military followed suit in the 1730s (Hauptstaatsarchiv Dresden, Musterlisten). Yet, other evidence is scarce. In contrast, data for the second half of the century are plentiful, and these do provide some information on the height of men born beginning with the 1730s. In addition to the military,

the institutions of indentured and convict servitude also provide some scattered evidence on European physical stature, inasmuch as a number of servants ran away from their owners, and advertisements in North American newspapers seeking their return did often mention the servants' physical description (Komlos 1993a, 1999). Hence, the extant information on Europeans serving in North American armies is a significant source for the physical stature of men born in this period.<sup>1</sup>

The evidence assembled thus far indicates that biological welfare declined after the Middle Ages and reached a nadir in France, and quite likely in the rest of Europe as well, in the 17<sup>th</sup> century (Steckel 2004; Komlos et al., 2003). Living conditions improved thereafter reflecting improvements in climatic conditions and in agricultural productivity. Europeans were markedly shorter than the inhabitants of the New World throughout the 18<sup>th</sup> century – by as much as 3-10 cm (1-4 inches) and remained smaller than Americans during the subsequent two centuries, though the gap disappeared by the mid-20<sup>th</sup> century (Komlos 2001; Komlos and Baur 2004). This is even true for slaves (Komlos 1994). Europe, moreover, was about to experience a demographic explosion in the second half of the century which put downward pressure on food consumption with the consequence that the height of the population diminished after mid-century. This was the case everywhere in Europe so far examined: Ireland, Scotland, England, Bohemia, Galicia, Moravia, Hungary, Lower Austria, France, Bavaria, Sweden and Northern Italy (A'Hearn, 2003; Heintel, Steckel and Sandberg, 1998; Komlos 1985, 1989, Sandberg and Steckel 1987). Thus, the history of human height in the 18<sup>th</sup> century is one of recovery from 17<sup>th</sup> century lows, followed by a decline as the population's nutritional status diminished, brought about by increasing food prices and a shift away from protein consumption. While the 17<sup>th</sup> century nadir was never again reached, and a subsistence crisis was ultimately averted, in many cases not until the turn of the 20<sup>th</sup> century did European heights exceed the levels of the early 18<sup>th</sup> century. We now turn to new

evidence on Europeans serving in North American armies and of soldiers serving in the army of Saxony in order to expand our knowledge of the first half of the 18<sup>th</sup> century.

### **Data**

Nearly 5,000 data were collected pertaining to the militias and armies of Connecticut, Maryland, New York and Virginia (Table 1). Almost all (86%) of those adults (51 > age >22) who could be identified as European-born were from the United Kingdom, with Germany being the only other European country sufficiently represented to estimate mean height. Most of the height distributions deviate markedly from normality: minimum height requirement (MHR) of 64 inches appears to have been generally enforced (Figure 1). In addition, the height distributions of the English soldiers seem to have a shortfall also above 68 inches. This must have been the case because tall sailors were disadvantageous aboard ships, and as a consequence, fewer tall sailors were admitted into the Royal Marines and presumably also into the merchant marine (Komlos 1993b). To be sure, the Irish height distribution appears to be nearly normal (Figure 2), albeit this is not the case for sub-periods (not shown here).<sup>2</sup> The MHR of 64 inches is also evident among the German and Scottish soldiers (Figures 3 and 4). In the latter case, however, the maximum height requirement of 68 inches is also evident.

Insert Table 1 and Figures 1-4 about here.

In addition, c. 10,000 records on adult soldiers were extracted from the State Archive in Dresden, Saxony, in order to estimate the trend in the height of the male population. The height distributions show the enforcement of a MHR of 72 Saxon inches (169.9 cm) (1 Saxon inch = 2,36 cm) (Figure 5). The MHR was probably above the mean height of the population. In such cases A'Hearn (2004) has shown that the best results are obtained with using truncated regression, restricting the standard deviation to the modern value of 6.86 cm (Komlos 2004).

## Results

The estimated mean height of English, German, and Scottish soldiers are (65.3, 64.9 64.4 inches c. 163.6-165.9 cm) respectively for the period as a whole, while that of the Irish is somewhat greater, 66.1 inches (167.9 cm) (Table 2). Because of the small number of observations, the trends can be estimated only for height of the English, Irish and Saxon soldiers. The OLS results for the English and Irish heights are reported in order to show that the truncated regression estimates provide similar trends, though the levels are lower (Figure 5). While they are estimated independently, the Irish and English trends are similar, even if the Irish tend to be taller by about an inch. There is a very large decline in English heights in the 1725-29 quinquennium, and then again a slight decline in the 1740s and 1750s. Irish heights also dipped during the 1725-29 quinquennium. While the decline in height of the late 1720s appears implausibly large amongst the English, it is likely that nutritional status did decline in this period on account of the substantial subsistence crisis that struck the kingdom in 1729. The crude death rate increased from 28 to 36 in this quinquennium, never to reach that level again<sup>3</sup> (Wrigley et al., Ch. 8 and Table A9.1, 1997). Moreover, real wages declined in 1729 by c. 15% compared to 1727 and then rebounded by 24% by 1731 (Phelps Brown and Hopkins 1962). Hence, the decline in height in the late 1720s is plausible based on the evidence of mortality rates and real wages.

Table 2 and Figures 5 about here

## Conclusion

In some respects the new evidence on heights in the early 18<sup>th</sup> century does fit well into the hitherto known pattern, but in other respects it does not. The general trend agrees with those handful of estimates that do exist for this period: France, Bohemia, and Hungary, except that French mean heights are lower before 1725, and do not decline in the 1725 quinquennium as in the United Kingdom (Figure 6). Moreover, generally, agricultural populations tended to be taller than those regions which were more urbanized and more

advanced on the road to industrialization. Hence, Hungary had a taller population than Bohemia in the period considered (Figure 7), and in the current sample, too, Irishmen were taller than Englishmen. A similar pattern was found in a sample of convict servants of the late 18<sup>th</sup> century: English men were 65.8 inches (167 cm) Irishmen were 66 cm (167.6 cm) (Nicholas and Steckel, 1991, Table 4). The Irish advantage – at about half an inch - persisted into the 19<sup>th</sup> century (Floud et al. 1990, p. 201; Komlos, 1993b Figure 6; Mokyr and O’Grada, Table 5; Nicholas and Oxley 1993). The height of Saxon soldiers also fits into this pattern insofar as it had a relatively low-productive agricultural sector, but with widespread proto-industrial activity (Table 2 and Figure 8). In contrast, Hungary and Ireland had higher agricultural productivity- and higher per capita consumption of nutrients.

Figures 6-8 about here

For the first time we have extensive evidence on the height of the German population in the early 18<sup>th</sup> century. Both samples, the German soldiers serving in North America, and the soldiers serving in the Saxon army indicate that German men were relatively short by contemporary standards, implying that perhaps living conditions in Germany were particularly bad at the time (Figure 8). The height of German runaways was 65.7 cm (166.8 cm) 0.8 in (2 cm) taller than that of the soldiers (Table 2).

The Irish indentured servants (N=1,186) (66.4 in 168.7 cm) were about as tall as the Irish soldiers (66.1 in or 167.9 cm) (Table 2). Yet, the height of the English soldiers in this sample are well below those obtained in the only other extant sample for this period pertaining to English men, those of the runaway indentured and convict servants in colonial North America (Komlos 1993a; 1999, Table 4). The English runaway servants (N=590) at 67.0 inches (170.2 cm) – were 1.7 inches (4.3 cm) taller than the soldiers in the above military sample<sup>4</sup> (Table 2). One can merely speculate about the reason for this discrepancy. Do the results pertain perhaps to different segments of the lower classes, different urban/rural provenance, or perhaps were those servants who ran away from their masters much taller

than average? And why is this the case for the English servants but not for the Irish servants? Although one might think that the soldiers were more representative of the population of the United Kingdom than were the runaway servants, it is not necessarily the case, given the existence of the maximum height requirement applied to sailors and royal marines. Given that mean heights are difficult to estimate accurately when only a small range of heights are available from the original height distribution, as in this case - between 64 and 68 inches,- the extent to which this sample should be considered representative of the population of the United Kingdom is not at all obvious. Yet, because we cannot be sure that the heights in this sample are downwardly biased, they do cast some doubt on the substantial decline in heights found in many other European samples during the second half of the century. This is the case, because the height of convict servants transported to Australia toward the end of the century was about the same as those found in this sample of English soldiers (Nichols and Steckel 1991). Hence, more anthropometrical research is needed before we will have a clearer understanding of the cycles and trends in the height of the British population in the 18<sup>th</sup> century. Because of the rarity of such evidence for the period under consideration, it is useful to consider the evidence at hand in spite of its imperfections. It is probable, though that the populations in the proto-industrial areas of Bohemia, Saxony, and the industrially advanced England were among the shortest in Europe during the first half of the 18<sup>th</sup> century.

**Table 1. Characteristics of the sample**

<b>Whole sample</b>			<b>Adults</b>		
<i>Occupation</i>	<i>Frequency</i>	<i>Percent</i>	<i>Occupation</i>	<i>Frequency</i>	<i>Percent</i>
Laborer	1505	30,3	Laborer	1130	29,5
skilled trades incl. merchant	2082	41,9	skilled trades incl. merchant	1685	43,9
farmer, yeomen	200	4,0	farmer, yeomen	159	4,1
Planter, gentlemen	382	7,7	planter, gentlemen	279	7,3
other incl. soldier, sailor	499	10,0	other incl. soldier, sailor	356	9,3
missing	299	6,0	missing	226	5,9
Total	4967	100,0	Total	3835	100,0
<i>Enlisted</i>	<i>Frequency</i>	<i>Percent</i>	<i>Enlisted</i>	<i>Frequency</i>	<i>Percent</i>
NY	3257	65,6	NY	2519	65,7
VA	796	16,0	VA	623	16,2
MD	127	2,6	MD	85	2,2
CT	7	0,1	CT	4	0,1
Missing	780	15,7	Missing	604	15,7
<i>Birth Date</i>	<i>Frequency</i>	<i>Percent</i>	<i>Birth Date</i>	<i>Frequency</i>	<i>Percent</i>
<1720	668	13,4	<1720	606	15,8
1720-24	535	10,8	1720-24	535	14,0
1725-29	757	15,2	1725-29	757	19,7
1730-34	1312	26,4	1730-34	1211	31,6
1735-39	1101	22,2	1735-39	612	16,0
1740-49	499	10,0	1740-49	73	1,9
1750s	95	1,9	1750s	41	1,1
<i>Provenance</i>	<i>Frequency</i>	<i>Percent</i>	<i>Provenance</i>	<i>Frequency</i>	<i>Percent</i>
Ireland	1899	38,2	Ireland	1523	39,7
England	1463	29,5	England	1119	29,2
Germany	871	17,5	Germany	649	16,9
Scotland	443	8,9	Scotland	315	8,2
Netherlands	75	1,5	Other	229	6,0
Switzerland	69	1,4			
France	67	1,3			
Spain, Portugal	29	0,6			
Scandinavia	26	0,5			
Italy	15	0,3			
Denmark	10	0,2			
<i>Age</i>	<i>Frequency</i>				
16	18	0,4			
17	45	0,9			
18	89	1,8			
19	137	2,8			
20	262	5,3			
21	234	4,7			
22	285	5,7			
Adults (23-50)	3835	77,2			
>50	62	1,2			

Source: See Data Sources in list of References.



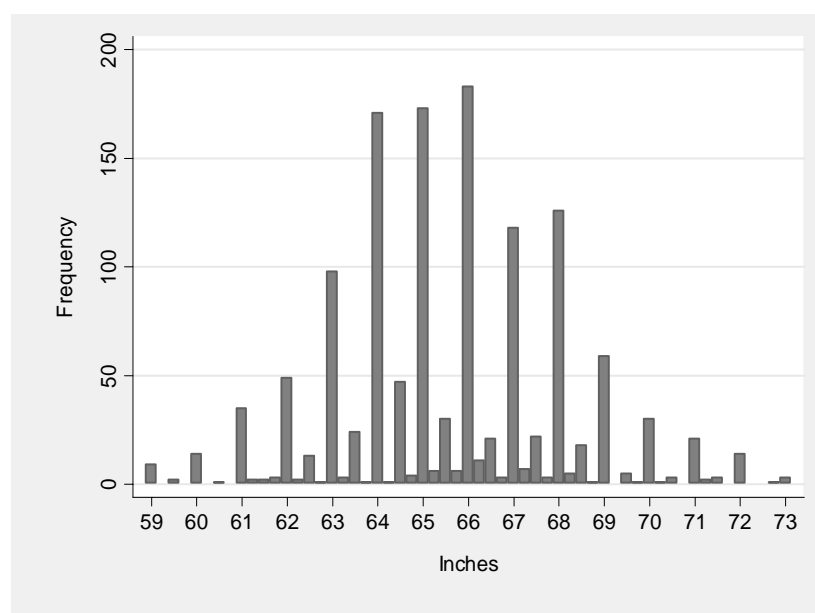
**Table 2. Height of Adult Men: birth cohort c.1735-1739**

Country of Birth	Inches	Cm	Residence	Inches	Cm	Residence
N. America	67,3	171,0	N. America			
Ireland	66,1	167,9	N. America	66,4	168,7	N. America
Hungary	65,9	167,4	Hungary			
France	65,8	167,1	France			
Bohemia	65,4	166,1	Bohemia			
England	65,3	165,9	N. America	67,0	170,2	N. America
Germany	64,9	164,8	N. America	65,7	166,8	N. America
Saxony	64,8	164,6	Saxony			
Scotland	64,4	163,6	N. America	66,7	169,3	N. America

*Note:* Indentured and Convict Servants.

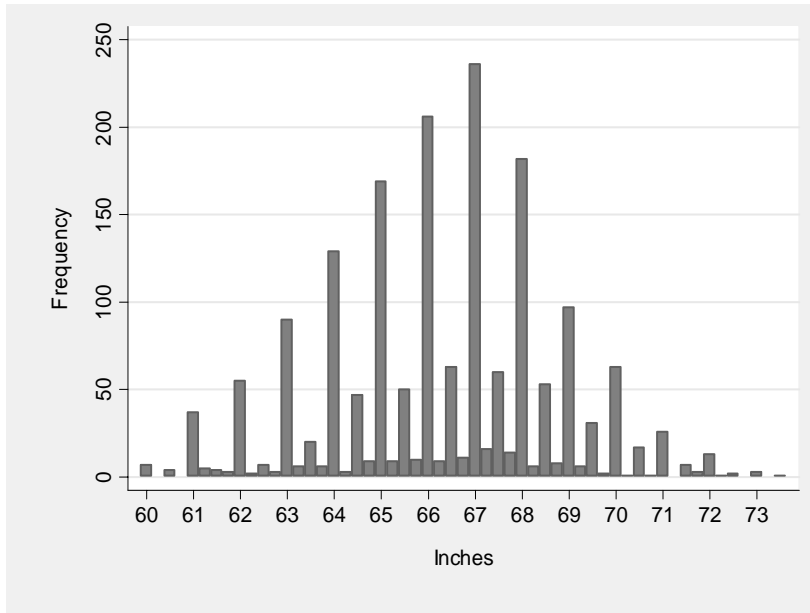
*Sources:* Komlos 1989, 1999, 2001; Komlos et al. 2003, See also list of references for Data sources.

**Figure 1. Height Distribution of Adult English Soldiers in America.**



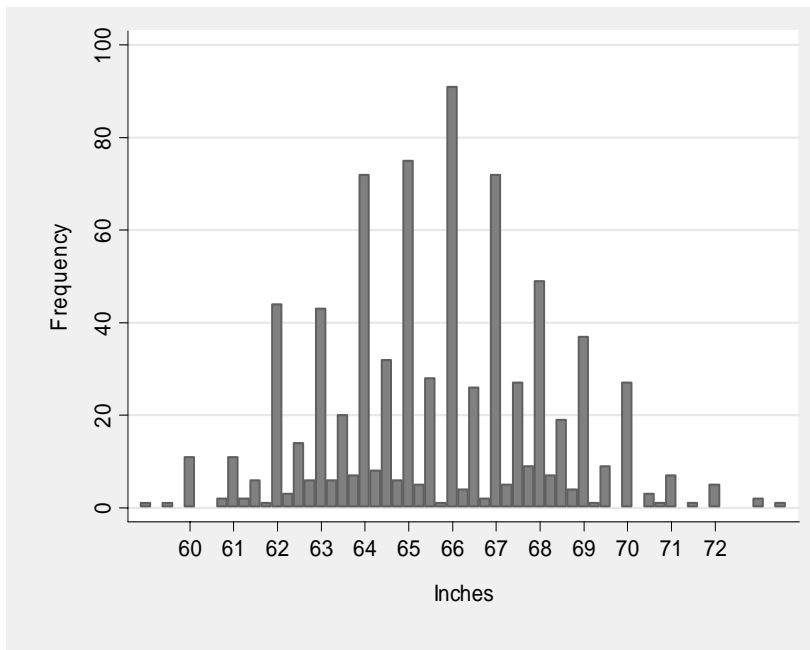
*Note:* Number of observations = 1359.

**Figure 2. Height Distribution of Adult Irish Soldiers in America.**



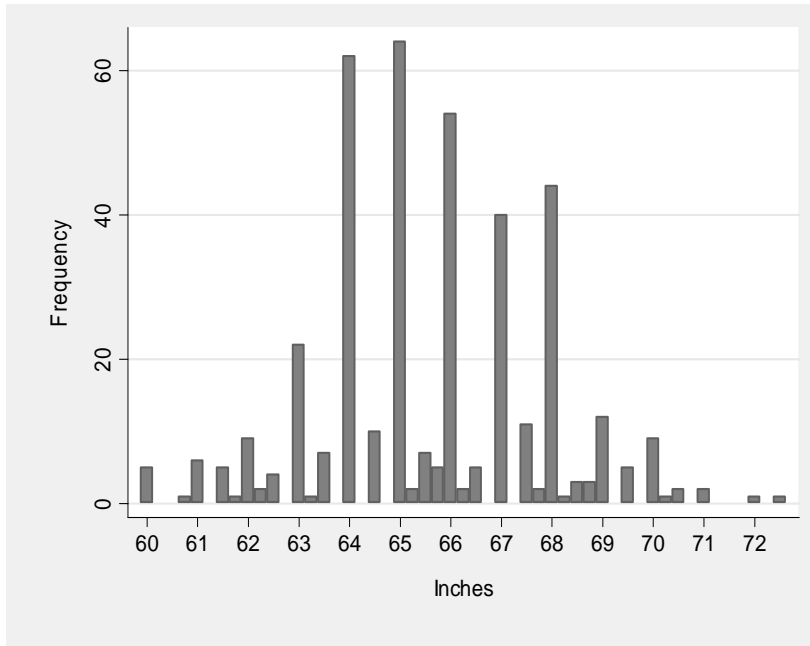
*Note:* Number of observations = 1812.

**Figure 3. Height Distribution of Adult German Soldiers in America.**



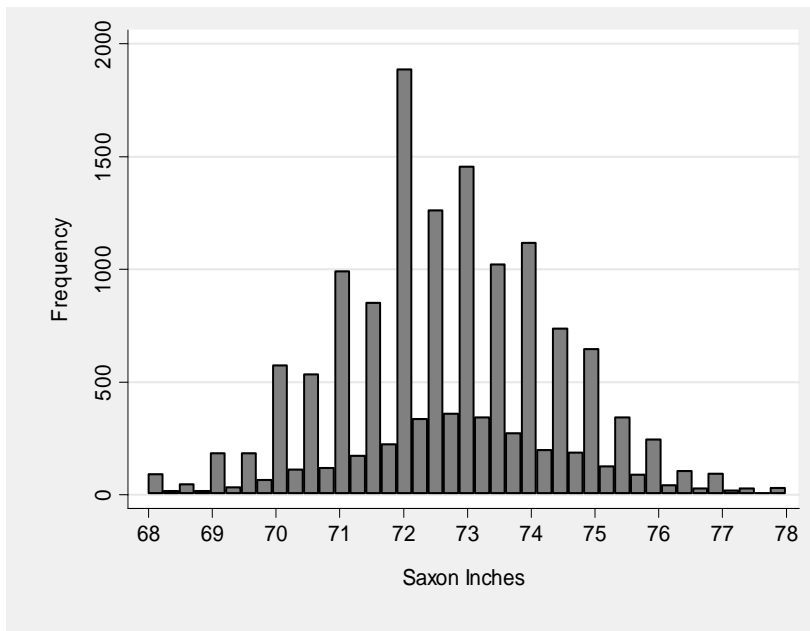
*Note:* Number of observations = 814.

**Figure 4. Height Distribution of Adult Scottish Soldiers.**



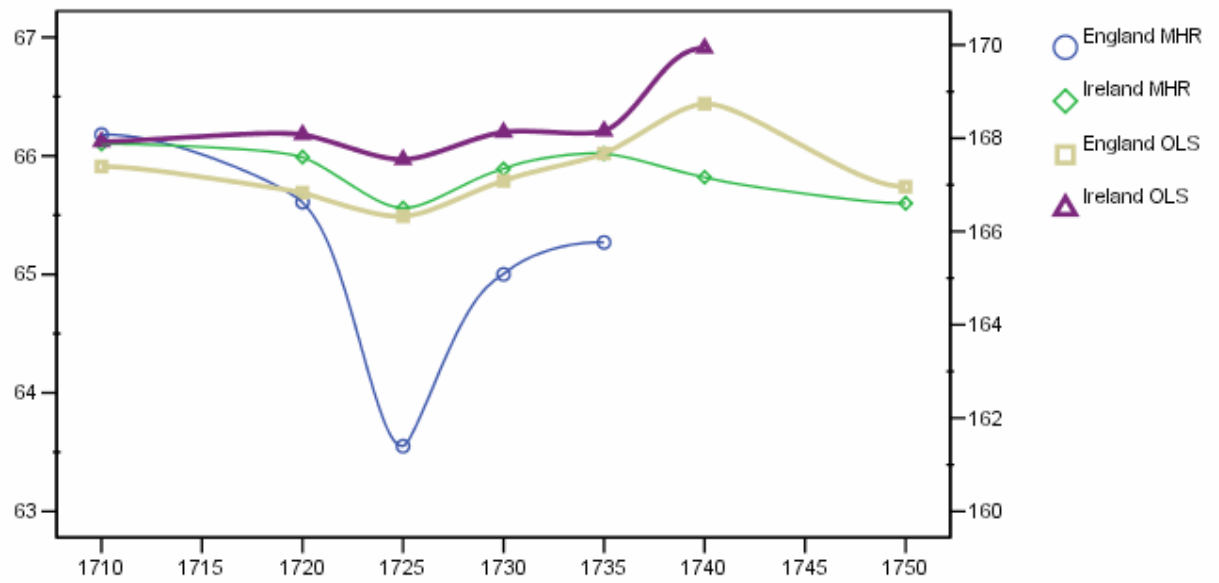
*Note:* Number of observations = 412.

**Figure 5. Height Distribution of Adult Saxon Soldiers.**



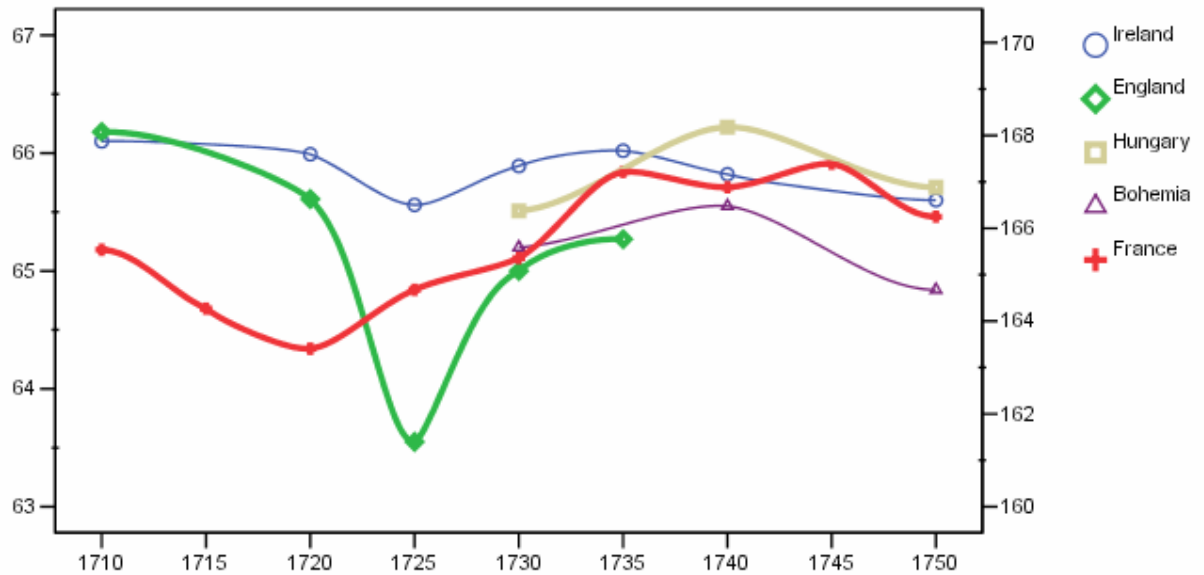
*Note:* Number of observations 14083. Saxon Inches = 2.36 cm.

**Figure 6. Height of Adult English and Irish Men**



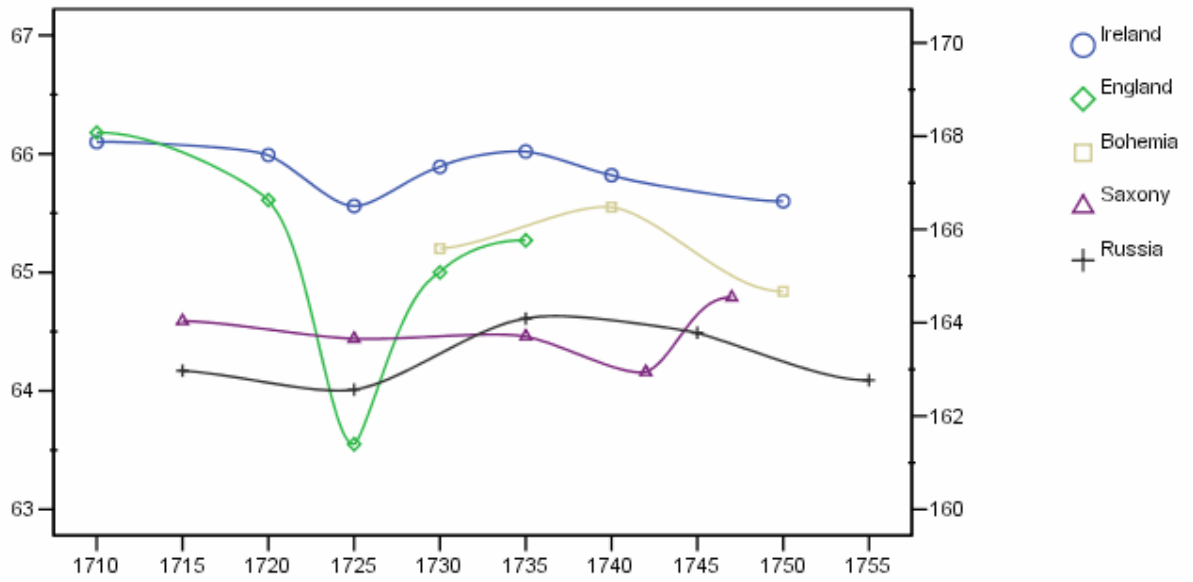
*Note:* X-axis shows birth-cohort; left axis height in inches, right axis in centimeters.

**Figure 7. Height of Adult European Men**



*Note:* X-axis shows birth-cohort; left axis height in inches, right axis in centimeters.

**Figure 8. Height of Adult European Men**



*Note:* X-axis shows birth-cohort; left axis height in inches, right in centimeters. Saxon and Russian Inches have been transformed into British Inches. Russian data are courtesy of Boris Mironov.

## Data Sources

Connecticut Military Records: Soldiers and Officers, CD, Genealogical Publishing Company: [http://www.genealogical.com/item\\_detail.asp?afid=&ID=7120](http://www.genealogical.com/item_detail.asp?afid=&ID=7120).

Hauptstaatsarchiv, Dresden, Germany. Musterlisten.

Maryland Settlers and Soldiers, CD, Genealogical Publishing Company: [http://www.genealogical.com/item\\_detail.asp?afid=&ID=7521](http://www.genealogical.com/item_detail.asp?afid=&ID=7521).

New York in the Colonial Wars, the Revolution and the War of 1812: CD, Genealogical Publishing Company: [http://www.genealogical.com/item\\_detail.asp?afid=&ID=7143](http://www.genealogical.com/item_detail.asp?afid=&ID=7143).

Virginia Military Records: Colonial Wars, Revolutionary War, War of 1812, CD, Genealogical Publishing Company: [http://www.genealogical.com/item\\_detail.asp?afid=&ID=7121](http://www.genealogical.com/item_detail.asp?afid=&ID=7121).

## References

A'Hearn, B. (2004), A restricted maximum likelihood estimator for truncated height samples. *Economics and Human Biology*, 2, 5-20.

A'Hearn B., (2003). Anthropometric Evidence on Living Standards in Northern Italy, 1730-1860 *Journal of Economic History* 63 no. 3 (June 2003), 351-381.

Baten, J. (2000a) "Heights of Men and Women in Nineteenth Century Bavaria: Economic, Nutritional, and Disease Influences," with John Murray, in *Explorations in Economic History* 37 (2000), pp. 351-369.

Baten, J. (2000b) "Economic Development and the Distribution of Nutritional Resources in Bavaria, 1797-1839," in *Journal of Income Distribution* 9 (2000), pp. 89-106

Baten, J. (2001). Climate, Grain Production and Nutritional Status in Southern Germany during the XVIIIth Century. *Journal of European Economic History* 30, 9-47.

Heintel, M., Sandberg, L. and Steckel, R. (1998). Swedish Historical Heights Revisited: New Estimation Techniques and Results. In J. Komlos and J. Baten (eds), *The*

*Biological Standard of Living in Comparative Perspectives: Proceedings of a Conference Held in Munich January 18-23, 1997.* Stuttgart: Franz Steiner Verlag, pp. 449-458.

Komlos, J., (2004). "How to (and How Not to) Analyze Deficient Height Samples: an Introduction," Historical Methods, forthcoming (2004) 37, No. 4, Fall 2004.

Komlos, J., (2003) "An Anthropometric History of Early-Modern France, 1666-1766," in collaboration with Michel Hau and Nicolas Bourguinat, European Review of Economic History (2003), 7: 159-189.

Komlos, J. (2001) "On the Biological Standard of Living of Eighteenth-Century Americans: Taller, Richer, Healthier," Research in Economic History 20 (2001): 223-248.

Komlos, J. (1999) "On the Nature of the Malthusian Threat in the Eighteenth Century," Economic History Review 52, no. 2 (Nov. 1999): 730-48.

Komlos, J. (1998) "Shrinking in a Growing Economy? The Mystery of Physical Stature during the Industrial Revolution," Journal of Economic History 58 (1998) 3: 779-802.

Komlos, J. (1994) "The Stature of Runaway Slaves in Colonial America," in Komlos (ed.) Stature, Living Standards, and Economic Development: Essays in Anthropometric History, Chicago: University of Chicago Press, 1994, pp. 93-116.

Komlos, J. (1993a) "A Malthusian Episode Revisited: The Height of British and Irish Servants in Colonial America," Economic History Review 46 (Nov. 1993): 768-82.

Komlos, J. (1993b) "The Secular Trend in the Biological Standard of Living in the United Kingdom, 1730-1860," Economic History Review 46 (Feb. 1993): 115-44.

Komlos, J. (1989) Nutrition and Economic Development in the Eighteenth-Century Habsburg Monarchy: An Anthropometric History, Princeton University Press: 1989.

Komlos, J. (1985) "Stature and Nutrition in the Habsburg Monarchy: The Standard of Living and Economic Development," American Historical Review 90 (1985): 1149-1161.

Komlos, J., and Baten, J., (2003) "Looking Backward and Looking Forward: Anthropometric Research and the Development of Social Science History," Social Science History (2004) 28, 2: 191-210.

Komlos, J., and Marielouise Baur, 2004, "From the Tallest to (One of) the Fattest: The Enigmatic Fate of the Size of the American Population in the Twentieth Century," Economics and Human Biology 2, no. 1: 57-74.

Mironov, B.N., (2004), Antropometricheskii podkhod k izucheniiu blagosostoianii naseleniia Rossii v XVIII veke. Otechestvennaia istoria, 6, pp. 17-30 (The Anthropometric Approach in the Studying of Well-being of Russian Population in the 18th Century).

Mokyr, J., and O'Grada, C., (1996), Height and Health in the United Kingdom, 1815-1860: Evidence from the East India Company Army," Explorations in Economic History 33, 141-168.

Nicholas, Stephen, and Richard H. Steckel. "Heights and Living Standards of English Workers during the Early Years of Industrialization, 1770-1815." Journal of Economic History 51, no. 4 (1991): 937-957.

Nicholas, S., and Oxley, D. (1993). The Living Standards of Women during the Industrial Revolution 1795-1820. Economic History Review 46, 723-749.

Phelps Brown, E.H. and S.V. Hopkins, "Seven Centuries of Prices of Consumables Compared with Builders' Wages rates," In E. M. Carus Wilson, (ed.), Essays in Economic History, London, 1962, Vol 2, pp. 179-96.

Sandberg, Lars, and Richard H. Steckel. "Heights and Economic History: The Swedish Case." Annals of Human Biology 14, no. 2 (1987): 101-10.

Schwarz, L. D. "The Standard of Living in the Long Run: London, 1700-1860." Economic History Review 38, no. 1 (1985): 24-41.

Steckel, R. 2004. "The Remarkably Tall Stature of Northern European Men during the Medieval Era," Social Science History, 28, 2, 211-230.



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<sup>1</sup> Evidence on women in larger numbers first appeared in 19<sup>th</sup>-century penitentiaries.

<sup>2</sup> However, the Irish heights did not yield reasonable estimates when the maximum height requirement of 68 inches was used.

<sup>3</sup> For the whole period after 1536 there was only one quinquennium during which the crude death rate was above this level.

<sup>4</sup> These estimates were obtained using truncated regression with standard deviation set to 2.7 inches (A'Hearn 2004). The height distribution indicates that perhaps taller servants had a greater propensity to runaway from their masters. Hence, a Minimum Height requirement of 65.5 inches was used in this estimation procedure. The results were not meaningfully different from the OLS calculations reported in (Komlos 1999). The number of observations on the Scottish is too small (N=107) to draw robust conclusions.