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Economic History Review (2015)

Occupational structure in the Czech lands under the second serfdom[†]

By ALEXANDER KLEIN and SHEILAGH OGILVIE*

This article presents an analysis of occupational structure, a key component of the ‘Little Divergence’, in an eastern-central European economy under the second serfdom, using data on 6,983 Bohemian villages in 1654. Non-agricultural activity was lower than in western Europe, but varied positively with village size, pastoral agriculture, sub-peasant strata, Jews, freemen, female headship, and mills, and negatively with arable agriculture and towns. It showed a curvilinear relationship with the ‘second serfdom’, as proxied by landlord presence on village holdings. Landlord presence in serf villages also reversed the positive effects of female headship and mills on non-agricultural activities. Under the second serfdom, landlords encouraged serf activities from which they could extract rents, while stifling others which threatened manorial interests.

Changes in occupational structure—particularly a shift away from agriculture towards industry and services—are widely viewed as indicators of economic growth. Debates about the early modern ‘Little Divergence’, during which the economies of north-west Europe are thought to have decisively pulled ahead of the east and south, centre partly on rival estimates of the size of the non-agricultural sector.¹ A high density of non-agricultural occupations, such as the 60 per cent observed in the seventeenth-century Netherlands,² is viewed as indicating that agricultural productivity had risen enough to release labour and that specialization was enhancing efficiency and work incentives.³ Many studies emphasize that *rural* non-agricultural activities, even those oriented mainly to local markets, can fuel economic growth via specialization and consumption linkages.⁴ Occupational

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[†]We would like to thank Lenka Matušiková, Pavla Jirková, and Helena Klímová for generous help with historical data sources and useful discussions of the Berní Rula; Josef Grulich and Eduard Maur for illuminating conversations about the economic history of early modern Bohemia; Leigh Shaw-Taylor and Tony Wrigley for their insights into occupational structure; Steve Broadberry, Tracy Dennison, Jean-Laurent Rosenthal, and three anonymous referees for stimulating comments on earlier drafts; and seminar participants at the London School of Economics, Caltech, the Economic History Society 2013 meeting in York, and the European Historical Economics Society 2013 meeting in London for helpful feedback. We gratefully acknowledge financial support from the Professor Dame Elizabeth Hill Fund at the University of Cambridge; the British Academy Small Research Grant Scheme; the Collaborative Project HIPOD, supported by the European Commission’s 7th Framework Programme for Research, contract no. SSH7-CT-2008-225342; and the Grant Agency of the Czech Republic, grant no. 13-138485. Alexander Klein Snr, Lucie Matějková, and Václav Žďárek provided excellent research assistance. This project builds on the lifelong work of the late Václav Cervený and we are grateful to him for allowing us to have the data he collected.

¹ Broadberry, Campbell, and van Leeuwen, ‘Britain’; Clark, ‘1381’.

² de Vries and van der Woude, *First modern economy*, pp. 525, 527.

³ Crafts, ‘British industrialization’, pp. 2, 64, 115–22, 138–40; de Vries, *Industrious revolution*, pp. 90–4; Allen, *British industrial revolution*, pp. 57–79.

⁴ See the essays in Haggblade, Hazell, and Reardon, eds., *Transforming*.

structure in general and rural non-agricultural intensification in particular are thus important economic indicators.

Despite the theoretical role ascribed to non-agricultural activities, we still lack quantitative evidence of their importance in many European economies during the Little Divergence. Economic historians are gradually compiling data for north-west Europe, particularly England and the Netherlands, but have hardly touched upon slower-growing economies. In particular, little is known of occupational structure in those many central and eastern European economies that experienced the intensification of landlord powers over the rural population during the early modern 'second serfdom'.⁵

This article addresses that gap by investigating occupational structure in seventeenth-century Bohemia (the modern Czech Republic). Although some older literature argued that the Bohemian second serfdom was unusually mild and only began after 1648, most scholars now acknowledge that from c.1550 (and possibly earlier), Bohemian landlords increased extraction of money rents and labour services, extended such burdens to new economic activities, intensified market monopolies, and imposed heavier constraints on their serfs' economic and demographic decisions.⁶ This did not mean that market exchange was absent: early modern Bohemian serfs participated actively in markets for labour, capital, land, and agricultural and industrial output including grain, cattle, timber, beer, wine, dairy products, yarn, textiles, shingles, and many other products.⁷ However, these serf market transactions were circumscribed by manorial rent extraction. Bohemian landlords constrained labour markets directly by extorting coerced labour services and indirectly by enforcing restrictions on geographical mobility, marriage, apprenticeship, household formation, and settlement. They constrained land markets by expanding the manorial demesne, prohibiting partition of serf holdings, and regulating sales, inheritance, rentals, and mortgages of serf holdings. They constrained output markets by enforcing manorial purchasing prerogatives, granting privileges to merchants and craftsmen, and imposing demesne monopolies on key consumption goods such as beer and spirits.⁸

This thoroughgoing manorial rent extraction meant that before Emancipation in 1781, Bohemia had little claim to be a prosperous economy. It suffered from high risks, grinding poverty, and starvation for some of the poorest. Living standards, as measured by life expectancies, were low by European standards.⁹ After

⁵ For pioneering work on eighteenth-century Bohemian occupational structure, however, see Cerman, 'Labour-intensive proto-industrialization'.

⁶ Maur, *Český komorní velkostatek*, pp. 87–93; Donth, *Rochlitz*, pp. 20–6; Cerman, 'Proto-industrialisierung', pp. 81–145; idem, 'Gutsherrschaft', pp. 91–105; Melton, 'Population structure', pp. 315–26; Ogilvie, 'Economic world', pp. 434–5, 448–51; Klein, 'Institutions', pp. 59, 64–76.

⁷ Maur, *Český komorní velkostatek*, pp. 113–14; Klíma, *Manufakturní*, pp. 227–233, 352–3; idem, 'Industrial development', pp. 87, 91–4; idem, 'English merchant capital', pp. 35–8; Cerman, 'Proto-industrialisierung', pp. 259–323; Melton, 'Population structure', pp. 316, 318; Ogilvie, 'Economic world', pp. 441–7; eadem, 'Communities', pp. 103–8; eadem, 'Staat', pp. 60–3, 72–4, 78–81; eadem, 'Village community', pp. 421–4.

⁸ Klíma, 'Agrarian class structure', p. 53; Maur, *Český komorní velkostatek*, pp. 44–9, 94–8, 119–20, 127–9; Blum, *End*, p. 165 (on beer); Petráň, 'Höhepunkt', pp. 332–4; Donth, *Rochlitz*, pp. 12, 241–2, 334–9, 349, 479; Cerman, 'Proto-industrialisierung', pp. 88–109; idem, 'Gutsherrschaft', pp. 92–5; Stejskal, 'Bauer', pp. 211–14; Melton, 'Population structure', pp. 315–25; Ogilvie, 'Economic world', pp. 436–47; eadem, 'Village community', p. 406; Ogilvie and Edwards, 'Women', pp. 982–90; Klein, 'Institutions', pp. 70–80.

⁹ Cerman, 'Bohemia', pp. 154–9; Grulich and Zeithofer, 'Lebensformen', p. 31; Zeithofer, 'Besitztransfer', pp. 119–20; idem, *Besitzwechsel*, pp. 39, 66, 71, 126–7, 149–50, 163–6, 210, 217, 232, 290–3, 303–6; Ogilvie, 'Economic world', p. 451.

Emancipation, Bohemia developed into the economic powerhouse of the Habsburg lands, but in the seventeenth century it lay definitively on the low-performing side of the 'Little Divergence'.¹⁰

To explore occupational structure in early modern Bohemia, we analyse a large dataset drawn from the 1654 *Berní Rula*, a detailed national tax register. We focus on rural non-agricultural occupations, since rural non-agricultural activity is an important growth indicator and in Bohemia the rural economy comprised most of the labour force. Our findings shed light both on the shift away from agriculture during the early modern Little Divergence and on the broader operation of the European second serfdom.

I

Is there any point in analysing non-agricultural occupations in a serf economy? Many scholars portray central and eastern European serfs as having Chayanovian mentalities which made them stick to subsistence farming and avoid industry or market exchange.¹¹ Many others assume that serfdom prevented markets from functioning, stifling occupational specialization: landlords prohibited serfs from engaging in crafts or commerce, the theory goes, because such non-taxable occupations diverted them from farm-work which paid manorial rents and dues.¹² If such assumptions were correct, rural economies under the second serfdom should have been exclusively agricultural, apart from forced labour by serfs in manorial manufactories.

To investigate these questions, we compiled a large dataset from the *Berní Rula*, a detailed tax register drawn up in 1654 to bring the Habsburgs' Bohemian subjects under fiscal control after the Thirty Years War. The *Berní Rula* was the first national tax register for Bohemia and provided the basis for piecemeal 'revisitations' in the 1670s and the comprehensive Theresian Cadaster in the eighteenth century.¹³ The *Berní Rula* registered every 'holding' (that is, dwelling plus any land) in 1654, recording whether it was currently occupied or vacant, its arable area, its draft animals and other cattle, its current occupier (individual, community, or landlord), and the characteristics of individual holders (name, gender, social stratum, serf status, and any non-agricultural occupations). The register also recorded larger local infrastructure such as mills, ironworks, and breweries.¹⁴

We collected data from the *Berní Rula* for 7,257 villages on 893 feudal estates, encompassing more than 70 per cent of the total area of Bohemia in

¹⁰ Klíma, *Manufakturní*, pp. 19–23, 102–4; idem, 'Industrial development', pp. 95–7; idem, 'English merchant capital', pp. 45–8; idem, 'Role', pp. 55–6; idem, 'Agrarian class structure', pp. 52–67; Míka, *Poddaný lid*, pp. 282–4; Petrůň, *Zemědělská výroba*, pp. 228–33; idem, *Poddaný lid*, pp. 282–4; Maur, *Český komorní velkostatek*, pp. 7–8; idem, 'Vývojové etapy', pp. 203–6; idem, 'Zemědělská výroba', pp. 4–5; Myška, 'Pre-industrial iron-making', pp. 59–72; Ogilvie, 'Economic world', pp. 448–51; eadem, 'Communities', pp. 103–8; eadem, 'Staat', pp. 60–3, 72–4, 78–81; Ogilvie and Edwards, 'Women', pp. 982–90; Klein, 'Institutions', pp. 76–81.

¹¹ For critical surveys of this view, see Ogilvie, 'Economic world', pp. 430–5; Dennison, *Institutional framework*, pp. 1–28; Cerman, *Villagers*, pp. 109–11; Ogilvie, 'Choices', p. 269–78.

¹² Kriedte, Medick, and Schlumbohm, *Industrialization*, pp. 17–20, 216–20.

¹³ On the institutional and political background to Bohemian state taxation and the *Berní Rula*, see Pekař, *České katastry*, pp. 4–14; *Berní Rula 1*, pp. 35–50; Ogilvie and Cerman, 'Bohemian census', pp. 333–6; Matusíková and Ogilvie, 'Bohemia', pp. 1–5; and Klein and Ogilvie, 'Occupational structure', pp. 2–5.

¹⁴ Pekař, *České katastry*, pp. 6–10; *Berní Rula 1*, pp. 43–4; Červený and Červená, *Berní Rula*, pp. VIII–IX; Ogilvie and Cerman, 'Bohemian census', pp. 333–6; Matusíková and Ogilvie, 'Bohemia', pp. 1–5; Klein and Ogilvie, 'Occupational structure', pp. 4, 16, 28, 35–6.

1654.¹⁵ Of these villages, 274 lay completely empty so they did not have an occupational structure that could be analysed. For each of the 6,983 occupied villages in our dataset, we calculated the share of households recorded as practising occupations outside agriculture. These occupations did not consist of work by serfs in manorial manufactories. Rather, they were activities undertaken by serf households on their own initiative. These ranged from primary-sector occupations such as miner and charcoal burner, through secondary-sector ones such as baker, butcher, smith, tanner, miller, tailor, and weaver, to tertiary-sector occupations such as merchant, petty trader, tavern-keeper, clerk, and teacher.

The occupations recorded in the *Berní Rula*, like those in most pre-modern tax registers, should be regarded as a minimum measure of non-agricultural activity, since pre-modern tax systems focused primarily on real estate.¹⁶ However, the *Berní Rula* had no reason to under-record non-agricultural activity to a greater extent than other pre-modern European fiscal sources. On the contrary, several characteristics of the *Berní Rula* justify regarding the information it contains on rural non-agricultural activity as a reliable minimum proxy measure of underlying occupational structure.¹⁷ First, the *Berní Rula* neither rewarded nor penalized state tax commissioners, manorial authorities, or serfs themselves for reporting non-agricultural activity. Tax liability did not depend on non-agricultural activity, but was determined via a standardized unit (the *osedly*) based on the legal social stratum of the landholding, with one *osedly* defined as equal to one 'peasant' holding, four 'smallholdings', or eight 'cottager' holdings; adjustment of tax burdens to take account of holders' income (for example, from non-agricultural activity) was not envisaged at the time of data collection.¹⁸ Second, the *Berní Rula* commissioners recorded abundant non-agricultural occupations for town-dwellers, despite not being instructed to do so, testifying to their conscientiousness in inquiring into taxpayers' economic circumstances. Third, our statistical tests established that the share of non-agricultural occupations recorded was not significantly related to measurable characteristics of recording conventions, including the composition of state commissions drawing up the *Berní Rula* in particular places.¹⁹ Fourth, as discussed below, the *Berní Rula* yields estimates of the minimum size of the non-agricultural sector which are consistent with available data from other studies. Finally, as we find in the econometric analyses presented below, rural non-agricultural activity in the *Berní Rula* varied substantially and systematically across villages, in ways that were significantly related to other socioeconomic characteristics.

What emerges, then, when we investigate rural occupational structure in mid-seventeenth-century Bohemia? Table 1 presents descriptive statistics for the 6,983 occupied villages in our dataset. The proportion of householders in Bohemian villages engaging in non-agricultural activities in 1654 varied between 0 and 100 per cent of all household heads, with an average of 6.7 per cent. These findings decisively refute the traditional assumptions discussed above, according to which

¹⁵ Červený and Červená, *Berní Rula*, p. xxii; Klein and Ogilvie, 'Occupational structure', pp. 2–3, 5–6.

¹⁶ Cerman, 'Proto-industrialisierung', pp. 259–325; Zeitlhofer, 'Besitztransfer', pp. 49–109; Zeitlhofer, *Besitzwechsel*, pp. 71–9; Klein and Ogilvie, 'Occupational structure', pp. 6–8.

¹⁷ Klein and Ogilvie, 'Occupational structure', pp. 6–8.

¹⁸ Pekař, *České katastry*, pp. 4–5, 9; *Berní Rula 1*, pp. 38–40.

¹⁹ Throughout this article, 'significant' means the null hypothesis is rejected at the 0.05 level.

Table 1. *Summary statistics on characteristics of villages in Bohemia, Berni Rula, 1654*

<i>Variable</i>	<i>No. of obs.</i>	<i>Mean</i>	<i>Std. dev.</i>	<i>Min.</i>	<i>Max.</i>
Share of non-agricultural occupations	6,983	0.06	0.15	0.00	1.00
No. of holdings	6,983	11.44	10.79	1.00	133.00
Share of empty holdings	6,983	0.14	0.20	0.00	0.99
Total arable land of occupied holdings per holder	6,983	26.31	23.32	0.00	390.00
No. of working animals per holder	6,983	1.80	1.16	0.00	11.00
No. of (non-working) cattle per holder	6,983	2.47	1.35	0.00	34.00
Share of 'cottagers'	6,983	0.24	0.29	0.00	1.00
Share of 'smallholders'	6,983	0.13	0.22	0.00	1.00
Share of 'freemen'	6,983	0.02	0.13	0.00	1.00
Share of 'peasants'	6,983	0.59	0.35	0.00	1.00
Share of Jews	6,983	0.001	0.03	0.00	1.00
Share of female household heads	6,983	0.032	0.10	0.00	1.00
Share of urban occupied holdings on estate	6,983	0.15	0.16	0.00	0.998
Presence of a mill	6,983	0.06	0.23	0.00	1.00
Share of holders with less than 15 <i>strych</i> of arable land	6,983	0.36	0.34	0.00	1.00
Presence of a holding held/used by landlord	6,983	0.07	0.25	0.00	1.00
No. of holdings held/used by landlord	6,983	0.15	0.80	0.00	19.00
Share of land held/used by landlord	6,910	0.02	0.09	0.00	1.00

Sources: *Berni Rula* database; see section II of this article for detailed data description.

serfdom precluded rural non-agricultural activity except as coerced labour for overlords.²⁰ Rather, one in 15 Bohemian rural households was engaged in non-agricultural activity sufficiently prominent to be recorded in a register primarily focused on agricultural landholding.

Table 2 sets these findings in a comparative context, while recognizing that compiling early modern occupational data is still a work in progress.²¹ A first step was to use our findings on *rural* occupational structure to calculate estimates of *overall* occupational structure. Our dataset covers *c.*70 per cent of Bohemia but excludes the capital Prague and other urban centres. Combining its figures on rural non-agricultural activity with plausible assumptions about occupational structure of missing regions and urban centres yields an estimated overall proportion of non-agricultural occupations which lies in the range between 18.2 per cent (excluding Prague and assuming towns were 55 per cent non-agricultural) and 31.3 per cent (including Prague and assuming towns were 100 per cent non-agricultural).

The average for our 6,983-village sample in 1654, as table 2 shows, is similar in magnitude to averages reported in Bohemian regional studies using other sources, including manorial lists of industrial and commercial dues.²² It is also consistent with Cerman's finding that even regions of Bohemia (such as the north) that ultimately became densely industrial in the later eighteenth century initially expanded mainly through agricultural intensification and agricultural wage-labour rather than proto-industrialization.²³ Even northern Bohemia's rural industries

²⁰ Kriedte et al., *Industrialization*, pp. 17–20, 216–20.

²¹ de Vries and van der Woude, *First modern economy*, p. 527; Shaw-Taylor, 'Occupational structure', pp. 1–5; Shaw-Taylor and Wrigley, 'Occupational structure', pp. 53–7, 82–6; Cerman, 'Labour-intensive proto-industrialization', pp. 1–5; Klein and Ogilvie, 'Occupational structure', pp. 8–10.

²² Cerman and Štefanová, 'Wirtschaft', pp. 80–2; Matušiková and Pazderová, 'Regionen', p. 144.

²³ Cerman, 'Proto-industrialisierung', pp. 266, 270, 274–6, 286, 324.

Table 2. *Proportion of non-agricultural occupations, various European societies, 1381–c. 1800*

<i>Society</i>	<i>Date</i>	<i>Rural non-agricultural (%)</i>	<i>Total non-agricultural (%)</i>
England			
National estimate: 892 settlements ^a	1381		33.0
Rutland (Cornwall) ^a	1522	22.8	
Coventry + Babergh + Rutland ^a	1522		31.8
Myddle (agricultural village) ^b	1550	11.0	
National estimate ^c	c.1710		50.2
National estimate ^{a,d}	1755		56.0
National estimate ^c	c.1817		64.3
Netherlands			
National estimate ^e	1675		60.0
Friesland ^e	1749	38.0	56.0
Veluwe ^e	1749	34.0	53.0
National estimate ^e	c.1750		59.0
Overijssel ^e	1795	40.0	54.0
National estimate ^e	c.1800		59.0
Poland			
Greater Poland ^f	1580	10.4	
Lesser Poland ^f	1580	12.3	
Mazowsze ^f	1580	6.9	
National estimate ^f	1580	10.2	
Bohemia			
Frydlant villages (proto-industrial estate) ^g	1630	12.1–12.3	
Liberec villages (proto-industrial estate) ^g	1630	26.1–27.1	
Frydlant villages (proto-industrial estate) ^g	1640–51	12.2–12.4	
National estimate: 6,983 villages ^h	1654	6.7	18.2–31.3
Frydlant villages (proto-industrial estate) ^g	1700–3	15.9–20.0	
Poděbrady villages (agricultural estate) ⁱ	1713	3.1	
Rychnov villages (proto-industrial estate) ⁱ	1713	9.6	
Poděbrady villages (agricultural estate) ⁱ	1719/26	9.0	
Frydlant villages (proto-industrial estate) ^g	1722	17.5	
Liberec villages (proto-industrial estate) ^g	1722	30.0	
Italy (south)			
Santo Marco dei Cavoti (agro-town) ^j	c.1750	<10.0	10.0
Locorotondo (agro-town) ^j	c.1750	<14.0	14.0
Finland			
National estimate ^k	1754		21.3
National estimate ^k	1769		19.8
National estimate ^k	1805		17.9

Note: Excludes one observation for Rychnov villages in 1719, on the grounds that it involves an 85.9 percentage-point rise in the six years since 1713, believed to reflect a discontinuity in record-keeping.

Sources:

a Broadberry et al., 'Britain', pp. 17–19.

b Coleman, *Economy*, p. 73.

c Shaw-Taylor and Wrigley, 'Occupational structure', p. 59.

d Shaw-Taylor, 'Occupational structure', p. 30 ('plausible guess').

e de Vries and van der Woude, *First modern economy*, pp. 525, 527.

f Gieysztor, 'Russie', p. 567.

g Cerman and Štefanová, 'Wirtschaft', pp. 80, 82.

h Tab. 1.

i Matušiková and Pazderová, 'Regionen', p. 144.

j Curtis, 'Agro-town', p. 399.

k Mitchell, *European historical statistics*, p. 163.

intensified only gradually in the course of the seventeenth century, and Cerman finds no evidence that textile proto-industries stimulated a penumbra of provisioning industries by other rural inhabitants, as occurred in England.²⁴ Even serf brewers and distillers were scarce in rural Bohemia, since provision of beer and spirits was monopolized by demesne breweries and village headmen with manorial privileges.²⁵ Long after 1700, Bohemian proto-industrial settlements were characterized by multiple, part-time, irregular by-employments rather than specialization in non-agricultural occupations.²⁶ Zeitlhofer reports similar findings for southern Bohemia: low proportions of non-agricultural occupations even among land-poor and landless groups, who instead depended mainly on agricultural wage-labour.²⁷

The proportion of non-agricultural occupations in Bohemia in 1654, as table 2 shows, was similar to that in Poland in 1580, southern Italy around 1750, or Finland in the 1750s and 1760s.²⁸ These eastern-central, southern, and Nordic European regions were, as late as the eighteenth century, characterized by 6–14 per cent non-agricultural occupations in rural areas and 10–30 per cent overall. This contrasts starkly with England and the Netherlands, which from an early date had 20–40 per cent non-agricultural occupations in rural areas (even non-proto-industrial ones), and 30–60 per cent overall. Non-agricultural specialization was thus distinctly lower in mid-seventeenth-century Bohemia than in the precocious north Atlantic economies, but comparable to other societies in eastern-central, southern, and Nordic Europe.

As table 1 reveals, moreover, there was substantial variation across Bohemian villages: in some, all householders practised non-agricultural occupations, while in others, no one did so. What gave rise to such wide variation across the same rural economy at the same period? Exploration of this question may help us to understand why occupational structure varied so greatly across different parts of Europe during the early modern Little Divergence.

To this end, we undertook a multivariate regression analysis of the relationship between the density of non-agricultural occupations and other village characteristics in mid-seventeenth-century Bohemia. We estimated the following general regression equation:

$$\begin{aligned} \text{NonagricEmpl}_{ij} = & \alpha + \beta_1(\text{Village Size})_{ij} + \beta_2(\text{Arable Sector})_{ij} + \beta_3(\text{Pastoral Sector})_{ij} \\ & + \beta_4(\text{Social Composition})_{ij} + \beta_5(\text{Other Village Characteristics})_{ij} \\ & + \beta_6(\text{Second Serfdom Proxy})_{ij} + \delta_j + \varepsilon_{ij} \end{aligned} \quad (1)$$

The dependent variable, *NonagricEmpl*_{ij}, is defined as the share of holders engaged in non-agricultural activities in village *i* located on an estate *j*; α is a constant term; δ_j is an estate *j* fixed effect; and ε_{ij} is an error term. The β -coefficients represent the vectors of estimated coefficients, since each set of explanatory variables contains several regressors. The definitions of the individual regressors,

²⁴ Ibid., pp. 291–2.

²⁵ Ibid., p. 102; Ogilvie, 'Economic world', p. 449; eadem, 'Village community', pp. 406, 421–4.

²⁶ Cerman, 'Proto-industrialisierung', pp. 297–301; idem, 'Labour-intensive proto-industrialization', pp. 11–20; Melton, 'Population structure', pp. 324–5.

²⁷ Zeitlhofer, *Besitzwechsel*, esp. pp. 91–100.

²⁸ The similar figures for Bohemia and Poland cast further doubt on the assumption that Bohemia was an outlier among second-serfdom economies.

and the theoretical motivations for including them, are discussed below in the context of the findings for each set of explanatory variables.

The econometric analysis raised a number of issues, including potential multicollinearity of independent variables, left-censoring of the dependent variable, estate-specific fixed effects, and outliers.²⁹ To establish the extent of multicollinearity, we calculated correlations among the explanatory variables and variation inflation factors for each explanatory variable. The correlations were small and the variation inflation factors less than 2, indicating that multicollinearity was not an issue.³⁰ To accommodate left-censoring of our dependent variable, we use a Tobit estimator. To check the sensitivity of our results to the parametric assumption which Tobit makes about the distribution of the error term ε_{ij} , we relaxed the assumption using pseudo-Poisson maximum likelihood (PPML).³¹ All regressions were robust to using this alternative estimator. To control for unobserved effects of the estate or overlord on villages, we used estate-specific dummies δ_j , and to allow for arbitrary correlation and heteroskedasticity of errors within estates we used cluster-robust standard errors at the estate level.³² Since the Tobit estimator is highly sensitive to extreme observations, we tested for outliers, conservatively excluding 147 villages which combined extremely high proportions of deserted holdings with extremely high levels of female headship.³³

Having described our econometric approach, we are now in a position to discuss the multivariate findings and their implications for early modern occupational structure and the second serfdom.

II

How was occupational structure affected by urbanization and agglomeration economies? Changes in occupational structure in early modern Europe are widely regarded as resulting partly from increases in settlement size: a growth in the size of villages, creating larger local pools of demand for crafts and services; and an expansion of towns, creating positive externalities for rural hinterlands.³⁴ These hypotheses motivated us to include as regressors the number of holdings (that is, households) in the village, the share of empty holdings in the village, and the share of the estate's population living in towns.

In theory, both larger rural settlements and larger urban centres could have created economies of agglomeration attracting rural people into non-agricultural activities through information flow, specialization, division of labour, and larger pools of suppliers and customers. A first positive effect would operate via the size

²⁹ Klein and Ogilvie, 'Occupational structure', pp. 17–20.

³⁰ Unsurprisingly, the exception was correlation among different measures of social stratification, as discussed below.

³¹ Santos Silva and Tenreiro, 'Log'; eisdem, 'Further simulation evidence'; Klein and Ogilvie, 'Occupational structure', p. 18. PPML does not require the dependent variable to be an integer; see Gouriéroux, Monfort, and Trognon, 'Theory'; eisdem, 'Applications'; Cameron and Trivedi, *Regression analysis*, p. 63. We therefore estimated PPML with the dependent variable as the share and (separately) the number of non-agricultural occupations.

³² Wooldridge, *Econometric analysis*, p. 867; Klein and Ogilvie, 'Occupational structure', pp. 18–19.

³³ Klein and Ogilvie, 'Occupational structure', pp. 19–20.

³⁴ de Vries and van der Woude, *First modern economy*, pp. 522–9; van den Heuvel and Ogilvie, 'Retail development', pp. 78–82.

of the village itself, with larger village size encouraging non-agricultural occupations, both by reducing production costs and by increasing demand. A second positive effect would operate via town size, whereby rural non-agricultural activities might be encouraged by urban demand for rural goods and services. Towns might also transmit urban consumption aspirations to country-dwellers, creating demand for village shops or crafts, as postulated by theories of an early modern consumer and industrious revolution. A third effect of towns would be negative, however: urban crafts and services might *substitute* for rural non-agricultural activities, via superior production efficiency or institutional suppression of rural competition. The effects of agglomeration economies on rural non-agricultural occupations were therefore likely to differ depending on whether the agglomeration was located within the village or in towns, and on whether towns complemented or substituted for village activities.

Bohemia provides a good laboratory for exploring agglomeration economies beyond north-west Europe. First, it had many fewer towns than the north Atlantic societies for which hypotheses about early modern agglomeration economies were originally formulated. Second, its towns and villages were smaller, depopulated by warfare (1618–48) and re-Catholicization (1651–4).³⁵ Third, its towns enjoyed institutional privileges entitling craftsmen and merchants to suppress rural competition to a degree no longer possible in the Low Countries or England.³⁶

Our analysis finds that *village* agglomerations in seventeenth-century Bohemia exercised the predicted positive effect on occupational structure. In table 3, non-agricultural activity in a village was positively associated with its number of households. The positive association is statistically significant, both in regression (1) where the share of deserted holdings is not taken into account and in regressions (2) to (7) where this variable is included to control for the effects of war and religious emigration. The magnitude of village agglomeration economies was not trivial, since the elasticity of non-agricultural activity with respect to village size, evaluated at sample mean values, was 0.52. That is, a 1 per cent increase in village size was associated with a 0.52 per cent increase in the fraction of village householders engaging in non-agricultural activities.

The positive association between village size and non-agricultural activity in Bohemia is consistent with findings for the Netherlands, Flanders, England, and Germany, where larger settlements had significantly higher densities of one specific non-agricultural activity, retailing.³⁷ *Local* agglomeration economies inside villages prevailed not just in western Europe, therefore, but also in eastern-central Europe under the second serfdom. This provides further evidence of the non-autarkic character of the serf economy, and suggests that Bohemia's non-agricultural sector was likely to have expanded alongside its demographic recovery after 1654, an important hypothesis for exploration in future research.

Urban agglomerations, by contrast, were *negatively* related to rural non-agricultural activity in early modern Bohemia. Manorial migration barriers and purchasing prerogatives inhibited serf transactions outside the estate, so urban

³⁵ Fügedi, 'Demographic landscape', pp. 55–7; Cerman, 'Bohemia', pp. 149–52; Melton, 'Population structure', pp. 318–20.

³⁶ Ogilvie, 'Economic world', pp. 449–50; eadem, *Institutions*, pp. 31–3.

³⁷ Ogilvie, 'Consumption', pp. 301–4; van den Heuvel and Ogilvie, 'Retail development', pp. 78–9.

Table 3. *Regression analysis of the determinants of non-agricultural activity in rural Bohemia in 1654 (Tobit model)*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Size of village							
No. of holdings	0.0051*** [0.00002]	0.0053*** [0.00002]	0.0052*** [0.00002]	0.0053*** [0.00002]	0.0053*** [0.00002]	0.0053*** [0.00002]	0.0054*** [0.00002]
Share of empty holdings		-0.179*** [0.0019]	-0.185*** [0.0021]	-0.178*** [0.0019]	-0.179*** [0.00187]	-0.172*** [0.0021]	-0.159*** [0.00185]
Arable sector							
Total arable land of occupied holdings per holder	-0.0013*** [0.00003]	-0.0012*** [0.00003]	-0.0011*** [0.00003]	-0.001*** [0.00003]	-0.0006*** [0.00003]	-0.0007*** [0.00003]	-0.0007*** [0.00003]
Share of holders with less than 15 <i>strych</i> of arable land					0.121*** [0.0014]	0.130*** [0.00139]	0.119*** [0.0014]
No. of working animals per holder	-0.016*** [0.00046]	-0.019*** [0.00045]	-0.018*** [0.0005]	-0.016*** [0.0005]	-0.012*** [0.0005]	-0.011*** [0.00045]	-0.013*** [0.0005]
Pastoral sector							
No. of (non-working) cattle per holder	0.011*** [0.00025]	0.013*** [0.00025]	0.012*** [0.0003]	0.012*** [0.00025]	0.011*** [0.0002]	0.0097*** [0.0002]	0.011*** [0.0002]
Social composition							
Share of 'cottagers'	0.169*** [0.0008]	0.170*** [0.0009]		0.182*** [0.0009]	0.110*** [0.0012]	0.097*** [0.0012]	0.108*** [0.0012]
Share of 'smallholders'	0.301*** [0.001]	0.296*** [0.001]		0.308*** [0.001]	0.219*** [0.0014]	0.209*** [0.0015]	0.219*** [0.0014]
Share of 'freemen'				0.199*** [0.0014]	0.194*** [0.00138]	0.199*** [0.00137]	0.195*** [0.0014]
Share of Jews				0.928*** [0.001]	0.825*** [0.0015]	2.890*** [0.009]	0.819*** [0.001]
Share of 'peasants'			-0.224*** [0.001]				
Other village characteristics							
Presence of a mill	0.3704*** [0.0013]	0.3703*** [0.0013]	0.368*** [0.0014]	0.371*** [0.0013]	0.368*** [0.0013]	0.363*** [0.00129]	0.367*** [0.0013]
Share of female household heads	0.074*** [0.0034]	0.063*** [0.0034]	0.0629*** [0.004]	0.062*** [0.0035]	0.061*** [0.0036]	0.045*** [0.0037]	0.056*** [0.0036]
Share of occupied urban holdings on estate	-54.99*** [0.0023]	-54.96*** [0.0023]	-54.76*** [0.003]	-59.16*** [0.0024]	-58.75*** [0.002]	-59.50*** [0.0024]	-58.76*** [0.002]
Second serfdom proxy							
Presence of a holding held/used by landlord	0.067*** [0.0004]	0.091*** [0.00087]	0.091*** [0.00088]	0.092*** [0.00087]	0.092*** [0.00087]		
Share of land held/used by landlord						0.224*** [0.003]	
No. of holdings held/used by landlord							0.009*** [0.0003]
Constant	0.333*** [0.0008]	0.331*** [0.0008]	0.322*** [0.001]	0.311*** [0.0008]	0.265*** [0.0008]	0.276*** [0.0008]	0.269*** [0.0008]
Estate dummies	YES	YES	YES	YES	YES	YES	YES
N	6,836	6,836	6,836	6,836	6,836	6,768	6,836
Log-likelihood value	-1,641	-1,628	-1,630	-1,620	-1,614	-1,569	-1,621
Sigma	0.282	0.281	0.281	0.281	0.281	0.276	0.28
Pseudo-R ²	0.463	0.467	0.467	0.47	0.472	0.475	0.47

Note: * Significant at the 0.10 level. ** Significant at the 0.05 level. *** Significant at the 0.01 level.

Sources: *Berni Rula* database; see section II of this article for detailed data description.

influences are best measured by urbanization on the estate itself.³⁸ In all specifications in table 3, this variable was negatively related to non-agricultural activity in the estate's villages. This contrasts with the situation in the developed western provinces of the Netherlands, for instance, where high retail density in towns was associated with high retail density in villages. Only in less developed eastern Dutch provinces, where towns enjoyed greater institutional advantages, was there a wide rural–urban gap, suggesting that urban traders crowded out rural ones.³⁹ Bohemia was more similar to these eastern Dutch provinces: the presence of urban centres did not favour rural non-agricultural activity but discouraged it.

Craftsmen and merchants in Bohemian towns observably used their urban privileges to restrict rural competition.⁴⁰ In a single court sitting in 1662, for instance, the Frýdlant town butchers got the local seigneur to punish a villager for violating their guild privileges by trading in cattle, and the tailors brought down seigneurial penalties on serfs from three other villages for buying cheap garments from rural interlopers.⁴¹ In 1686, the Frýdlant potters secured heavy seigneurial penalties against a poor villager who had built a rural kiln 'counter to guild privileges'.⁴² As late as the mid-eighteenth century, villages around Cheb were forbidden to admit new inhabitants practising non-agricultural occupations, existing village weavers were forbidden to operate additional looms, and villagers were ordered to patronize town craftsmen.⁴³ Such prohibitions and penalties could not wholly stifle rural crafts and commerce, but certainly increased their costs and risks, reducing the economic viability of marginal village operations.⁴⁴

This arose from the fact that in Bohemia, as in many parts of central and eastern Europe, towns were not enclaves of institutional freedom. 'Free' towns such as Cheb may have been insulated from the powers of great seigneurs under the second serfdom, but they used their political dominion over the surrounding villages to enforce the economic privileges of their gilded burghers. 'Subject' towns such as Frýdlant were subordinated to the jurisdiction and fiscal exactions of the seigneur who owned the surrounding villages. Their gilded burghers put pressure on the seigneur to enforce their privileges against competitive pressures, even when these emanated from his own villagers, and gave him fiscal incentives to do so. Across Bohemia as a whole, such urban pressures against rural competition appear to have operated strongly enough to counteract the potentially stimulative effect of urban agglomeration economies.

The findings for Bohemia, as for the eastern Netherlands, show that certain types of urban centre could actually hinder rural development. In a wider perspective, this suggests caution in using urbanization as a metric for pre-modern economic growth where other evidence is lacking.

³⁸ Krofta, *Dějiny*, pp. 196–8; Petrůň, *Poddaný lid*, pp. 188–9; Ogilvie, 'Communities', pp. 81, 92–8; Klein, 'Institutions', pp. 67–8; Ogilvie, 'Choices', pp. 280–3.

³⁹ van den Heuvel and Ogilvie, 'Retail development', pp. 78–9.

⁴⁰ Cerman, 'Proto-industrialisierung', pp. 283–4, 300; Zeitlhofer, 'Besitztransfer', pp. 67–8, 78, 84; Ogilvie, 'Economic world', pp. 449–50.

⁴¹ Státní Oblastní Archiv Litoměřice, Pobočka Děčín, Fond Rodinný Archiv Clam-Gallasů, Historická Sbirka, Kart. 80, Amtsprotokolle 1661–4, fos. 57–9, 1 Aug. 1662.

⁴² *Ibid.*, 2. část, dodatky (Frýdlant) 11, Amtsprotokolle 1685–7, fo. 31r, 24 April 1686.

⁴³ Chalupa, Lišková, Nuhlíček, and Rajtoral, *Tereziánky katastr*, p. 283.

⁴⁴ Ogilvie, 'Economic world', pp. 449–50; eadem, 'Staat', pp. 60–3.

III

Analysis of *non*-agricultural activities requires controlling for characteristics of agriculture, the largest sector of the economy. Agriculture affects non-agricultural activity directly through costs of industrial raw materials (such as flax or timber) and trade wares (such as grain or cattle), and indirectly through opportunity costs of using labour, land, and capital in crafts or commerce instead of farming.⁴⁵ In theory, richer agricultural resource endowments could create countervailing effects on non-agricultural activities: a positive, complementary effect via reduction of local costs of agricultural products for further industrial processing, trading, and transporting; and a negative, substitution effect via an increase in the opportunity costs of allocating inputs to non-agricultural activities.

To explore these multiple influences, we included as regressors various measures of each village's agricultural activity: the total arable land per occupied holding (in all specifications); the share of holders with fewer than 15 *strych* (4.3 hectares or 10.7 acres) of arable, the minimum needed to support an average central European family of around five persons (specifications 5–7);⁴⁶ the share of 'peasants', householders with enough arable for subsistence (specification 3); the share of 'smallholders' with little arable and of 'cottagers' with no arable (specifications 1–2, 4–7); and the number of working and non-working animals per holder (all specifications).

As table 3 shows, the coefficients on all measures of arable endowments were significant and negative, suggesting that opportunity costs played an important role in serfs' occupational choices. Inhabitants of villages with more arable land per farm, lower proportions of householders with little or no arable land, and more working animals faced higher opportunity costs of engaging in non-agricultural activity and did so less. Surprisingly, however, these 'arable' variables *all simultaneously* show a significant relationship with non-agricultural occupations, showing that they exercised *independent* effects. Smallholders and cottagers with little or no arable land *needed* to find other livelihoods, but in villages where average endowments of arable land and draft animals were low, *all* holders apparently faced lower opportunity costs of allocating resources outside agriculture.

Pastoral agriculture, by contrast, was positively associated with non-agricultural activities, as shown by the significant positive coefficient on the number of non-working cattle in all specifications in table 3. Cattle were valuable inputs in diversifying into crafts such as butchering, tanning, and cheese-making, and into trading in animals, meat, leather, and dairy products.⁴⁷ These complementarities evidently outweighed any tendency for pastoral production and non-agricultural occupations to increase each other's opportunity costs in terms of labour, land, or capital deployment.

In a wider perspective, the significant and pervasive relationship between arable agriculture and rural non-agricultural activity is consistent with Bohemian serfs' taking account of opportunity costs in allocating resources to different occupations. This decisively refutes the still influential Chayanovian idea that serfs were unwilling or unable to ascribe quantitative values to time, land, capital, or animal

⁴⁵ See Ogilvie, 'Proto-industrialization', pp. 162–6.

⁴⁶ Achilles, *Deutsche Agrargeschichte*, pp. 23–4, 26.

⁴⁷ Ogilvie, 'Economic world', p. 444.

energy.⁴⁸ The fact that the relationship between non-agricultural activity and the other explanatory variables holds even controlling for agricultural characteristics demonstrates that non-agricultural work was not merely something serfs fell back on when farm-work was unavailable, but rather a positive choice taken in response to other aspects of their constraint structure. We now turn to these other factors.

IV

The first factor is social stratification. A central institutional feature of many early modern European economies was that each person formally belonged to a given social stratum. In Bohemia, as in many other parts of central and eastern Europe, social stratum was not defined economically (in terms of occupation or wealth) or socio-culturally (in terms of education, speech, or consumption habits), but institutionally and legally. At the top of the village hierarchy were the ‘peasants’ (Czech *sedlák* or *rolník*, German *Bauer*), who owned enough arable land for agricultural subsistence, paid the highest manorial dues and state taxes, and owed the most forced labour to the overlord, often with draft animals as well as human workers. Then came the smallholders (Czech *zahradník*, German *Gärtner*), who had some arable land but not enough to subsist from, paid lower dues and taxes, and owed services to the landlord with human labour only. Finally, the cottagers (Czech *chalupník*, German *Häusler*) held only their own cottages and gardens, paid minor dues and taxes, and owed lighter (though increasing) labour services.⁴⁹ All other Bohemian serfs lived in households headed by members of these three official strata, as family members, servants, or inmate-lodgers (Czech *podruh*, German *Hausleute* or *Hausgenossen*).⁵⁰ A few outsiders, notably freemen (Czech *svobodník*, German *Freibauer*) and Jews (Czech *žid*, German *Jude*), also dwelt in Bohemian villages under manorial ‘privileges’.

A Bohemian serf belonged to a particular social stratum because of the manorial status of his landholding. He could only move into a different stratum by moving to an existing landholding that appertained to that stratum. Bohemian landholdings were legally impartible, and new ones could only be created with manorial and communal agreement. The relative size of the three core social strata in a Bohemian village was thus exogenous to its occupational structure. The social structure of the village was the outcome of the initial allocation of landholdings of different strata in that village’s original settlement charter in the middle ages, the number of generations during which non-inheriting offspring or immigrants sought to establish smallholdings or cottages on marginal or common land, and the varying incentives of different overlords and communes to tolerate the formation of such holdings.⁵¹ The relative size of the different strata in a Bohemian village in 1654

⁴⁸ Chayanov, Thorner, Kerblay, and Smith, *Theory*, pp. 1–5; Kriedte et al., *Industrialization*, pp. 16, 40–4, 51, 58, 79, 214–15, 236, 239, 274, 286, 330. For criticisms, see Ogilvie, ‘Economic world’, pp. 430–5; Dennison, *Institutional framework*, pp. 1–28; Cerman, *Villagers*, pp. 109–11; Ogilvie, ‘Choices’, pp. 269–78.

⁴⁹ Ogilvie and Cerman, ‘Bohemian census’, pp. 335, 345; Cerman, ‘Proto-industrialisierung’, pp. 189–258; Ogilvie and Edwards, ‘Women’, p. 976; Zeitlhofer, ‘Besitztransfer’, pp. 86–109.

⁵⁰ Our *Berni Rula* data record only 11 independent rural inmate-lodgers and provide no information on economic activities of dependent ones inside others’ households. For a detailed examination of Bohemian inmate-lodgers, see Ogilvie and Cerman, ‘Bohemian census’.

⁵¹ *Ibid.*; Cerman, ‘Proto-industrialisierung’, pp. 316–22; Zeitlhofer, ‘Besitztransfer’, pp. 86–109; *idem*, *Besitzwechsel*, pp. 71–85.

was thus not a short-term, individual choice variable, but rather historically and institutionally determined and hence exogenous to the village's current occupational structure.

Given the importance of these institutionally defined social strata in the Bohemian economy, all our regressions included variables registering their proportions among village holdings. In table 3, specifications 1–2 control for the proportions of smallholders and cottagers only, specification 3 focuses on the proportion of peasants, and specifications 4–7 also include the proportions of freemen and Jews.

Traditional historiography argued that 'sub-peasant' strata (smallholders and cottagers) were compelled into non-agricultural activities by lack of land. Cerman, by contrast, found that it was initially the peasant stratum that dominated Bohemian rural industries; sub-peasants only entered later, and then often in irregular by-employments alongside agricultural labour and other wage-work. Non-agricultural activity could thus be undertaken by *any* Bohemian social stratum.⁵²

For 1654, however, our multivariate analysis finds that non-agricultural activity was indeed significantly greater in villages with larger sub-peasant strata. Density of non-agricultural occupations was positively related to the proportions of smallholders and cottagers (table 3, specifications 1–2 and 4–7) and negatively to the proportion of peasants (specification 3).⁵³ Strikingly, the positive relationship between non-agricultural activity and the proportion of smallholders and cottagers remains significant even controlling for the share of village holdings with fewer than 15 *strych* of arable land, the minimum necessary for agricultural self-sufficiency (specification 5).⁵⁴ This suggests that the positive link between non-agricultural activity and sub-peasants was caused not merely by their lack of land but also by other aspects of their status. One possibility is that their lower burden of manorial labour services freed their household labour for alternative work. This hypothesis opens perspectives for future research into precisely how manorial demands affected labour allocation by different rural strata.

'Outsider' groups such as freemen and Jews were also positively associated with rural non-agricultural activity (table 3, specifications 4–7). Freemen could practise any occupation, and landlords often permitted them residence precisely because they had industrial skills unavailable locally, although almost all freemen in our *Berni Rula* data also held arable land. Jews were forbidden to practise many occupations, including agriculture, so they had to engage in non-agricultural activities.⁵⁵ Thus the least advantaged groups in Bohemian rural society—land-poor smallholders, landless cottagers, and outsiders such as Jews and freemen—were central to the growth of non-agricultural occupations under the second serfdom.

V

What role was played by large-scale industrial infrastructure? Early modern Bohemia certainly possessed such infrastructure, as shown by the fact that the

⁵² Cerman, 'Proto-industrialisierung', pp. 294–7.

⁵³ The 'peasant' variable and the 'smallholder'/cottager' variables were multicollinear, so could only be included in separate regressions.

⁵⁴ Achilles, *Deutsche Agrargeschichte*, pp. 23–4, 26.

⁵⁵ The low share of Jews explains the volatility of the coefficients in tab. 3, specifications 5–7.

Berní Rula recorded mills, ironworks, and breweries. In theory, industrial infrastructure might either encourage serfs' non-agricultural activity through complementarities or stifle it by competing for inputs. Our regressions found no significant relationship with ironworks or breweries, suggesting that such manufactories, often owned by landlords, operated orthogonally to small-scale serf enterprises.⁵⁶

The presence of a mill in the village, by contrast, was associated with significantly higher non-agricultural activity in all specifications in table 3. Since the location of water-driven mills was exogenously determined by hydrological factors, we know the causal effect ran from the mill to other non-agricultural enterprises and not vice versa. Mills had an advantage over 'organic' energy from human and animal labour because they supplied energy more intensely and continuously. Although the *Berní Rula* did not usually record the specific purpose for which a mill was used, in pre-modern Europe watermills increased the productivity of a wide array of energy-intensive activities including grinding grain into flour for baking, cracking husks of malted barley and wheat for brewing, cutting logs into planks, fulling woollen cloths, tanning leather, crushing ores, running blast furnaces, driving forge hammers, slitting iron bars into rods, sharpening tools, pressing oil from hemp and other seeds, pulping rags for paper, and driving bellows for smithies. Such processing activities in turn attracted ancillary non-agricultural activities, especially in transport and commerce, which benefited from proximity to mills as processing centres.

The regression results in table 3 suggest that such complementarities between mills and other non-agricultural activities were substantial in rural Bohemia. The only factor that interfered with the positive relationship between milling and other non-agricultural activities was landlord presence on village holdings. As shown by the negative coefficient on the interaction term in table 5, the otherwise positive synergies between milling and rural non-agricultural enterprises turned decisively negative in villages with some direct landlord presence. This striking reversal, discussed below, sheds light on the complex impact of the second serfdom on the Bohemian rural economy.

VI

How did occupational structure interact with the position of women? Gender roles in historical societies are sometimes assumed to be culturally or biologically determined, but recent historiography suggests that women's position both influenced the economy and was influenced by it.⁵⁷ Our regression models therefore included the share of independent households headed by females, an indicator of women's position that has been successfully used to analyse early modern European economies.⁵⁸ Across our entire sample of 6,983 Bohemian villages in 1654, the average female headship rate was just over 3 per cent. This is considerably lower than the 10–15 per cent normally found in early modern western European villages, but lies in the range reported in other studies of eastern-central European

⁵⁶ Results are available from the authors on request.

⁵⁷ Ogilvie, *Bitter living*, pp. 320–54.

⁵⁸ Ogilvie and Edwards, 'Women', pp. 965–82; Ogilvie, *Bitter living*, pp. 217–24; van den Heuvel and Ogilvie, 'Retail development', pp. 77–8; Todd, 'Demographic determinism', pp. 426, 444, and *passim*.

rural societies, including Bohemia.⁵⁹ However, Bohemian female headship was not invariant: some villages had 30 per cent female householders while others had none.

In all regression specifications in table 3, higher female household headship was associated with a significantly higher share of householders practising non-agricultural occupations. In this, Bohemia resembled western European economies such as the Netherlands, where non-agricultural activities such as retailing were denser in villages with higher female headship rates.⁶⁰ Indeed, the findings for Bohemia strengthen the hypothesis that female headship was positively associated with non-agricultural activity in the pre-industrial economy by confirming that this prevailed even controlling for settlement size, agricultural structure, social composition, and other village characteristics, and in eastern-central Europe under the second serfdom as well as in the economically precocious North Sea region.⁶¹

A two-way causal relationship almost certainly underlay this positive link. Female headship could encourage non-agricultural activity in several ways. Physical differences made women more productive in activities such as crafts and commerce, requiring endurance, dexterity, communication, or calculation skills, while men were more productive in occupations such as arable agriculture and labouring which required greater upper-body strength. Women with offspring were also relatively productive in activities such as crafts and commerce that could be carried out in domestic locations and combined more easily with household production. So if the rate of female headship was high in a village for exogenous reasons (for example, wartime devastation, male emigration, institutional tolerance), this could increase local density of non-agricultural activities. However, causation could also run in the opposite direction. If intensity of non-agricultural occupations was high in a village for exogenous reasons—the ones this article seeks to identify—that could enable more women to support independent households there. Furthermore, underlying factors could facilitate both female headship and non-agricultural activity. Less severe communal or manorial enforcement, for instance, could lower barriers to women seeking to support themselves independently in all occupations (not just non-agricultural ones) and to all economic agents (not just women) in seeking to practise non-agricultural occupations.⁶²

For mid-seventeenth-century Bohemia we could not address the econometric problems created by these two-way causal links using instrumental variables, since the documentary sources supply no variable correlated with female headship but not with the intensity of non-agricultural occupations. Furthermore, the determinants of pre-industrial female headship itself are still not fully understood. Our alternative econometric approach was to estimate our regressions with and without the female headship variable, interact female headship with other variables, and test for robustness. The inclusion of female headship hardly altered the estimated coefficients on other variables and the link between female headship and occupational structure was statistically significant in all specifications. This provides comprehensive support for the conclusion that there was a significant and pervasive association between women's autonomy and non-agricultural activity, even

⁵⁹ Ogilvie and Edwards, 'Women', esp. p. 971, tab. 2.

⁶⁰ van den Heuvel and Ogilvie, 'Retail development', pp. 77–8.

⁶¹ Ogilvie and Edwards, 'Women', pp. 980–9.

⁶² *Ibid.*, pp. 982–9; van den Heuvel and Ogilvie, 'Retail development', p. 78.

controlling for other factors. However, the potential for two-way causal effects remains, opening up perspectives for deeper analyses to investigate micro-level determinants of gender-specific work patterns under the second serfdom.

The only exception to the positive association between female headship and rural non-agricultural activity in rural Bohemia emerged when we introduced interactions between female headship and measures of landlord presence in the village, as shown by the negative coefficient on the interaction term in table 5. This indicates the importance of exploring the economic role of Bohemian landlords under the second serfdom, to which we now turn.

VII

In early modern Bohemia, serfs participated actively in factor and product markets, but within comprehensive institutional constraints imposed by landlords.⁶³ The rich historiography on the European second serfdom is deeply divided concerning its economic impact. On the one hand, traditional ‘manorial dominance’ views assume that under serfdom landlords stifled serfs’ non-agricultural activities altogether.⁶⁴ On the other, revisionist, ‘communal autonomy’ approaches hold that landlords were unable to intervene inside villages and hence hardly affected serfs’ economic activities. Some revisionist approaches go so far as to claim that western European ‘free’ economies were no more advanced than east-Elbian ‘serf’ economies, including in their occupational structure: demesne lordship, it is argued, positively encouraged serf crafts and commerce.⁶⁵ A more recent, ‘institutional’ approach argues that although the overarching institutional framework of serfdom tended to distort resource allocation and stifle growth, certain components of this framework enabled landlords to extract rents from specific non-agricultural activities, which they therefore had incentives to encourage.⁶⁶

This continuing debate motivated our search for a way to measure the intensity of the second serfdom quantitatively. The only measures available for our sample of 6,983 villages in 1654 related to the presence of village holdings currently used or occupied by the landlord. We postulated that manorial presence on village holdings might capture the intensity of landlords’ interest, information, and control over villagers’ economic choices. To interpret this proxy for manorial control, however, we must recognize the complexities it raises.

The first complexity arises from the difficulty of measuring institutional constraints quantitatively. Bohemian landlords had wide and variegated entitlements to intervene in villagers’ lives. A variable capturing manorial presence on village holdings is better than having no quantitative measure of the second serfdom at all, but does not register *how* manorial presence was being exercised. The *Berní Rula* does, however, provide some indications of what it implied. For one thing, such holdings tended to bring manorial personnel to the village, as when the *Berní Rula*

⁶³ Maur, *Český komorní velkostatek*, pp. 44–9, 87–98, 113–14, 119–20, 127–9; Cerman, ‘Proto-industrialisierung’, pp. 81–145, 259–323; idem, *Villagers*, pp. 108–11; Ogilvie, ‘Economic world’, pp. 434–5, 441–51; eadem, ‘Communities’, pp. 103–8; eadem, ‘Staat’, pp. 60–3, 72–4, 78–81; eadem, ‘Village community’ pp. 421–4; Klein, ‘Institutions’, pp. 59, 64–76.

⁶⁴ For example, Kriedte et al., *Industrialization*, pp. 17–20, 216–20.

⁶⁵ Cerman, *Villagers*, pp. 109–11, 118, 123.

⁶⁶ Ogilvie, ‘Serfdom’; Klein, ‘Institutions’; Dennison, ‘Institutional framework of serfdom’; Briggs, ‘English serfdom’.

recorded that ‘the nobility’s bureaucrat is living in a dwelling owned by the landlord’.⁶⁷ Local presence of manorial personnel inevitably created the potential for enhanced manorial monitoring and control over serfs’ activities. In other cases, the *Berní Rula* recorded that ‘the nobility is sowing the fields’, indicating potential enhanced demand for agricultural labour.⁶⁸ A third major type of manorial presence was when ‘the nobility has built a tavern in the village’.⁶⁹ This was likely to signal enhanced manorial surveillance over those non-agricultural activities legally monopolized by privileged village taverns, including hop cultivation, brewing, distilling, baking, and butchering.⁷⁰ Qualitative and institutional evidence can thus illuminate the econometric findings.

A second complexity arises from the fact that although manorial presence on village holdings registered a potential increase in landlord intervention, it measured this at the ‘intensive margin’ (stronger versus weaker enforcement of an existing institutional system) rather than the ‘extensive margin’ (presence or absence of the institutional system altogether). This variable does not compare ‘serf’ settlements with ‘free’ ones, since all the villages were subject to the second serfdom. Rather, it offers a measure of the degree to which the second serfdom was locally monitored and controlled. It therefore captures those effects of the second serfdom that depended on direct local enforcement, not those generated by wider institutional constraints implemented beyond the individual village via manorial courts, manorial administrators, demesne foremen, collaboration among different landlords (for example, reciprocal migration restrictions), or state enforcement (for example, military force or jurisdictional inaccessibility).⁷¹

A third complexity is the probable two-way causal relationship between manorial presence and occupational structure. On the one hand, manorial presence could affect serfs’ incentives to undertake non-agricultural activities. Conversely, however, existing non-agricultural activities could affect landlords’ incentives, for example, by attracting landlords to occupy village holdings in order to monitor extraction of rents from rural crafts. Surviving data sources provide no instrumental variable (one correlated with landlord presence but not with non-agricultural activity) that could solve this endogeneity problem. Our alternative approach was to estimate the regressions with and without landlord presence, to explore different measures of landlord presence, and to include interaction terms between landlord presence and other regressors. The results enable us to characterize the complex relationship between landlords and serfs’ occupational decisions more fully, while still leaving interesting open questions for future research.

The traditional ‘manorial dominance’ view of serfdom, at least in its more extreme manifestations, is refuted by our findings. Mid-seventeenth-century Bohemia was no autarkic or purely agricultural economy in which landlords stifled all rural non-agricultural activity. On the contrary, as we have seen, the *Berní Rula* recorded non-agricultural activities covering the entire spectrum: locally oriented crafts, export-oriented proto-industries, retail trades, and even merchant

⁶⁷ See *Berní Rula 11*, p. 516 (Kraj čáslavský II); *Berní Rula 28*, p. 849 (Kraj prácheňský II. díl); *Berní Rula 31*, p. 109 (Kraj vltavský).

⁶⁸ See *Berní Rula 8–9*, pp. 24, 344 (Kraj boleslavský); *Berní Rula 11*, p. 613 (Kraj čáslavský II); *Berní Rula 12*, p. 226 (Kraj hradecký 1. díl); *Berní Rula 26*, p. 239 (Kraj podbrdský); *Berní Rula 32*, p. 247 (Kraj žatecký 1. díl).

⁶⁹ See *Berní Rula 18*, pp. 344, 449 (Kraj kouřimský díl 1); *Berní Rula 25*, p. 893 (Kraj plzeňský díl 3).

⁷⁰ Ogilvie, ‘Village community’, pp. 421–5.

⁷¹ Klein, ‘Institutions’, pp. 59, 64–76; Ogilvie, ‘Staat’, pp. 60–3, 72–4, 78–81.

commerce. Rural non-agricultural activity was less prevalent in Bohemia than in western Europe but not stifled altogether, and varied significantly with village characteristics.

However, the revisionist 'communal autonomy' view, according to which landlords were uninvolved with economic life inside serf villages, is also refuted by our findings, which reveal a significant and robust association between non-agricultural activity and landlord presence. Table 3, column 1, the simplest specification, already showed that the presence of at least one holding in the village occupied or used by the landlord was associated with a significantly higher intensity of non-agricultural activity in the village. This result became more striking in the specification in column 2, which controlled for the share of empty holdings in the village on the grounds that the use of a holding by a landlord might also be picking up the effect of desertions. It was also fully robust to alternative specifications of village social structure, as shown in columns 3–5. Changing how landlord presence was measured (specifications 6 and 7) left the significance of the association unchanged: the presence of landlord-occupied holdings, the share of arable land occupied by the landlord, and the number of holdings he occupied were all significantly related to the density of non-agricultural activities.⁷²

Superficially, this might seem to support a second variant of the revisionist view, according to which serfdom presented no obstacle to economic dynamism because landlords encouraged serf enterprises. However, deeper econometric analysis shows that the interrelationship between landlord presence and rural non-agricultural activity was not straightforwardly positive. Rather, as tables 4 and 5 show, landlord presence also brought in its wake significant negative pressures on rural non-agricultural activity, both via nonlinearities and via interactions with other variables.

We first investigate whether the association between non-agricultural activity and landlord presence was in fact a linear one. Table 4 presents the results of introducing into the regression specifications in table 3 the square of the share of arable land occupied by the landlord and the square of the number of holdings thus occupied. It turns out that the association between non-agricultural activity and landlord presence was not linear at all, since the quadratic terms are negative and significant. The positive coefficient on landlord presence in table 3 was merely a snapshot of the initial upward slope of a curvilinear relationship: a small landlord presence in the village was positively associated with non-agricultural activity, but after a certain point this relationship flattened out. In concrete terms, on a single village holding, manorial presence might increase demand for non-agricultural goods or services from serfs, but when manorial presence spread to multiple holdings it began to crowd out serf crafts and commerce, possibly by siphoning off labour or by stifling enterprise through surveillance and rent extraction.

Interaction terms reveal a second set of complexities. Table 5 presents the results of interacting landlord presence with, respectively, female household headship and the presence of mills. The original explanatory variables retain similar statistical significance and magnitudes to the ones they have in table 3, landlord presence retains its positive coefficient, but the interaction terms are negative. On their own,

⁷² We estimated all specifications in tab. 3, cols. 1–5, using all alternative measures of landlord presence, but present only the specification in col. 5. Results are available from the authors on request.

Table 4. *Regression analysis with second-serfdom non-linear terms (Tobit model)*

	(1)	(2)
Size of village		
No. of holdings	0.0053*** [0.00002]	0.0054*** [0.00002]
Share of empty holdings	-0.173*** [0.0025]	-0.169*** [0.0017]
Arable sector		
Total arable land of occupied holdings per holder	-0.00067*** [0.00003]	-0.00065*** [0.00003]
Share of holders with less than 15 <i>strych</i> of arable land	0.131*** [0.0014]	0.119*** [0.00139]
No. of working animals per holder	-0.0112*** [0.00045]	-0.0119*** [0.00046]
Pastoral sector		
No. of (non-working) cattle per holder	0.0097*** [0.0002]	0.011*** [0.0002]
Social composition		
Share of 'cottagers'	0.097*** [0.00125]	0.111*** [0.00122]
Share of 'smallholders'	0.208*** [0.0016]	0.221*** [0.0014]
Share of 'freemen'	0.1999*** [0.0014]	0.195*** [0.0014]
Share of Jews	2.894*** [0.009]	0.825*** [0.001]
Other village characteristics		
Presence of a mill	0.363*** [0.00129]	0.368*** [0.0013]
Share of female household heads	0.044*** [0.0038]	0.053*** [0.0036]
Share of occupied urban holdings on estate	-59.51*** [0.0024]	-58.75*** [0.0023]
Second serfdom proxy		
Share of land held/used by landlord	0.301*** [0.026]	
(Share of land held/used by landlord) ²	-0.124*** [0.032]	
No. of holdings held/used by landlord		0.047*** [0.001]
(No. of holdings held/used by landlord) ²		-0.005*** [0.0001]
Constant	0.276*** [0.0008]	0.269*** [0.0008]
Estate dummies	YES	YES
N	6,768	6,836
Log-likelihood value	-1,569	-1,616
Sigma	0.276	0.28
Pseudo-R ²	0.475	0.471

Note: * Significant at the 0.10 level. ** Significant at the 0.05 level. *** Significant at the 0.01 level.

Sources: As for tab. 3.

both landlord presence and female headship were associated with greater non-agricultural activity, but when the landlord was present on village holdings, female headship was associated with less non-agricultural activity. Likewise, on their own, both landlord presence and village mills were positively associated with non-agricultural activity, but when the landlord was present on village holdings the association between milling and non-agricultural activity turned negative.

Table 5. *Regression analysis with second-serfdom interactions (Tobit model)*

	(1)	(2)	(3)
Size of village			
No. of holdings	0.0053*** [0.00002]	0.00535*** [0.00002]	0.0054*** [0.00002]
Share of empty holdings	-0.179*** [0.0019]	-0.168*** [0.002]	-0.169*** [0.0018]
Arable sector			
Total arable land of occupied holdings per holder	-0.0006*** [0.00003]	-0.0006*** [0.00003]	-0.0007*** [0.00003]
Share of holders with less than 15 <i>strych</i> of arable land	0.121*** [0.00139]	0.1299*** [0.0014]	0.119*** [0.0014]
No. of working animals per holder	-0.012*** [0.00046]	-0.01*** [0.00046]	-0.011*** [0.00046]
Pastoral sector			
No. of (non-working) cattle per holder	0.011*** [0.0002]	0.009*** [0.0002]	0.0108*** [0.0002]
Social composition			
Share of 'cottagers'	0.111*** [0.001]	0.099*** [0.0013]	0.11*** [0.001]
Share of 'smallholders'	0.219*** [0.0014]	0.207*** [0.0015]	0.219*** [0.0014]
Share of 'freemen'	0.1915*** [0.00138]	0.199*** [0.00137]	0.192*** [0.00138]
Share of Jews	0.832*** [0.0015]	2.889*** [0.009]	0.826*** [0.001]
Other village characteristics			
Presence of a mill	0.376*** [0.0014]	0.367*** [0.0014]	0.372*** [0.00137]
Share of female household heads	0.087*** [0.005]	0.058*** [0.0047]	0.082*** [0.0047]
Share of occupied urban holdings on estate	-58.805*** [0.0023]	-59.591*** [0.0024]	-58.844*** [0.0023]
Second serfdom and its interactions			
Presence of a mill x presence of a holding held/used by landlord	-0.13*** [0.0057]		
Share of female household heads x presence of a holding held/used by landlord	-0.362*** [0.039]		
Presence of a holding held/used by landlord	0.115*** [0.002]		
Presence of a mill x share of land held/used by landlord		-0.194*** [0.028]	
Share of female household heads x share of land held/used by landlord		-1.224*** [0.161]	
Share of land held/used by landlord		0.302*** [0.006]	
Presence of a mill x no. of holdings held/used by landlord			-0.035*** [0.003]
Share of female household heads x no. of holdings held/used by landlord			-0.268*** [0.018]
No. of holdings held/used by landlord			0.049*** [0.001]
Constant	0.262*** [0.00082]	0.274*** [0.00083]	0.266*** [0.00083]
Estate dummies			
N	6,836	6,734	6,802
Log-likelihood value	-1,612	-1,566	-1,614
Sigma	0.279	0.276	0.281
Pseudo-R ²	0.473	0.474	0.47

Note: * Significant at the 0.10 level. ** Significant at the 0.05 level. *** Significant at the 0.01 level.

Sources: As for tab. 3.

Qualitative and institutional evidence can help explain these complex relationships between landlord presence, occupational structure, and other variables. Bohemian landlords engaged in a wide array of institutional interventions in the rural economy. At least four types of manorial intervention had the potential to affect serfs' non-agricultural activities: operating manorial manufactories using serf labour; extorting license fees and dues from serfs' non-agricultural enterprises; granting milling monopolies; and controlling serfs' access to landholdings. These four manorial strategies created multiple and often countervailing incentives for serfs to engage in non-agricultural activities.

First, Bohemian landlords directly intervened in the non-agricultural sector by establishing demesne manufactories.⁷³ These included ironworks, glassworks, fish-farms, breweries, and distilleries, often based on unpaid *corvée* labour and 'forced wage labour' extorted from serfs.⁷⁴ Demesne enterprises did not directly feed into the non-agricultural occupations recorded in the *Berní Rula*, which solely reflect serfs' own non-agricultural activities. However, demesne enterprises affected serf occupations indirectly, via manorial labour demand. In attempting to increase their profits by diversifying into non-agricultural activities, Bohemian landlords faced labour scarcity caused by wartime depopulation and religious emigration. They tried to reduce costs by replacing hired labour with coerced labour extorted from villagers under the second serfdom.⁷⁵ Demesne enterprises often mobilized both 'Robot' (compulsory labour dues) and 'forced wage-labour' (compulsory work at artificially low wages).⁷⁶

Demand for labour in demesne enterprises created incentives for landlords to establish a presence in villages that already had workers who were not fully employed in agriculture and might more easily be enticed or pressed to accept non-agricultural employment. Purely agricultural villages lacked local pools of workers with the desire, and possibly even the habits or skills, needed for non-agricultural work in demesne manufactories. Villages where local serfs were already active outside agriculture offered the possibility of recruiting non-agricultural labourers more cheaply and with less resistance. This created a motive for landlords to establish a presence in villages where such activities were already more highly developed, in order to monitor and mobilize local non-agricultural labour pools.

A second type of manorial intervention which interacted with serfs' non-agricultural activity was the practice of granting manorial licenses permitting serfs to engage in crafts and commerce in return for paying fees. Depopulation resulting from warfare and religious emigration shrank the pool of urban craftsmen.⁷⁷ Landlords profited by granting permits to rural artisans in return for annual rents, fees, and dues.⁷⁸ Rural bakers, butchers, and other craftsmen and traders were

⁷³ Janoušek, *Historický vývoj*, p. 12; Svoboda, 'Feudální závislost', p. 74; Kočí, 'Robotní povinnosti', p. 336; Maur, *Český komorní velkostatek*, p. 49; idem, 'Vývojové etapy', pp. 207, 211; idem, 'Zemědělská výroba', pp. 114, 120; Klíma, *Manufakturní*, pp. 131, 154; Myška, 'Pre-industrial iron-making', pp. 55–8.

⁷⁴ Myška, 'Pre-industrial iron-making', pp. 51–67; Maur, *Český komorní velkostatek*, pp. 45–7; Cerman, 'Proto-industrialisierung', pp. 10–67; Ogilvie, 'Economic world', p. 436; eadem, 'Village community', pp. 421–4.

⁷⁵ Kočí, 'Robotní povinnosti', p. 336; Maur, 'Poddaní točnického panství' [pt. 2], pp. 288, 297; idem, *Český komorní velkostatek*, pp. 119–20; Svoboda, 'Feudální závislost', p. 77.

⁷⁶ Petráň, *Zemědělská výroba*, pp. 165–6; Maur, *Český komorní velkostatek*, pp. 93, 120–1; Myška, 'Pre-industrial iron-making', pp. 59–61; Maur, 'Vývojové etapy', p. 208.

⁷⁷ Klíma, *Manufakturní*, pp. 20–3; idem, 'Industrial development', pp. 87–8, 90.

⁷⁸ Klíma, *Manufakturní*, pp. 444–5; idem, 'Industrial development', pp. 90–1; Petráň, *Zemědělská výroba*, p. 277.

often obliged to pay fees in return for manorial licenses to practise these occupations. Private glassworks and ironworks had to obtain manorial permission to construct industrial buildings and workers' houses, but then created demand for crafts and commercial operations servicing the manufactory and the surrounding industrial settlements, enabling the manor to levy additional dues.⁷⁹

The fact that Bohemian landlords could use their institutional powers to extract rents from serfs' crafts and trades created manorial incentives to tolerate or encourage such non-agricultural activities. Although urban guilds sometimes lobbied manorial administrations to restrict rural crafts, as we have seen, landlords had an incentive to ignore such lobbying if they could extort sufficient revenues from serf enterprises. The institutional characteristics of the Bohemian second serfdom were thus not inconsistent with a positive association between landlord presence and certain forms of non-agricultural activity by serfs.

This does not, however, establish whether any such association was causal or in which direction causation ran. On the one hand, landlords had incentives to encourage rural non-agricultural activities because of the rents they could extract from those activities, either directly through demanding dues or indirectly through increasing effective demand for demesne output such as beer and spirits. Having once encouraged such activities, landlords had an incentive to establish a presence in such villages to monitor and enforce the payment of craft dues. On the other hand, pre-existing non-agricultural activities in a village could attract manorial attention and create incentives for landlord presence in the village to ensure that any rents payable by rural tradesmen were properly delivered and that other activities that might threaten manorial interests were controlled. Such considerations make it likely that the positive association between at least a small degree of landlord presence and greater non-agricultural activity in a village—the upward slope of the curvilinear relationship—resulted more from landlords being attracted to industrial or commercial villages than from industry and commerce being attracted to villages where landlords were present. However, even if the dominant effect ran from non-agricultural activity to landlord presence, a subsidiary causal relationship may have operated in the opposite direction.

Bohemian landlords also extracted rents from the rural economy in a third way: by limiting competition.⁸⁰ One major sector in which they did so was milling. The landlord often legally bound villagers to a manorial mill and forbade them to use mills belonging to peasants, towns, or other landlords; the manorial mill charged monopoly prices, and the profits went to the landlord.⁸¹ Another manorial tactic was to grant a monopoly to a private miller, who could therefore charge monopoly prices, but shared his profits with the manor by paying a license fee.⁸² Monopolistic mills charged high prices, offered poor service, and profited the landlord, so millers and customers had incentives to avoid manorial dues on milling and its spin-off activities, including baking, brewing, smithing, sawing wood, and processing textiles.⁸³

⁷⁹ Klíma, *Manufakturní*, pp. 153–4; Míka, *Poddaný lid*, pp. 142–3; Maur, 'Zemědělská výroba', p. 113.

⁸⁰ Krofta, *Dějiny*, pp. 209–15; Klíma, *Manufakturní*, pp. 78–80; Janoušek, *Historický vývoj*, pp. 14–16; Ogilvie, 'Economic world', pp. 448–51.

⁸¹ Maur, 'Zemědělská výroba', p. 109; Klein, 'Institutions', p. 71.

⁸² Maur, *Český komorní velkostatek*, pp. 44–5; idem, 'Zemědělská výroba', pp. 109–12.

⁸³ Ogilvie, 'Economic world', p. 446.

The nexus of incentives created by manorial milling prerogatives is consistent with the negative coefficient in table 5 on the interaction term between mills and landlord presence. Manorial presence on village holdings facilitated manorial monitoring of the miller and any spin-off activities by serfs, burdening them with additional dues and stifling non-agricultural activities that the presence of a mill in the village would otherwise have encouraged.

Independently, mills were associated with more intense non-agricultural activity, as was a limited degree of landlord presence. However, in villages where both coexisted, manorial presence reversed the positive effect of mills. These two different components of the second serfdom—the extraction of manorial rents from serfs' non-agricultural occupations and the extraction of manorial rents from mills—exercised countervailing effects on the overall intensity of rural non-agricultural activity.

A fourth way Bohemian landlords affected non-agricultural activity was through the unintended consequences of policies they pursued in spheres that were not directly related to serfs' occupational choices. One example is the manorial regulation of access to landholdings, which discriminated strongly against females.⁸⁴ As discussed above, female headship in early modern Bohemia was very low by western European standards. Analysis of a panel dataset on Bohemian villages found a significant decline in the level of female headship and its elasticity with respect to socioeconomic influences over the period during which the Bohemian second serfdom intensified. Archival sources show manorial administrators ejecting female farmers as poor fiscal risks and yielding to rent-seeking by village communities, communal oligarchs, and male relatives who sought to take over women's holdings for their own ends. Manorial pressure was a major factor depressing female headship in Bohemia before Emancipation.⁸⁵

Female headship by itself, as discussed above, manifested a positive relationship with rural non-agricultural activity. However, the interaction term with landlord presence was negative, as table 5 shows. Independently, female headship was associated with greater non-agricultural activity, as was a limited landlord presence locally. But in villages where both coexisted, the landlord's presence reversed the positive relationship between female headship and non-agricultural activities, stifling a major source of non-agricultural initiative emanating from serfs themselves. Even where landlords were motivated to encourage non-agricultural occupations in order to extract rents from them, manorial policies to restrict female headship exercised a countervailing negative effect. The rents landlords could reap from female non-agricultural activity were evidently outweighed by the perceived risks posed by female householders, who were regarded not just as unreliable payers of money rents and labour dues, but also as vexatious to the communal oligarchies on whom landlords depended to make the second serfdom work.⁸⁶

These negative interaction effects between landlord presence and other factors that normally favoured rural non-agricultural activity—mills, female heads—raise broader considerations. The second serfdom was a multi-faceted institutional system involving a conglomeration of various landlord tactics to extract rents from

⁸⁴ Ogilvie and Edwards, 'Women', pp. 982–9; Velková, 'Women', pp. 257–9; idem, 'Role', p. 508.

⁸⁵ Ogilvie and Edwards, 'Women', pp. 978, 982–9.

⁸⁶ *Ibid.*, pp. 982–9; Ogilvie, 'Communities', pp. 113–15.

serfs.⁸⁷ Where landlords could extort fees and dues from serfs' crafts and commerce, they understandably permitted or even encouraged such activities. This incentive was stronger in villages where at least a limited degree of manorial presence facilitated monitoring and control over the inhabitants. However, landlords also engaged in *other* rent-extracting interventions, such as creating milling monopolies and restricting female headship, which choked off serfs' non-agricultural activities. These interventions were *also* facilitated by manorial presence in villages, and help explain the negative interaction terms in table 5. They may also explain why the relationship between non-agricultural activity and landlord presence was curvilinear: as manorial presence became more pervasive in a village, landlords' encouragement of specific non-agricultural activities was increasingly outweighed by the stifling effect of broader manorial surveillance.

The multiple effects of manorial rent extraction may also help explain the low intensity of rural non-agricultural activity overall. As table 2 showed, rural non-agricultural activity in early modern Bohemia, as in early modern Poland and Finland where landlords also enjoyed strong institutional powers, was substantially lower than in western Europe. Many Bohemian villages in 1654 had no inhabitants pursuing non-agricultural occupations, and the average proportion of rural non-agricultural activity was quite low. In Bohemia, as in other serf economies, landlords permitted or even encouraged non-agricultural activities under circumstances in which the manor was institutionally and operationally able to extract rents, including in villages where it had at least some local presence.⁸⁸ However, the wider panoply of manorial rent extraction imposed heavy costs and risks on serf entrepreneurship, creating an institutional environment in which it was difficult for non-agricultural activity to expand beyond a certain level. Thus, although local manorial oversight might motivate landlords to permit or even encourage some rural non-agricultural activity, the overall framework of the second serfdom affected it negatively.⁸⁹

VIII

What are the wider implications of these findings? Changes in occupational structure, particularly the spread of rural non-agricultural activities, are viewed as key indicators of economic growth and potential contributory factors to the early modern Little Divergence, but hitherto we have lacked any systematic understanding of occupational structure in those many European economies where landlord powers over the rural economy intensified under the early modern second serfdom.

Our quantitative evidence for 6,983 Bohemian villages in 1654 confirms previously impressionistic indications that eastern-central Europe had a lower intensity of rural non-agricultural activity than north-west Europe during the Little Divergence. On the other hand, early modern Bohemia was not wholly lacking in occupational diversification: its rural economy was characterized by a rich array of industrial and commercial activities and although many villages were purely

⁸⁷ Ogilvie, 'Serfdom'; Klein, 'Institutions'; Dennison, *Institutional framework*; idem, 'Institutional framework of serfdom'; Briggs, 'English serfdom'.

⁸⁸ Klíma, *Economy*; Cerman, 'Proto-industrialisierung'; Gestwa, *Proto-industrialisierung*.

⁸⁹ Klein, 'Institutions', pp. 76–81.

agricultural, there were also some in which all households were active outside agriculture.

Controlling for other local characteristics, rural non-agricultural activity in early modern Bohemia was significantly and positively associated with village size, pastoral agriculture, smallholder and cottager strata, Jews, freemen, female household heads, and mills. It was negatively related to arable agriculture, large peasant farms, and—strikingly—the presence of towns. These highly significant statistical relationships refute traditional assumptions that serf economies were characterized by a Chayanovian mentality or an absence of market activity.⁹⁰ Rather, Bohemian serfs participated in industrial and commercial markets and allocated resources according to their relative productivities in alternative activities.

The negative association between rural non-agricultural activity and urban density in early modern Bohemia casts intriguing doubt on the hypothesis, derived from western Europe, that urban centres uniformly benefited economic growth. At least in this eastern-central European economy, towns discouraged rural crafts and commerce, possibly because of institutional privileges and political influence enabling town burghers and guilds to hinder rural competition. These findings suggest that economic historians should be cautious in regarding the degree of urbanization as an indicator of pre-modern economic growth where other evidence is lacking. Certain types of town deployed institutional and political power to benefit the urban economy by stifling rural competition, damaging wider economic growth.

Our econometric analysis found a positive association between rural non-agricultural activities and a limited degree of landlord presence, but the relationship flattened out at higher levels and landlord presence reversed the otherwise positive effects of female headship and village mills. Our findings for early modern Bohemia do not imply that the second serfdom encouraged rural dynamism, since landlords were also attracted to villages by pre-existing non-agricultural activities. Rather, the econometric relationships revealed by the *Berni Rula* illuminate the multiplicity and complexity of the links between landlords' rent extraction and serfs' economic decisions. The non-agricultural activities observed in seventeenth-century Bohemia arose overwhelmingly from the initiative of villagers themselves. Landlords permitted those non-agricultural activities by serfs from which they themselves could extort rents, while stifling non-agricultural initiatives—such as those surrounding female household heads and village mills—that threatened manorial rent extraction. These wider unintended consequences of manorial interventions may help explain why Bohemia, like other societies in which landlords exercised strong institutional privileges, manifested a lower intensity of non-agricultural activity than western European economies during the early modern Little Divergence.

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⁹⁰ For critical discussions of this traditional literature on serfdom, see Ogilvie, 'Economic world', pp. 430–4; Dennison, *Institutional framework*, pp. 1–28; Cerman, *Villagers*, pp. 109–11; Ogilvie, 'Choices', pp. 269–78.

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