# Supplementary appendix to "Monopsony power and wages: Evidence from the introduction of serfdom in Denmark" (for online publication)

This supplementary appendix contains additional figures and tables mentioned in the main text.

*Figure A1: Price of rye and farmhand wages, 1705-1799*
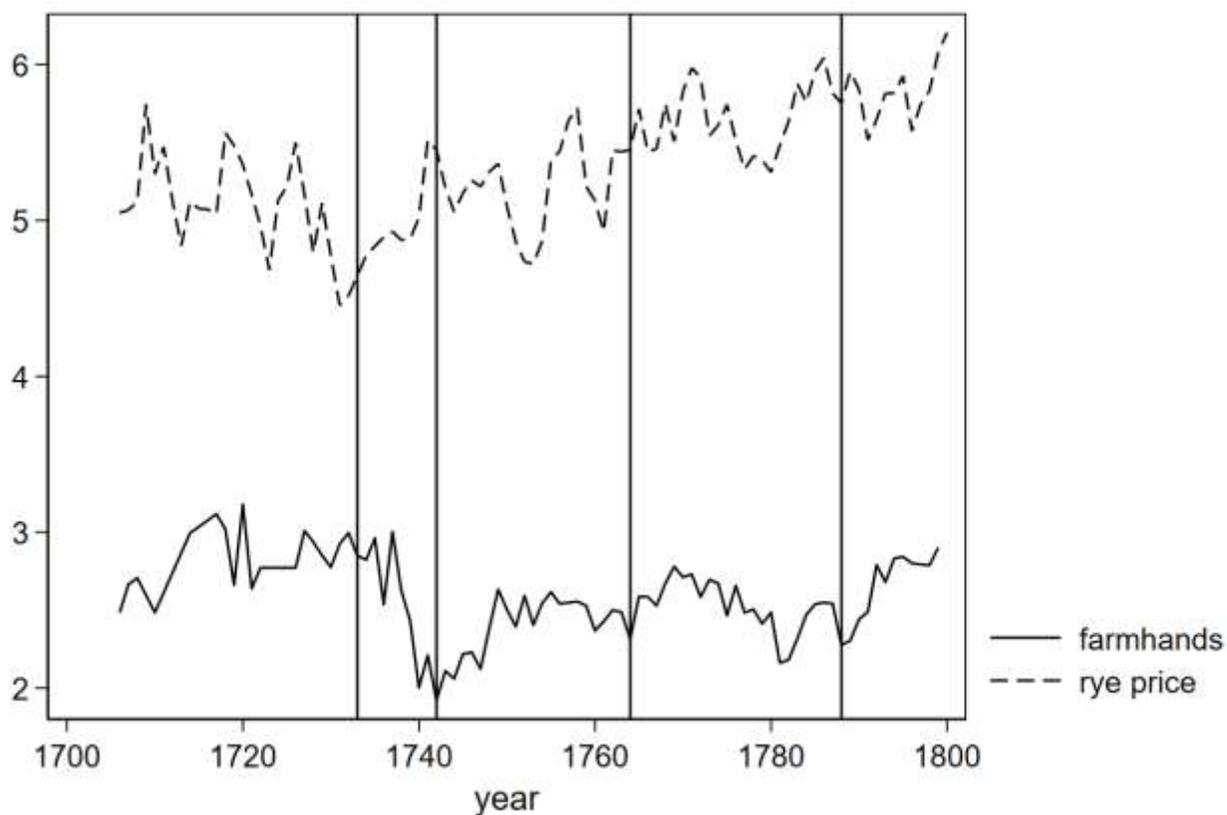
Notes: The variables on the second axis are the natural logarithm of the prices of rye and the natural logarithm of farmhand wages. The vertical lines represent 1733 (the year serfdom was introduced), 1742 (the first year serfdom was tightened), 1764 (the second year serfdom was tightened) and 1788 (the year the rules returned to those of 1733) respectively.

Figure A2: market integration of grain and labour markets 1, 1705-1799
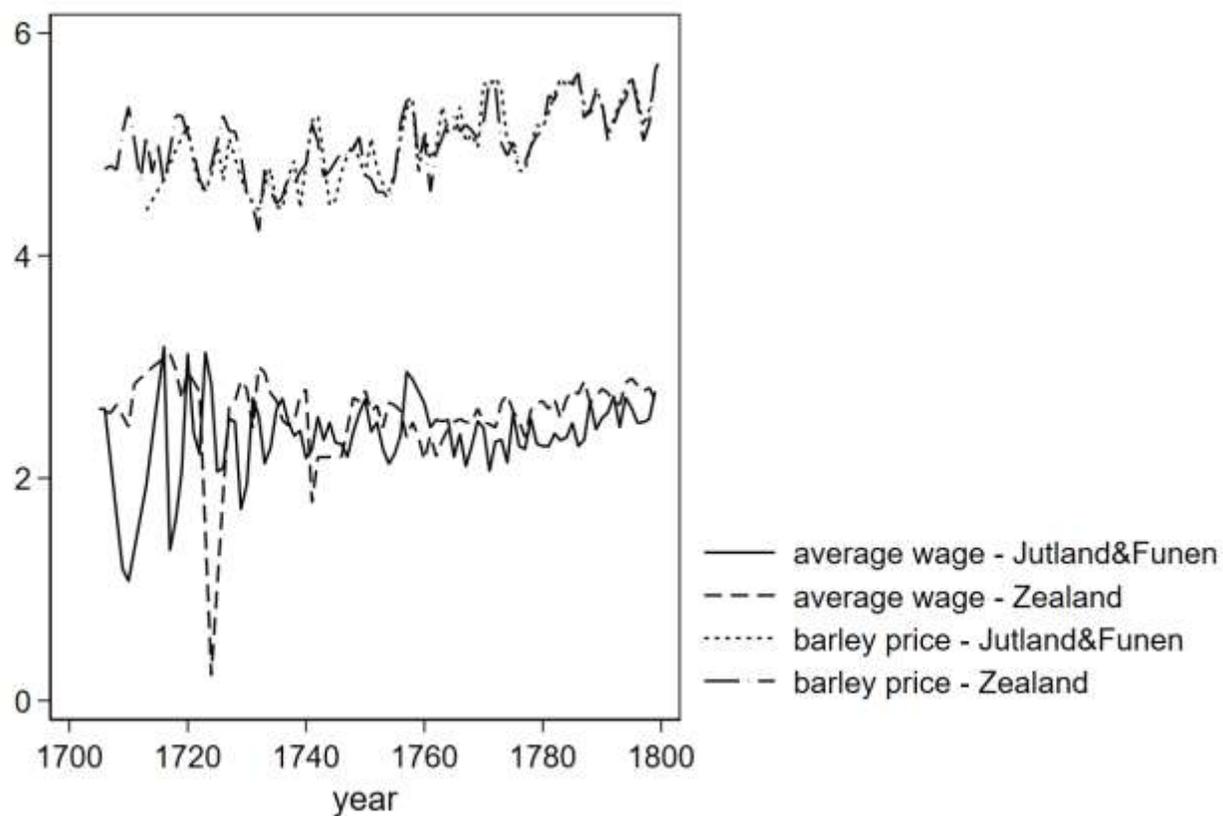
Notes: This figure shows average (log) barley and log (wages) by two geographical regions (Jutland/Funen compared to Zealand).

Figure A3: market integration of grain and labour markets 2, 1705-1799
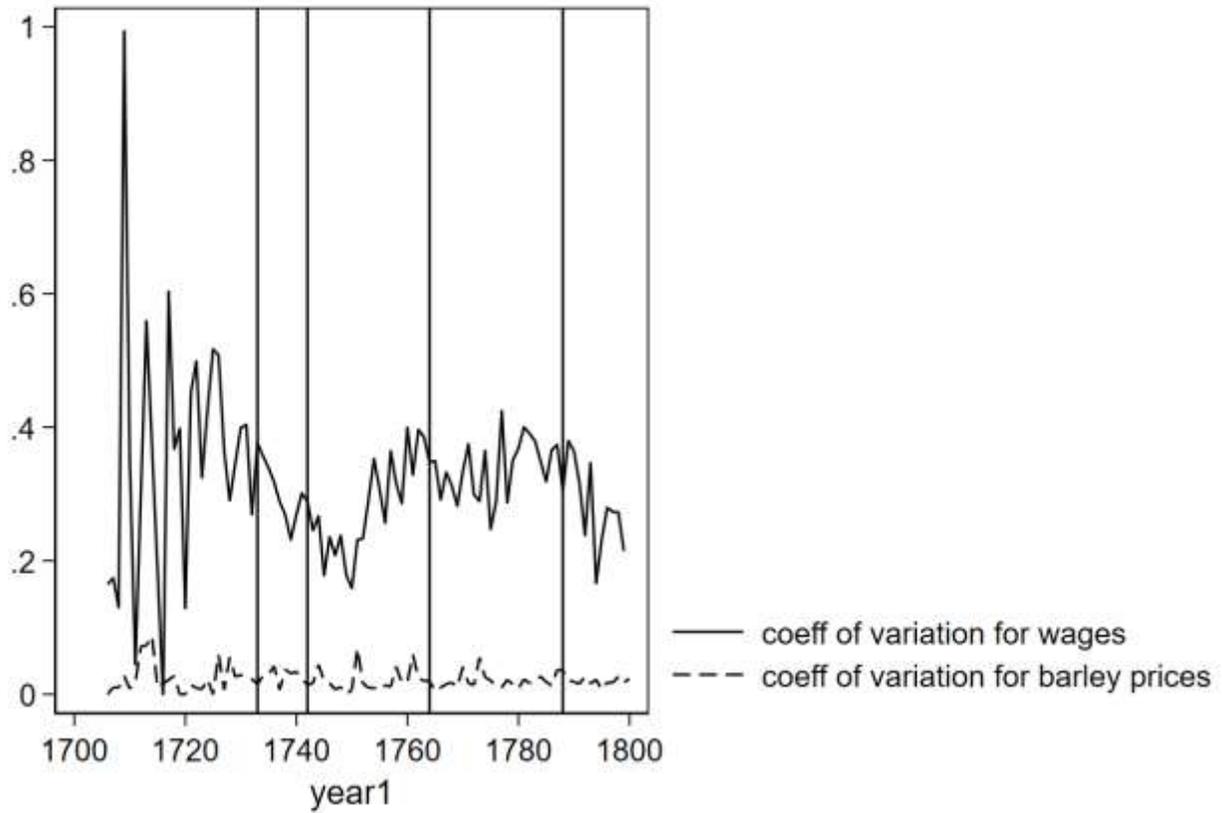
Notes: This figure shows the coefficient of variation for wages and barley prices.

Figure A4: Event study for the introduction of serfdom, coefficient on farmhands multiplied by year, males only
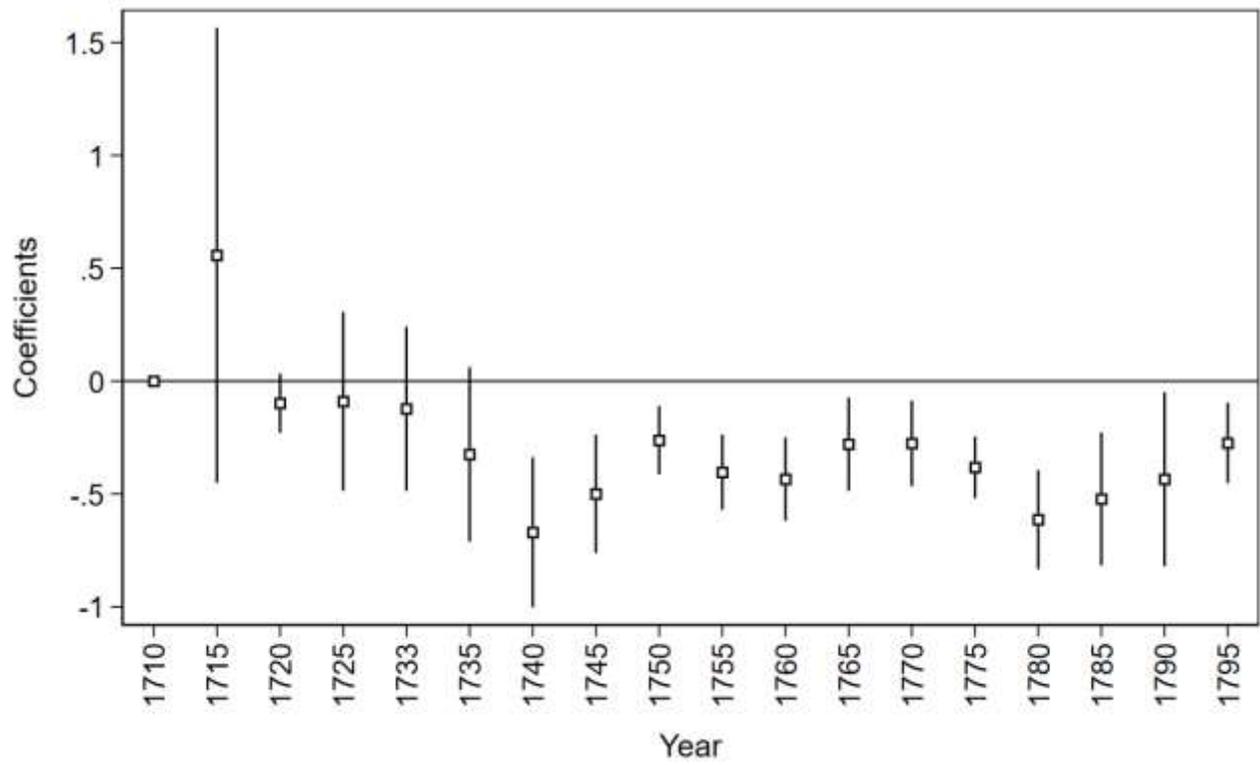
Figure A5: Fully flexible event study for the introduction of serfdom, coefficient on farmhands multiplied by year
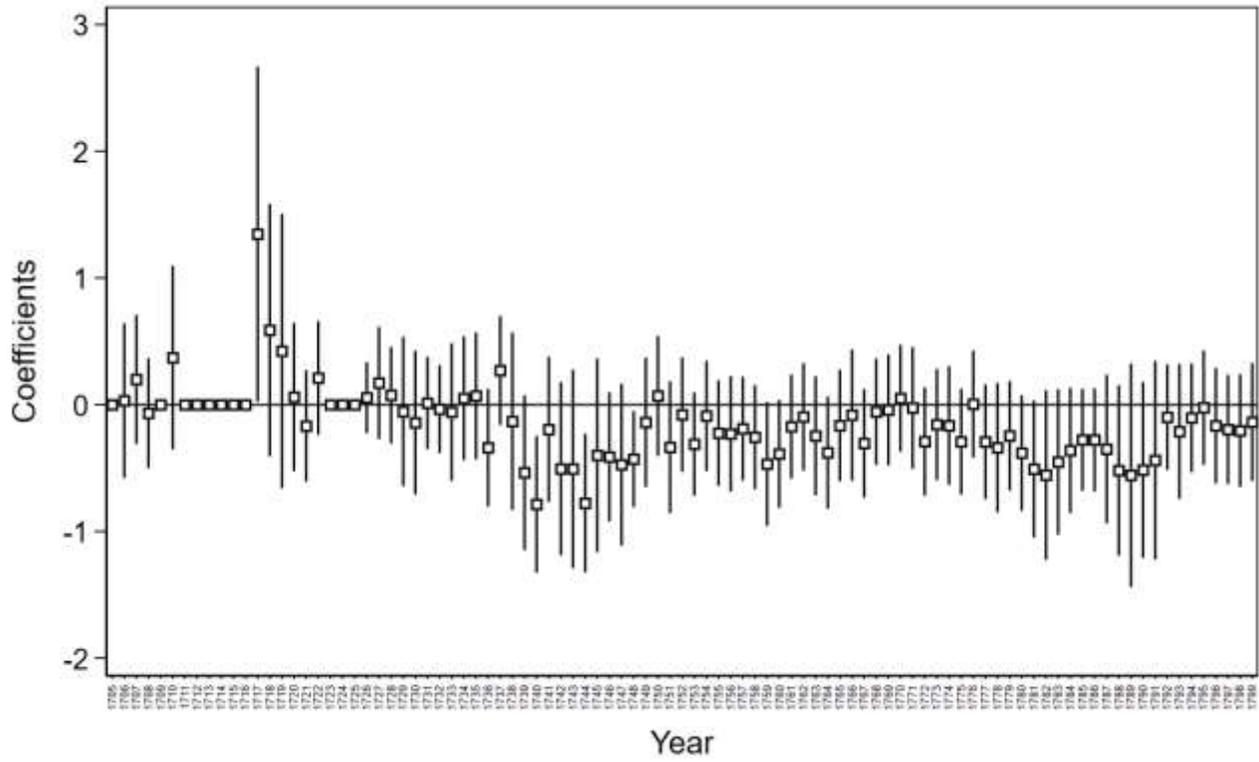
Notes: Coefficients obtained from the flexible-form with 95% confidence interval. 1705 is the omitted year. Due to an absence of observations on farmhands, some years are constrained to be zero in the period 1710-1720.

Figure A6: Event study for the introduction of serfdom, coefficient on farmhands multiplied by year, controlling for bricklayer multiplied by year
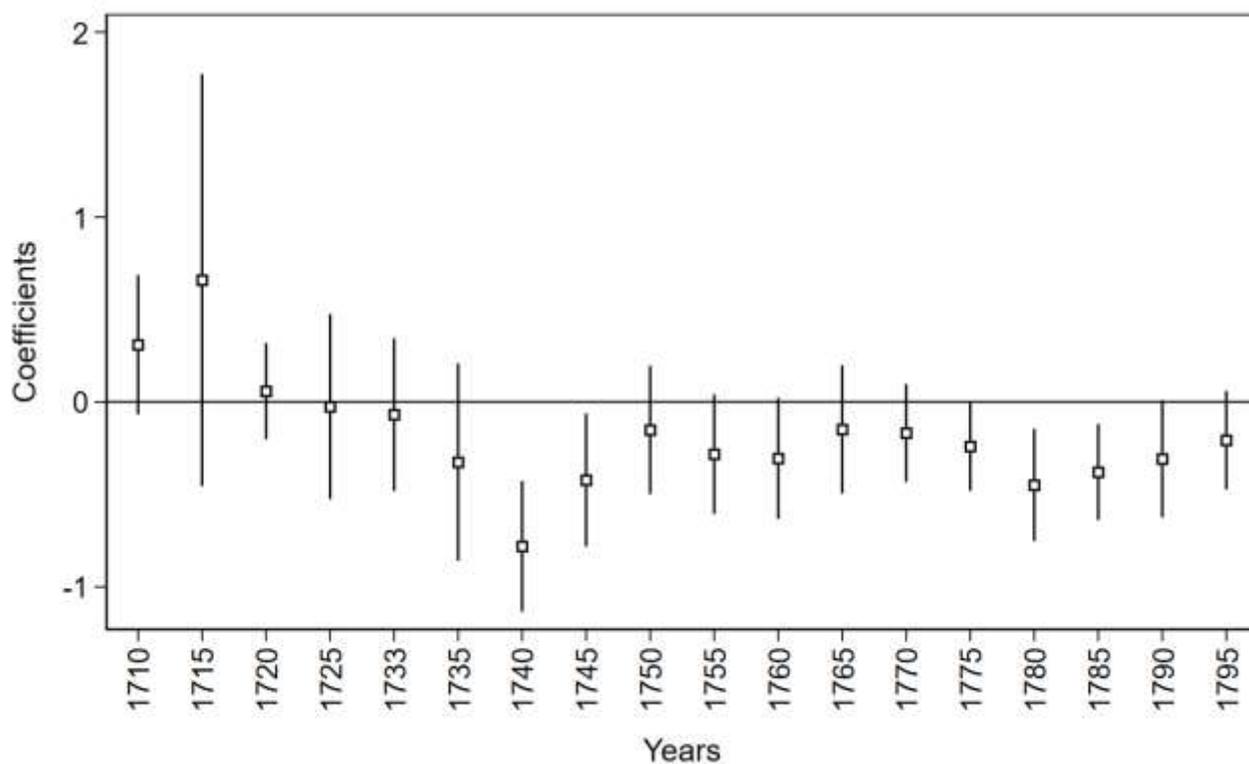
Notes: Coefficients obtained from the flexible-form with 95% confidence interval using the Danish dataset. 1705-1709 is the omitted year. The periods all include five years except 1725 (1725-1732) and 1733 (1733-1734).

Figure A7: Event study for the introduction of serfdom, coefficient on farmhands multiplied by year, controlling for carpenter multiplied by year
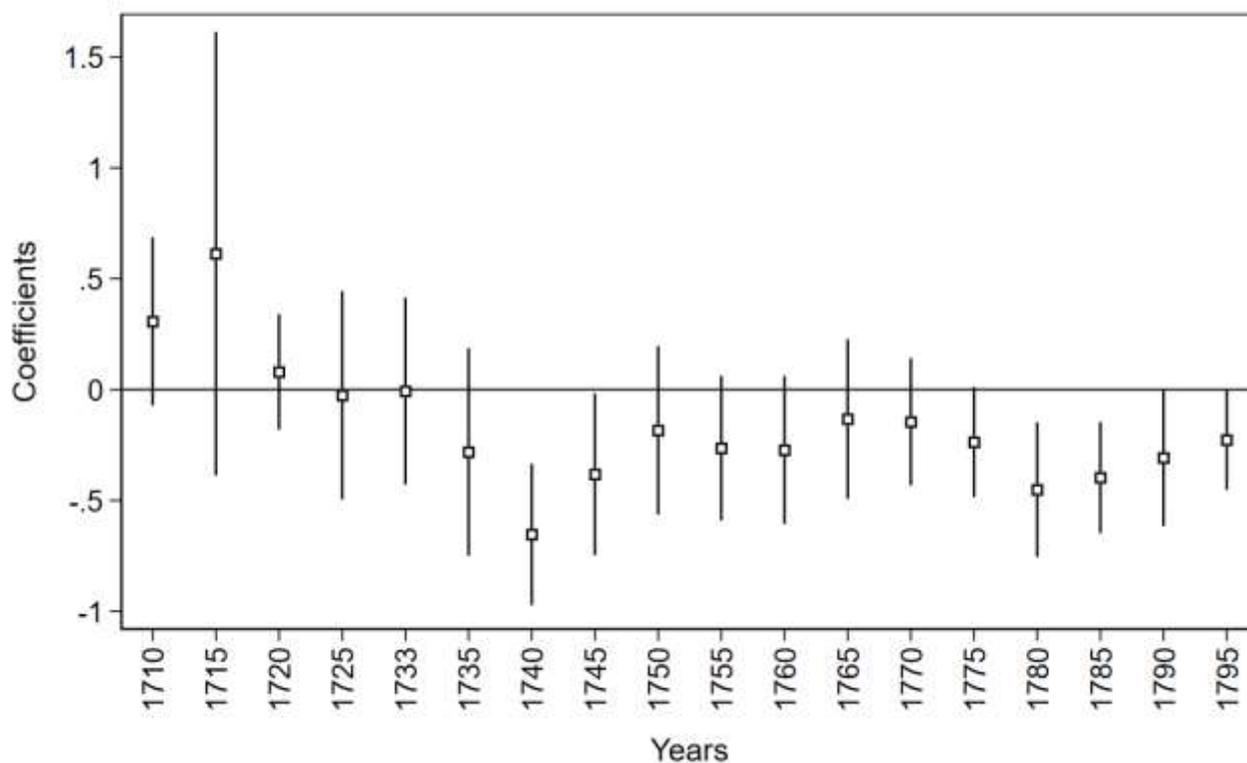
Notes: Coefficients obtained from the flexible-form with 95% confidence interval using the Danish dataset. 1705-1709 is the omitted year. The periods all include five years except 1725 (1725-1732) and 1733 (1733-1734).

Figure A8: Event study for the introduction of serfdom, coefficient on farmhands multiplied by year, controlling for head teacher multiplied by year
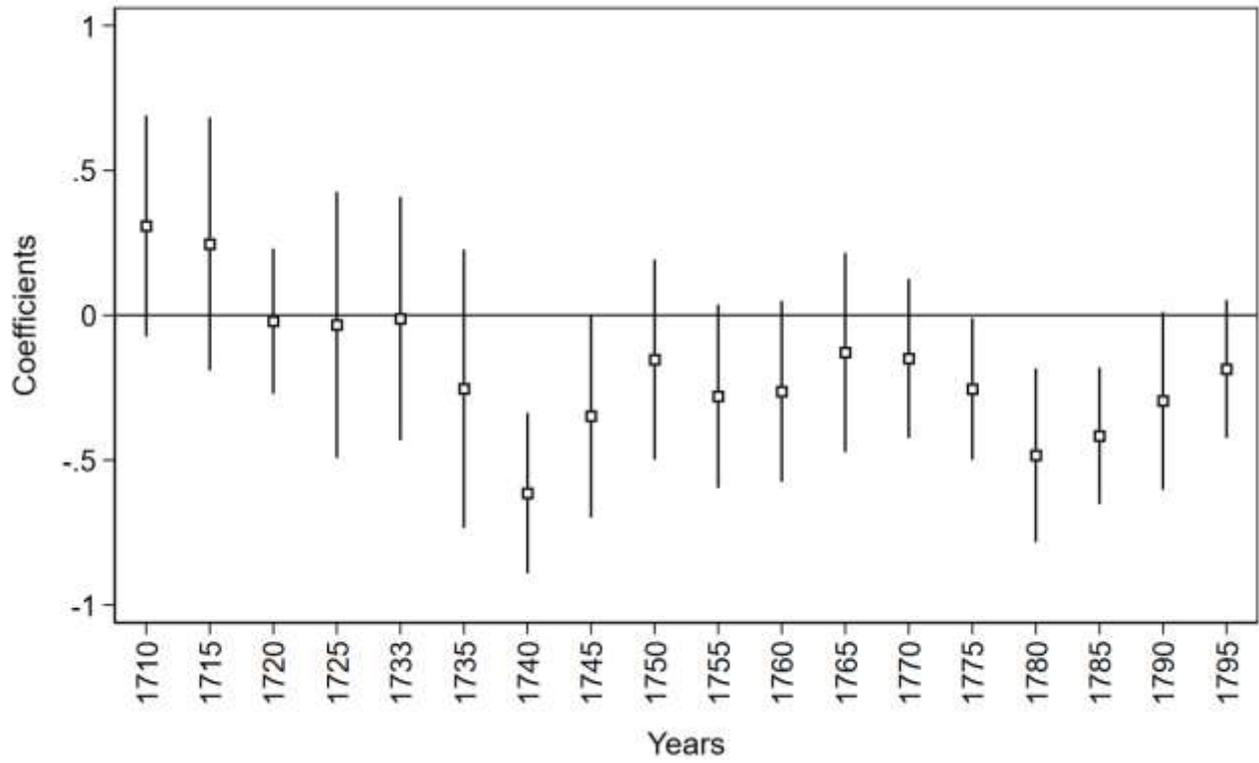

Notes: Coefficients obtained from the flexible-form with 95% confidence interval using the Danish dataset. 1705-1709 is the omitted year. The periods all include five years except 1725 (1725-1732) and 1733 (1733-1734).

Table A1: Existing empirical studies of serfdom

Study	Data	Findings	Type of serfdom
Cross-sectional design			
Domar and Machina (1984)	(Estimated) prices of serfs in Russian regions from different years in the period 1854-1858.	Unequal prices of serfs across Russian regions. Serf prices were different from zero indicating that serfdom was still profitable in the 1850s.	Russian serfdom
Klein and Ogilvie (2016)	Cross-sectional village level data for Bohemia for 1654	Presence of landholding of landlord/share of land held by landlord positively associated with more non-agricultural activity up to a point.	Multiple aspects, but proxy used is presence of landholding of landlord and thus the ability by the landlord to intervene in the lives of the serfs.
Ashraf et al. (2018)	Cross-sectional data for Prussia covering 1821-1848	Positive relationship between watermills and serf emancipation.	Emphasizes servile duties in empirical work.
Panel data			
Nafziger (2012)	Village level panel data for the Moscow province, 1876-1899	Some persistent negative effects after abolition of serfdom on labour mobility.	Russian serfdom – notes that restrictions on peasant mobility may not have ended as the commune took over the right to issue passports.
Malinowski (2016)	Populations for urban settlements in Poland, 1500-1772.	Urbans settlements with no legal protection of the peasantry had higher population when markets were not integrated.	Serfdom as a lack of legal protection of the peasantry against surplus extraction of landlords.
Buggle and Nafziger (2021)	Mainly Russian district level data for various years	Persistent negative effects of serfdom on well-being.	Russian serfdom

Markevich and Zhuraskay (2018)	Panel data for Russian provinces, 1800-1920.	Positive effect of abolition of serfdom on agricultural productivity.	Russian serfdom

Table A2: Empirical studies of other coercive labour market institutions

Study	Data	Findings
Naidu (2010)	Individual level data on the movements of tenants in Arkansas for 172 individuals. State level data on aggregate agricultural wages for 11 southern states.	Anti-enticement fines reduced mobility of share-croppers and aggregate agricultural wages.
Naidu and Yuchtman (2013)	District-level data on criminal prosecutions for breach of contract of employees for the UK for the years, 1858-1875. County-level wage data for 1851-1905.	Higher prices in an industry led to more prosecutions prior to 1875, County-level wages increased relatively more in counties with more prosecutions prior to 1876- the year in which criminal prosecutions for breach of contract was abolished.
Bobonis and Morrow (2014)	1910 Puerto Rican Census data for individual literacy, international coffee prices, and variation between non-coercive and coercive regimes during the 19th century.	Education did not respond to changing coffee prices during the coercive regime. Education was reduced when coffee prices increased in the non-coercive regime.
Dippel, Greif and Treffler (2020)	Use country level data for 14 colonies British West Indies for the period 1838 to 1913 on wages for mobile agricultural workers, sugar export shares, and legal coercion.	Higher sugar export shares associated with lower wages and higher sugar prices associated with higher wages.

Gupta and Swamy (2017)	Panel data for seven districts on migration to the Assam plantations in India and the price of tea	Higher tea prices are associated with higher migration, but if more coercive contracts are used in a district, this response is weakened.

Table A3: The years available for each region and estate

Region and estate	Period included
Zealand	1706-1799
Giesegaard (1721-1799)	1721-1799
Bregentved (1746-1800)	1746-1799
Gisselfeld Household (1706-1740)	1706-1740
Holsteinborg (1748-1800)	1748-1799
Fuirendal (1756-1795)	1756-1795
Sorø Academy (1740-1800)	1740-1799
Løvenborg (1752-1794)	1752-1794
Gauno (1751-1800)	1751-1799
Juellinge (1726-1748)	1726-1749
Funen	1723-1799
Taasinge (1725-1800)	1725-1799
Frederiksgave 1773-1800	1733-1799
Erholm Søndergade (1723-1800)	1723-1799
Jutland	1705-1799
Frijsenborg (1777-1800)	1777-1799
Støvringgard (1734-1800)	1734-1799
Lindenborg (1714-1799)	1714-1799
Odden (1705-1732)	1705-1732

Table A4: Distribution of observations across time and space

	1705-1799	1705-1741	1742-1763	1764-1787	1788-1799	Farmhands, 1705-1799	
Region	*Number of observations for all occupations*						*Percentage of all occupations*
Funen	5,418	73	1,061	2,267	1,990	1,890	34.88
Jutland	3,252	218	286	1,759	981	488	15.01
Zealand	12,257	440	3,514	6,445	1,668	3,620	29.53
Total	20,927	731	4,861	10,480	4,639	5,998	28.66
	Percentage of all occupations					*Percentage of all Farmhands*	
Funen	25.89	9.99	21.83	21.72	42.90	31.51	
Jutland	15.54	29.82	5.88	16.78	21.16	8.14	
Zealand	58.57	60.19	72.29	61.60	35.96	60.35	

Table A5: Occupations with at least one 100 observations

Occupation	HISCO	Observations	Percentage of full dataset
Labourer*	99910	2,709	12.94
Day labourer*	99920	2,421	11.57
Bricklayer	95120	2,371	11.33
Painter	93120	2,105	10.06
Carpenter	95410	1,189	5.68
Thatcher	95360	927	4.43
Farm labourer*	62105	868	4.15
Dairy worker	62510	679	3.24
Gardener	62740	597	2.85
livestock worker	62400	534	2.55
Joiner	95420	483	2.31
Stone mason	95140	462	2.21
Farm servant	62120	455	2.17
Teacher	13940	435	2.08
farm supervisor	22520	410	1.96
Coachman	98620	350	1.67
servant at home	54010	332	1.59
Gamekeeper	64960	307	1.47
Forest Supervisor	63220	283	1.35
Paviour	95160	275	1.31
Washerwoman	56010	249	1.19
barn bailiff	21990	242	1.16
stone cutter	82020	220	1.05
Logger	63110	201	0.96
Animal-Drawn Vehicle Driver (Road)	95910	177	0.85
Cook	53100	162	0.77

stone splitter	71220	140	0.67
Guard	58940	128	0.61
Housekeeper	22430	114	0.54

Notes: * indicates the occupations included in the farmhand occupation

Table A6: Alternative flexible estimations with regular five year periods

Dependent variable			
log wage			
Farmhand x 1710-1714	0.308	Farmhand x 1755-1759	-0.294*
	[1.744]		[-1.908]
Farmhand x 1715-1719	0.609	Farmhand x 1760-1764	-0.291*
	[1.304]		[-1.879]
Farmhand x 1720-1724	0.0432	Farmhand x 1765-1769	-0.146
	[0.364]		[-0.875]
Farmhand x 1725-1729	0.0297	Farmhand x 1770-1774	-0.158
	[0.130]		[-1.206]
Farmhand x 1730-1734	-0.0789	Farmhand x 1775-1779	-0.250**
	[-0.401]		[-2.152]
Farmhand x 1735-1739	-0.272	Farmhand x 1780-1784	-0.467***
	[-1.212]		[-3.278]
Farmhand x 1740-1744	-0.658***	Farmhand x 1785-1789	-0.400***
	[-4.439]		[-3.405]
Farmhand x 1745-1749	-0.409**	Farmhand x 1790-1794	-0.296*
	[-2.482]		[-2.016]
Farmhand x 1750-1754	-0.174	Farmhand x 1795-1799	-0.180
	[-1.024]		[-1.558]

Note: This table shows the flexible estimates for the effect of a being a farmhand on wages over five-year periods using the full sample (n=20,927). The time intervals indicate dummy variables, which are interacted with a farm hand dummy. The estimation sample consists of 20,927 observations. Coefficients are reported with the robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors are clustered at the estate level.

Table A7: Results with different time periods and 6 estates with data both before and after serfdom

	Dependent variable: log day wages							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Farmhand x Serfdom	-0.124	-0.349**	-0.350**	-0.351**	-0.0249	-0.233*	-0.304*	-0.248
	[-0.735]	[-2.187]	[-2.397]	[-2.322]	[-0.192]	[-2.149]	[-2.156]	[-1.781]
Period	1705-1741	1705-1763	1705-1787	Full	1705-1741	1705-1763	1705-1787	Full
#Estates included	16	16	16	16	6	6	6	6
Observations	731	5,592	16,288	20,927	630	1,978	4,223	5,768
R-squared	0.760	0.679	0.661	0.649	0.782	0.737	0.779	0.772

Notes: This table shows the effect of serfdom on farmhand wages (measured as the natural logarithm of the daily wage); Columns (1) to (4) shows results for the full sample for four different time periods. Columns (5) to (8) show results when using only Giesegaard, Gisselfeld Household, Juellinge, Taasinge, Erholm, Lindenborg for four different time periods. Control variables are as in column (1), Table 2; these control variables are fixed effects for region, occupation, year and season as well as dummy variables for whether an individual is a master craftsman, a woman or a child; coefficients are reported with the robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors are clustered at the estate level.

Table A8: Effects of using alternative treatment measure (farm labourer) and using men only

	Dependent variable: log day wages							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Farm labourer x Serfdom	-1.113***	-0.882***	-0.857***	-0.851***	-1.032***	-0.699***	-0.808***	-0.680***
	[-4.808]	[-4.664]	[-5.954]	[-6.877]	[-4.505]	[-6.972]	[-8.608]	[-16.77]
Period	1705-1741	1705-1763	1705-1787	Full	1705-1741	1705-1763	1705-1787	Full
#Estates included	16	16	16	16	6	6	6	6
Observations	634	5,232	14,954	19,004	533	1,758	3,617	4,924
R-squared	0.743	0.613	0.563	0.552	0.760	0.646	0.646	0.625

Notes: This table shows the effect of serfdom on farmhand wages (measured as the natural logarithm of the daily wage); Control variables are as in column (1), Table 2; these control variables are fixed effects for region, occupation, year and season as well as dummy variables for whether an individual is a master craftsman, a woman or a child; coefficients are reported with the robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors are clustered at the estate level.

Table A9: Results with additional robustness checks

	(1)	(2)	(3)	(4)	(5)	(6)
			Dependent variable: log day wages			
Farmhand x Period 1	-0.395*	-0.387**				
	[-1.895]	[-2.221]				
Farmhand x Period 2	-0.339*	-0.332*				
	[-2.104]	[-2.025]				
Farmhand x Period 3	-0.361**	-0.354**				
	[-2.375]	[-2.828]				
Farmhand x Period 4	-0.337*	-0.329**				
	[-1.915]	[-2.689]				
Farmhand x Post Vornedskab		0.00946				
		[0.0484]				
Farmhand x Serfdom			-0.351***	-0.351***	-0.340**	
			[-4.058]	[-2.622]	[-2.242]	
Farm labourer x Serfdom						-0.419**
						[-2.296]
Labourer x Serfdom						-0.340*
						[-1.939]
Day labourer x Serfdom						-0.257**
						[-2.535]
Sample	Full	Full	Full	Full	Extended dataset	Full
Observations	20,927	20,927	20,927	20,927	21,155	20,927
R-squared	0.649	0.649	0.649	0.649	0.655	0.649

Notes: This table shows the effect of serfdom on farmhand wages (measured as the natural logarithm of the daily wage); Control variables are as in column (1), Table 2; these control variables are fixed effects for region, occupation, year and season as well as dummy variables for whether an individual is a master craftsman, a woman or a child; coefficients are reported with the robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors are clustered at the estate level.

Table A10: Effects on other occupations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Dependent variable: log day wages					
Farmhand x Serfdom				-0.299**	-0.360**	-0.353**	-0.385**
				[-2.498]	[-2.173]	[-2.320]	[-2.30]
Head teacher x Serfdom	1.923***			1.838***			
	[4.479]			[4.261]			
Brick layer x Serfdom		0.025			-0.062		
		[0.109]			[-0.240]		
Carpenter x Serfdom			-0.150			-0.192	
			[-0.627]			[-0.797]	
Observations	20,927	20,927	20,927	20,927	20,927	20,927	20,927
R-squared	0.650	0.648	0.648	0.650	0.649	0.649	0.652

Notes: This table shows the effect of serfdom on farmhand wages (measured as the natural logarithm of the daily wage); Control variables are as in column (1), Table 1 except for column (7) which adds controls for linear time trends in log wages for head teachers, brick layers and carpenters; coefficients are reported with the robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors are clustered at the estate level.

Table A11: Results from the pseudo panel

	(1)	(2)	(3)	(4)
		Dependent variable: log day wages		
$\overline{Farmhand}$ X Serfdom	-0.273**	-0.256**	-0.236**	-0.475*
	[-3.620]	[-3.040]	[-3.149]	[-2.059]
Control for				
Share of masters	No	Yes	Yes	Yes
Share of estates	No	No	Yes	Yes
Share of occupations	No	No	No	Yes
Observations	402	402	402	402
R-squared	0.586	0.592	0.766	0.868

Notes: The dependent variable is the average natural logarithm of the daily wage per cohort. Serfdom represents a dummy variable which takes the value of 1 in the period in which serfdom affected workers (1733-1799); $\overline{Farmhand}$ is represented by the share of labourers, day labourers and farm labourers per cohort; the analysis is conducted for the period 1705-1799. Additional control in all regressions: share of children, share of region, share of season, year dummies, cohort fixed effects. Robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors are clustered at the cohort level.

Table A12: Results from the pseudo panel for koppelwirtschaft adoption

	Dependent variable: share with koppelwirtschaft			
	(1)	(2)	(3)	(4)
$\overline{Farmhand}$ X Serfdom	-0.416***	-0.447***	-0.234**	0.029
	[-4.178]	[-5.540]	[-2.657]	[0.244]
Control for				
Share of masters	No	Yes	Yes	Yes
Share of estates	No	No	Yes	Yes
Share of occupations	No	No	No	Yes
Observations	402	402	402	402
R-squared	0.600	0.637	0.753	0.829

Notes: The dependent variable is the share of a region that adopted koppelwirtschaft. Serfdom represents a dummy variable which takes the value of 1 in the period in which serfdom affected workers (1733-1799); $\overline{Farmhand}$ is represented by the share of labourers, day labourers and farm labourers per cohort; the analysis is conducted for the period 1705-1799. Additional control in all regressions: share of children, share of region, share of season, year dummies, cohort fixed effect. Robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors are clustered at the cohort level.

Table A13: Main results with standard errors correcting for spatial correlation of up to 40 kilometres.

	Dependent variable: log day wages					
Sample	Denmark	Funen and Jutland	Zealand	Denmark	Denmark, Men only	Denmark
	(1)	(2)	(3)	(4)	(5)	(6)
Farmhand x Serfdom	-0.351***	-0.505***	-0.297***	-0.261***	-0.397***	-0.347***
	[-3.474]	[-9.197]	[-2.848]	[-4.702]	[-4.030]	[-3.308]
Sample	Full	Funen and Jutland	Zealand	Full	Men only	Full
Fixed effects for:	Yes	Yes	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes	Yes	Yes
Occupation	Yes	Yes	Yes	Yes	Yes	Yes
Gender	Yes	Yes	Yes	Yes	Yes	Yes
Child	Yes	Yes	Yes	Yes	Yes	Yes
Master	Yes	Yes	Yes	Yes	Yes	Yes
Season	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Region x Year FE	No	No	No	Yes	No	No
Add in-kind payment dummy	No	No	No	No	No	Yes
Observations	20,927	8,670	12,257	20,927	19,004	20,927
R-squared	0.649	0.779	0.603	0.657	0.553	0.651

Notes: This table shows the effect of serfdom on farmhand wages (measured as the natural logarithm of the daily wage); coefficients are reported with the robust t-statistics in parentheses (*** p<0.01, ** p<0.05, * p<0.1); the standard errors correct for spatial correlation of up to 40 kilometres.