Case Study 11: The changing work of making boots

Mechanization, older workers, and the choices of a new generation

1 The same industry, a different workforce

English bootmaking employed roughly the same number of people in 1851 and 1911. Yet the work changed substantially: about 153,000 artisanal jobs disappeared while about 140,000 specialized jobs emerged. Did the old workers learn to do the new jobs? Were they pushed out and replaced? Or did the industry change as younger generations chose different careers?

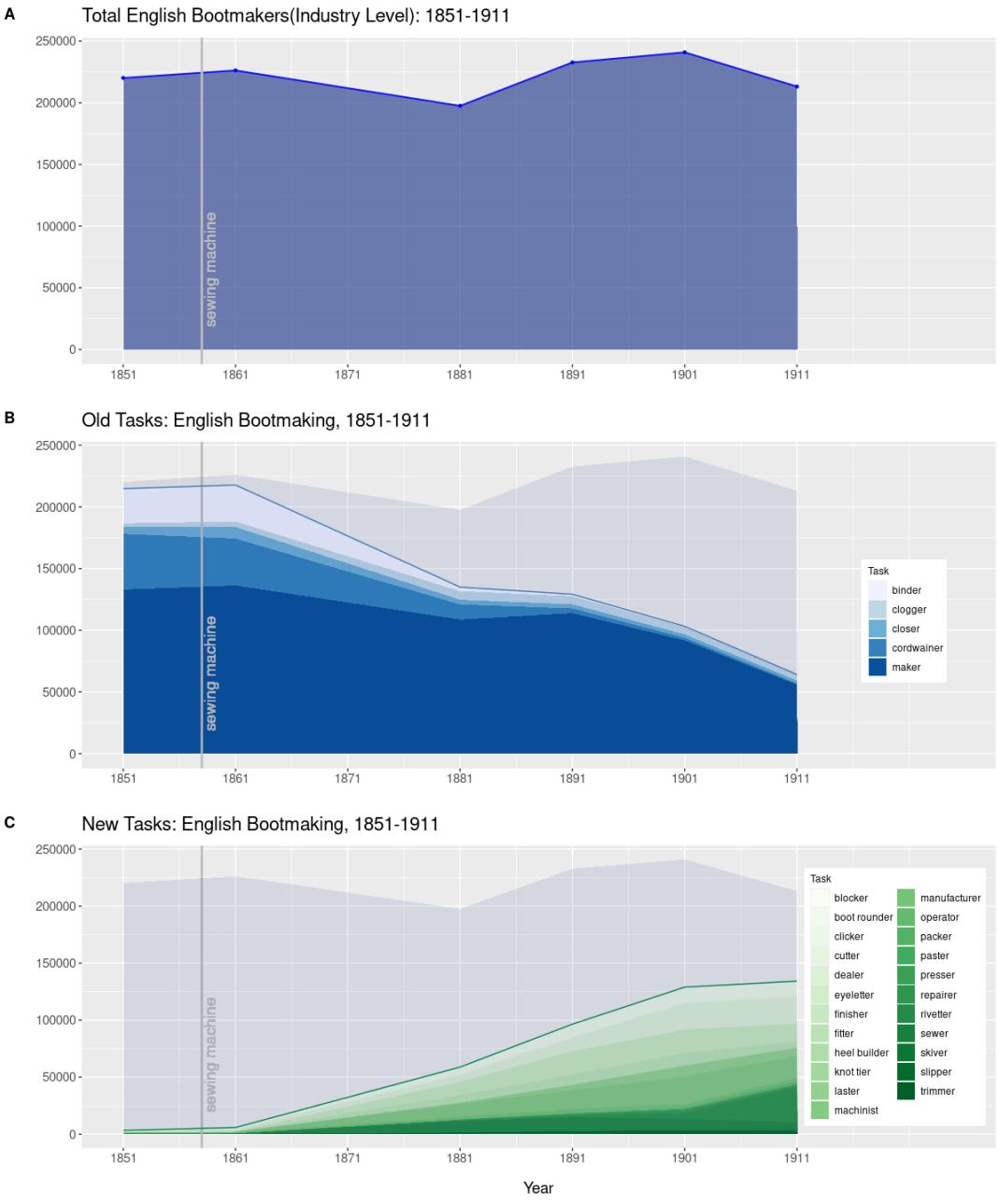
Making a boot required cutting leather, sewing the pieces into an upper, attaching a sole, and finishing the product. The bootmaking sewing machine, introduced in England in 1857, changed how some of this work was done. A worker who had spent years learning to sew leather by hand now faced competition from machine production. At the same time, factories needed sewing machinists, riveters, fitters, and supervisors. Mechanization changed both the activities workers performed and the skills employers wanted.

The choices facing an established artisan and a young entrant could be quite different. An artisan already had skills, tools, and customers. Continuing in the trade could remain worthwhile even as its prospects weakened. A young person still deciding what to learn could choose a different occupation. A trade can therefore lose its next generation before it loses most of its existing workers.

Following work and workers. English census records from 1851 to 1911 describe people's occupations in their own words. Labels such as "boot and shoe binder" and "boot sewing machinist" reveal changes hidden by a broad category such as "bootmaker." A recent study by economic historian Hillary Vipond classifies about 1.3 million bootmaking observations into detailed occupations. It also links individuals across censuses to follow workers already in the industry and young people entering employment.

Exhibit 1 puts the stable industry employment in perspective. Panel A shows roughly the same number of bootmakers in 1851 and 1911. By studying the descriptions of jobs in historical censuses, the researcher can distinguish between individuals performing different tasks within bootmaking. Some workers describe old *artisanal tasks* like being a binder, clogger, or closer. Other workers describe new *specialized tasks*. Panel B shows how the total employment in bootmaking hides a decline in the artisanal occupations while Panel C shows specialized occupations growing.

Exhibit 1. Similar totals, different work



Source: Vipond (2026), Figure 1. English census employment counts, 1851–1911. Panel A shows total bootmaking employment; B and C separate artisanal and emerging specialized occupations. The pale background in B and C shows the industry total.

2 What happened to workers already in the trade?

Exhibit 2 follows people recorded as bootmakers in 1861 who can be found again in 1881. Most of the linked men remained in bootmaking. Only a small share moved into the new specialized jobs. Among women, exit from bootmaking was much more common. Men made up more than four-fifths of the incumbent workforce, so the male pattern has a large influence on the industry total.

Exhibit 2. Where incumbent bootmakers were twenty years later



Source: Vipond (2026), Figure H1. Transitions among linked bootmakers, 1861–1881. "Stayed" means remaining in bootmaking; "new jobs" are the emerging specialized occupations. Counts and percentages refer to these linked workers.

The tasks performed by men and women help explain the contrast in Exhibit 2. About 95% of women in the old bootmaking trade were binders, sewing leather uppers by hand. Sewing machines took over much of this work. Many men instead made bespoke boots and shoes by hand, for which demand persisted among wealthier customers. Artisanal bootmakers remained more concentrated in wealthier parishes in 1881, consistent with continued demand for bespoke footwear.

Nevertheless, these trends are not enough to find the impact of technology in the workplace. Not all workers leaving bootmaking are displaced. Many workers leave occupations even without a new machine. They change careers, retire, or stop reporting an occupation when asked in the census. To assess displacement, the study asks whether bootmakers' exit rose unusually compared with exit from other occupations.

It compares two census windows: 1851–1861 and 1861–1881. Machine use was still limited in the earlier window and spread during the later one. The later window is also twice as long, giving workers more time to leave. The comparison with other occupations is therefore important: it provides a benchmark for changes in ordinary turnover as well as broader economic conditions.

Difference-in-differences. Let $x_{B,t}$ be the probability that a bootmaker leaves their occupation over window t, and $x_{C,t}$ the corresponding probability for workers in comparison occupations. The central

comparison is

$$\delta = (x_{B,1881} - x_{B,1861}) - (x_{C,1881} - x_{C,1861}).$$

A positive δ means that exit increased more among bootmakers. The identifying assumption is that, without mechanization, the two groups would have experienced the same change in exit after controlling for their characteristics. The estimates account for county, age, and marital status, and allow the effects of age and marital status to change between windows. Men and women are analysed separately.

Exhibit 3. Did exit rise unusually among bootmakers?

	Men	Women
Estimated additional increase in exit, δ	1.0*	13.8***

Source: Vipond (2026), Table 3, columns 3 and 6. Estimates are in percentage points. * denotes significance at 10%, *** at 1%. Exit is measured over each census window, not per year.

Exhibit 3 shows how much more the probability of leaving one's occupation rose for bootmakers than for workers of the same sex in other occupations. The additional increase in the exit probability from bootmaking is 1.0 percentage point for men and 13.8 percentage points for women.

3 What did the next generation do?

The key question here is about entry into bootmaking. Exhibit 4 follows young people aged 10–18 to the next available census, reporting each cohort's share in artisanal work, mechanized work, and bootmaking overall.

Exhibit 4. Where young people entered bootmaking

Share of the linked youth cohort (%)

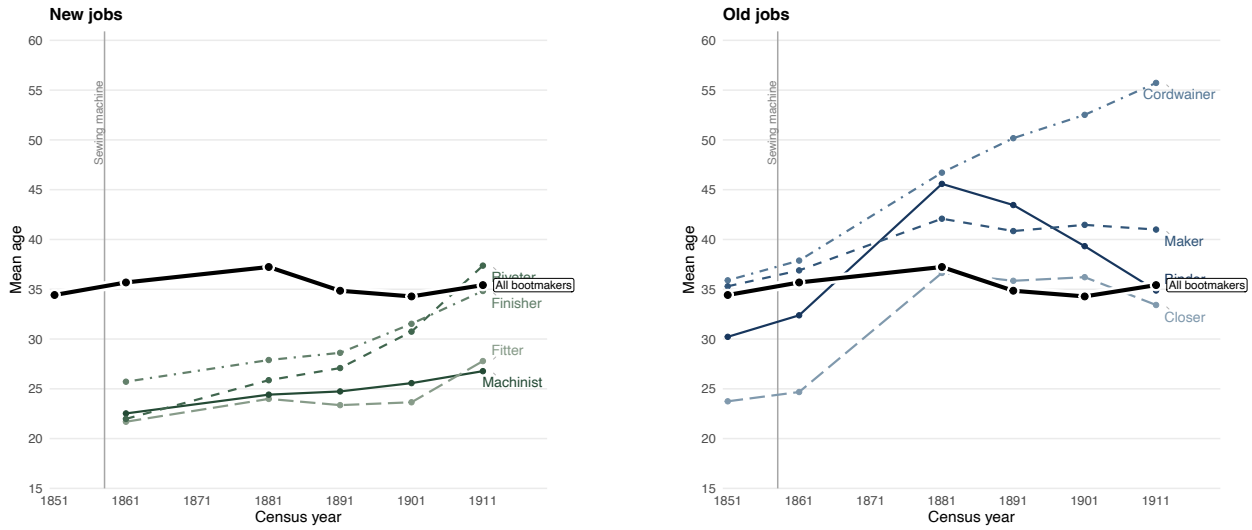
	1851–1861	1861–1881	1881–1891
Men			
Artisanal occupations	3.08	1.81	1.08
Mechanized occupations	0.07	0.63	1.14
All bootmaking	3.20	2.48	2.28
Women			
Artisanal occupations	0.75	0.08	0.09
Mechanized occupations	0.04	0.31	0.68
All bootmaking	0.81	0.42	0.82

Source: Vipond (2026), Table 7. Shares of youths aged 10–18 at baseline in each occupation at the next census. "All bootmaking" includes other jobs.

Exhibit 4 shows that fewer young people entered artisanal work while more entered mechanized jobs. For young men, the share entering bootmaking overall fell across the three cohorts. For young women, overall entry fell in the middle cohort and then recovered as mechanized entry rose.

Changes in entry also affect the age of a workforce. Exhibit 5 shows the mean age of workers in selected old and new bootmaking occupations at each census.

Exhibit 5. The ages of workers in old and new occupations



(a) Machine-era occupations

(b) Artisanal occupations

Source: Vipond (2026), Figure 5. Mean age in selected bootmaking occupations at each census; the black line shows the mean for all bootmakers. Each line describes an occupation's workforce at that date.

The mean age of cordwainers rose sharply, exceeding 50 by 1911, while machinists and fitters were much younger. Alongside Exhibit 2, these age profiles show how established artisans could remain in the trade while younger generations filled the new jobs. The same national employment total could be sustained by different generations doing different work.

Employment stocks and worker flows. For an occupation, let N_t be employment, E_t entries, and X_t exits over an interval. Then

$$N_{t+1} = N_t + E_t - X_t.$$

Entry includes new workers and people moving in from other occupations. Exit includes moves out, retirement, death, and other departures from the population being counted. An occupation shrinks when entries fail to replace exits. Its age composition also depends on which generations enter and which remain.

4 Was entering the old trade becoming costly?

Falling entry could reflect worse prospects in bootmaking or better opportunities elsewhere. The study examines the sons of bootmakers to learn whether following the family trade carried a cost. These

young men could draw on their fathers' tools, customers, and training, and were more likely to enter bootmaking than other young men.

The comparison starts within families: a son who became a bootmaker is compared with a brother who chose another occupation. The study then compares this brother gap across counties where bootmaking grew and counties where it declined. Families are observed in 1851 and the sons' adult outcomes in 1881. Growing counties had at least a 20% increase in bootmaking employment; declining counties had at least a 20% decrease.

Brothers share much of their upbringing and local environment. Comparing them accounts for those common influences; age and birth order are also controlled for. The remaining assumption is that differences between the brothers who chose the trade and those who did not would have been similar across the two county groups without the trade's decline.

Exhibit 6 reports marriage outcomes. Forming a household required resources, so marriage provides evidence about young men's material prospects. The study repeats the exercise for sons of carpenters, using the same classification of counties by bootmaking growth or decline. Like bootmakers' sons, sons who inherited carpentry tended to remain near home. This comparison helps distinguish the consequences of entering a declining trade from those of staying in a struggling place.

Exhibit 6. Following a father's trade: marriage outcomes

Difference from a brother in another occupation	Bootmakers' sons	Carpenters' sons
Gap in growing counties	2.8	−2.3
	(2.4)	(2.8)
Gap in declining counties	−6.5***	3.2**
	(1.9)	(1.5)
Additional gap associated with decline	−9.3***	5.4*
	(3.0)	(3.1)

Source: Vipond (2026), Tables 5–6, column 3, 1851–1881 cohort. Differences in the probability of being married are in percentage points. Parentheses contain standard errors clustered by county; *, **, and *** indicate significance at 10%, 5%, and 1%. Both columns classify counties by the change in *bootmaking* employment.

Among bootmakers' sons, the estimated marriage gap relative to a brother is +2.8 percentage points in growing counties but −6.5 in declining counties, an across-county difference of −9.3 points. The corresponding difference for carpenters' sons is +5.4 points. This contrast suggests a penalty associated with entering a declining trade, rather than just living where bootmaking declined.

5 Connecting the evidence to task assignment

Consider boot production with a fixed set of tasks $i \in [0, 1]$. Each task supplies a service, such as stitching leather or finishing a sole. Machines and workers have productivities $a_K(i)$ and $a_L(i)$, and

relative labour productivity $a_L(i)/a_K(i)$ increases with i. Let Y be output and L employment, with each worker supplying one unit of labour. Firms hire labour and machine services at fixed prices w and r. Production is competitive, so the boot price P equals minimized unit cost.

Represent mechanization as a rise in machine productivity, $a_K(i) \mapsto m a_K(i)$, with $m > 1$. Labour productivity and factor prices remain fixed, and both task cutoffs are interior. The model lets us connect a change in how boots are made to labour required per boot and total employment.

Tasks combine through equal-weight Cobb–Douglas aggregation:

$$\log Y = \int_0^1 \log y(i)\,\mathrm{d}i, \qquad y(i) = a_K(i)k(i) + a_L(i)\ell(i).$$

Firms compare $r/a_K(i)$ and $w/a_L(i)$. The cutoff I satisfies

$$\frac{a_L(I)}{a_K(I)} = \frac{w}{r}, \qquad \text{machines perform } i < I, \quad \text{workers perform } i > I.$$

Equal expenditure per unit task interval gives

$$wL = (1 - I)PY.$$

Improving an available production method cannot increase minimized unit cost. A census occupation bundles activities; a worker's occupation can change as those activities are reorganized.

Question 1. Can mechanization leave employment unchanged? (30 marks)

(a) Show how mechanization changes task assignment, using a labelled relative-productivity diagram. What happens to labour required per boot? [10 marks]

(b) A commentator claims that the stable total in Exhibit 1 proves machines saved no labour. Evaluate the claim using the model. [10 marks]

(c) Mechanization can also create work in maintaining machines and coordinating factory production. Suppose new tasks that only workers can perform enter at the high end, while an equal measure of old machine tasks leaves. Active tasks are now $i \in [N-1, N]$; machines perform tasks below I and workers perform tasks above I. Using equal expenditure across tasks, explain how new-task creation affects labour's share of production costs. Can it offset the effect of mechanization on that share? Does it, by itself, explain the stable total employment in Exhibit 1? [10 marks]

Question 2. Were incumbent workers pushed out? (25 marks)

(a) Why is Exhibit 2 insufficient to identify displacement caused by mechanization? [10 marks]

(b) Explain the comparison behind Exhibit 3 and the assumption it requires. What does Exhibit 3 imply for men and women? Explain the role of the controls in assessing the results. [15 marks]

Question 3. Who changed occupations, and who chose different careers? (25 marks)

(a) A commentator claims that the decline of artisanal jobs mainly reflects older bootmakers retraining for the new jobs. Evaluate the claim using Exhibits 2, 4, and 5. [15 marks]

(b) How can artisanal employment shrink and its workforce become older without a large increase in male incumbents' exit? Use the stock–flow identity and the evidence. [10 marks]

Question 4. Why did young people turn away from the family trade? (20 marks)

(a) Explain what the two comparisons in Exhibit 6 are intended to isolate. What must be assumed for the additional brother gap to reflect the effect of a declining trade? [10 marks]

(b) Interpret the bootmaker results and the carpenter comparison. What do they suggest about the fall in entry, and what can they tell us about earnings? [10 marks]

References

- Vipond, H. G. (2026). *Technological Unemployment in Victorian Britain: Young Workers and the Collapse of Entry*. Stone Center Working Paper 26-13, August version.