14.773 Political Economy of Institutions and Development.
Lecture 4: Labor Coercion

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Introduction

- One very common form of economic institutions under elite dominance is forced labor or labor coercion (including slavery, corvée labor, encomienda-type arrangements and feudal labor relations).
- "In the context of universal history, free labor, wage labor, is the peculiar institution"—M.I. Finley
- Forced labor (**slavery, serfdom**) basis of ancient Greece, Egypt and Rome; several Islamic and Asian empires; most pre-Colombian civilizations; plantation economies in Latin America and the U.S. South; European agriculture until the 19th century (feudalism).
- The ILO estimates that there are still between 8 and 12 million forced laborers worldwide, not counting forced sex workers.

Key Questions

- In what dimensions is labor coercion inefficient (or is it?), and when does it arise?
- Does labor coercion have persistent effects on technology, institutions, politics, inequality...?
- Is coercion to complement or to substitute to effort? I.e., should we expect more labor coercion when employers wish to induce greater effort from their workers?
  - Either could be rationalized on a priori grounds.
- Also, in this context some of the major reforms turn on the relationship between labor scarcity and coercion.

Labor Scarcity and Coercion

- **Central question:** Does labor scarcity lead to more or less coercion?
- "I would... expect to find a positive statistical correlation between free land and serfdom (or slavery)"—Evsey Domar (1970)
- "Rising population, rising prices, rising agricultural profits, low real incomes for the mass of the population, unfavorable terms of trade for industry" ... leading to the collapse of feudalism. H.J. Habakkuk, M.M. Postan, North and Thomas.
- Acemoglu, Johnson and Robinson (2012): "High population density, by providing a supply of labor that could be forced to work in agriculture or mining, made extractive institutions more profitable for the Europeans".

How to Model Labor Coercion?

- One natural approach is developed by Michael Chwe (1990): think of it as a principal-agent relationship and coercion corresponds to punishments conditional on the realization of output.
  - This, however, does not capture the essential feature of coercion: it is not a free relationship, but a forced relationship from the beginning.
- Alternative: Acemoglu and Wolitzky (2011): labor coercion arises if employers use force or threat of force to make agents accept contracts that they would not otherwise accept.
  - Still a form of principal-agent relationship, but different from the standard ones.
  - New technical and conceptual problems.
  - This will shed light on the relationship between labor scarcity and coercion.
- Then we will turn to how this perspective informs empirical work.

Model

- Mass 1 of *producers*, mass $L < 1$ of *agents*. All risk-neutral and identical
- Each producer has a project that yields x units of a consumption good if successful, 0 if unsuccessful.
- $x \sim F(x)$, density $f(x)$, on $[\underline{x}, \bar{x}]$, $\underline{x} > 0$.
- Market price P.
- Producers and agents matched at random.
- Once matched, producer chooses "guns" $g \geq 0$ at cost $\eta\chi(g)$, and offers a contract (w^y, p^y). $\chi(g)$ convex.
- w =wage, p =punishment.
- $w^y \geq 0$, $p^y \geq 0$ for $y \in \{0, x\}$ ("y^l, y^h") — thus limited liability.
- **Important**: g is "coercion", not p — coercion is about forcing people accepting contracts that they would not otherwise accept.

Model (continued)

- Agent accepts or rejects contract. If rejects, gets

$$\bar{u} - g.$$

This is where coercion enters— reducing the "outside option" of the worker if she rejects the employer's offer.

- If accepts, chooses $a \in [0,1]$, "effort", at cost $c(a)$.
- a =probability that project succeeds. $c(a)$ convex.
- Given contract (w^y, p^y), effort a, guns g, and output y, producer gets

$$Py - w^y - \eta\chi(g),$$

and agent gets

$$w^y - p^y - c(a).$$

- Given price P, outside option $\bar{u}$, and productivity x, what level of guns/what is the profit maximizing contract for a (matched) producer?

Model (continued)

- Similar to a standard principal-agent problem:

$$\max_{(a,g,w^h,w^l,p^h,p^l)} a\left(Px - w^h\right) + (1-a)\left(-w^l\right) - \eta\chi\left(g\right)$$

subject to

$$a\left(w^h - p^h\right) + (1-a)\left(w^l - p^l\right) - c\left(a\right) \geq \bar{u} - g, \qquad \text{(IR)}$$

and

$$a \in \arg\max_{\tilde{a}\in[0,1]} \tilde{a}\left(w^h - p^h\right) + (1-\tilde{a})\left(w^l - p^l\right) - c\left(\tilde{a}\right). \qquad \text{(IC)}$$

- Call solutions to this **equilibrium contracts**.

Characterization of Equilibrium Contracts

- First, Partial Equilibrium (later, endogenize P and $\bar{u}$ and look at GE).

Proposition

Suppose $Px > \bar{u} + c'(0)$. *Then any equilibrium contract involves* $a > 0$ *and* $g > 0$, *and an equilibrium contract for a producer of type* x *is given by* $\left(a, g, w^h, w^l, p^h, p^l\right)$ *such that*

$$(a, g) \in \arg \max_{(\tilde{a}, \tilde{g}) \in \mathbb{R}^2_+} Px\tilde{a} - \tilde{a}\left[(1-\tilde{a})\, c'(\tilde{a}) + c(\tilde{a}) + \bar{u} - \tilde{g}\right]_+ - \eta\chi(\tilde{g}), \tag{1}$$

with $w^l = p^h = 0$, $w^h = (1-a)\, c'(a) + c(a) + \bar{u} - g > 0$, *and* $p^l = c'(a) - w^h \geq 0$.

- $Px > \bar{u} + c'(0)$: to ensure that $a > 0$. In the paper, assumption on primitives ensures this.

Key Formula

- **Key formula**:

$$\max_{(a,g)} Pxa - a(1-a)c'(a) - ac(a) - a\bar{u} + ag - \eta\chi(g).$$

- Importantly, this problem is **supermodular** in $(a, g, x, P, -\bar{u} - \eta)$.
- This problem directly leads to a range of partial equilibrium comparative statics.
  - In particular, the set of equilibrium contracts (a, g) is a lattice, and its largest and smallest elements are increasing in x and P and decreasing in $\bar{u}$ and η.
- Note for future use that given the choice of a, g is uniquely pinned down by:

$$g = \chi^{-1}\left(\frac{a}{\eta}\right).$$

- Multiplicity may arise because multiple choices of a could be optimal.

Derivation of the Key Formula

- Let $u^h \equiv w^h - p^h$, $u^l \equiv w^l - p^l$.
- If $a > 0$, (IC) becomes

$$u^h - u^l = c'(a)$$

and (IR) becomes

$$au^h + (1-a)u^l - c(a) \geq \bar{u} - g \qquad (IR_1)$$

- Plugging $u^l = u^h - c'(a)$ into (IR_1) gives

$$u^h - (1-a)c'(a) - c(a) \geq \bar{u} - g \qquad (IR_2)$$

- There is a $1:1$ tradeoff between u^h and g in (IR_2).
- If $u^h = w^h$, this means that raising g by one unit lets the producer pay the worker one unit less after high output.

Derivation of the Key Formula (continued)

- Plugging (IR_2) into the principal's objective, assuming that $u^h = w^h$ and $w^l = 0$, gives

$$a(Px - ((1-a)c'(a) + c(a) + \bar{u} - g)) - (1-a)(0) - \eta\chi(g)$$
$$= aPx - a(1-a)c'(a) - ac(a) - a\bar{u} + ag - \eta\chi(g) \quad .$$

- High $a \implies$ success more likely $\implies$ reducing w^h more important.
  - Since raising g by one unit lets the producer reduce w^h by one unit,this means that the return to g is higher when a is higher.
- With multiple output levels, $1:1$ tradeoff between u^h and g may not hold, so complementarity between a and g may not hold. But does hold under reasonable conditions. For example, holds if $\Pr(y = \underline{y}|a) + \Pr(y = \bar{y}|a)$ doesn't depend on a. More generally, under MLRP and additional "mild" conditions.

Results

- Complementarity between a and g derived from principal-agent model.
- This is one of our main contributions and implies:

Proposition

1. *The set of equilibrium contracts for a producer of type x forms a lattice, with greatest and smallest equilibrium contracts $(a^+(x), g^+(x))$ and $(a^-(x), g^-(x))$. The extremal equilibrium contracts $(a^+(x), g^+(x))$ and $(a^-(x), g^-(x))$ are increasing in x and P and decreasing in $\bar{u}$ and η.*
2. *In addition, if $(1-a)c'''(a) \geq c''(a)$ for all a, then the equilibrium contract $(a(x), g(x))$ is unique and thus is everywhere increasing in x and P and decreasing in $\bar{u}$ and η.*

Results (continued)

- Immediate implications

Corollary

In equilibrium contracts:

1. *Agents with worse outside options (lower $\bar{u}$) are subject to more coercion.*
2. *Easier coercion (lower η) leads to higher effort.*
3. *Easier coercion reduces agent welfare.*
4. *Agents are better off when matched with less productive producers*

Interpretation

- Agents with worse outside options (lower $\bar{u}$) are subject to more coercion—why is this? Is this what we should have expected?
- Key formula is

$$\max_{(a,g)} Pxa - a(1-a)c'(a) - ac(a) - a\bar{u} + ag - \eta\chi(g).$$

- Recall that this is supermodular in $(a, g, -\bar{u})$. So lower $\bar{u}$ leads to higher a and g.
- Intuitively, it is cheaper to induce high effort when agents have bad outside options, so agents with worse outside options work harder. By supermodularity, this implies that agents with worse outside options are also subject to more coercion.
- This formalizes the **neo-Malthusian** idea that agents with low outside wages face more coercion.

Further Corollaries

Corollary

If coercion is sufficiently easy ($\eta < \eta^*$), effort is above first-best

Corollary

Banning coercion increases social welfare.

Coercion and Wages

Corollary

The correlation between expected wage payments and coercion is ambiguous (positive if $\partial w^h / \partial a > 0$, and negative if $\partial w^h / \partial a < 0$).

- Contrast to Fogel and Engerman:
  - Coercion increases effort, but generally this is not efficient. It also reduces "social welfare".
  - That the end of slavery did not increase wages is **not** a puzzle.
  - That gang labor did not arise after the end of slavery is **not** a puzzle.

Corollary

Greater demand (higher P) increases coercion and may or may not increase wages.

- Greater labor demand may not translate into higher wages because it also becomes optimal for employers to use more coercion.

Coercion and Social Welfare

- Banning coercion increases social welfare:

$$\begin{aligned} SW^C &= Pxa - a(1-a)c'(a) - ac(a) - a\bar{u} \\ &\qquad + ag - \eta\chi(g) + \bar{u} - g \\ &< Pxa - a(1-a)c'(a) - ac(a) - a\bar{u} + \bar{u} \\ &\leq \max_{\tilde{a}\in[0,1]} P x\tilde{a} - \tilde{a}(1-\tilde{a})c'(\tilde{a}) - \tilde{a}c(\tilde{a}) - \tilde{a}\bar{u} + \bar{u} \\ &= SW^N \end{aligned}$$

- Ignoring $\eta\chi(g)$, the benefit of coercion to the principal is ag and the cost of coercion to the agent is g.
- Coercion also distorts effort **away** from second-best.

General Equilibrium

- We next endogenize P and $\bar{u}$.
- Key questions:
  1. What is the effect of labor scarcity on coercion?
  2. What are the strategic interactions among producers?
  3. Can these overturn partial equilibrium comparative statics? Partial equilibrium welfare results?

Endogenizing Price

- **Endogenizing P:**
- Due to random matching, expected output per matched producer-agent pair is

$$Q \equiv \int_{\underline{x}}^{\bar{x}} a(x)\, x dF(x)$$

- QL is *aggregate output*.
- Assume that there is a downward sloping market demand curve so that *market price* is

$$P \equiv P(QL).$$

Endogenizing Outside Option

- **Endogenizing $\bar{u}$:**
- If an agent rejects a contract, let us assume that she is then matched with a random, previously unmatched coercive producer with probability γ, and is matched with a noncoercive ("city") producer with probability $1-\gamma$ and receives utility $\tilde{u}(L)$, where $\tilde{u}$ is decreasing in L (e.g., because when population is greater, wages in the noncoercive sector are also lower). So:

$$\bar{u} = \gamma \int_{\underline{x}}^{\bar{x}} (\bar{u} - g(x)) \, dF(x) + (1-\gamma) \tilde{u}(L)$$

- Let G be the average number of guns used by a matched, coercive producer, or equivalently *aggregate coercion*. Then

$$G \equiv \int_{\underline{x}}^{\bar{x}} g(x) \, dF(x).$$

$$\bar{u} = \tilde{u}(L) - \frac{\gamma}{1-\gamma} G.$$

General Equilibrium Definition

Definition

A (pure-strategy) equilibrium is a pair of functions $(a^*(\cdot), g^*(\cdot))$ *such that, for each* $x \in [\underline{x}, \bar{x}]$, $(a^*(x), g^*(x))$ *is an equilibrium contract given market price* P *and outside option* $\bar{u}$, *and* P *and* $\bar{u}$ *are given by*

$$P = P(QL)$$

and

$$\bar{u} = \tilde{u}(L) - \frac{\gamma}{1-\gamma} G$$

evaluated at $(a^*(\cdot), g^*(\cdot))$.

- Could also define a similar [more involved] definition of equilibrium in mixed strategies.

Side Comments

- This is an *aggregative game*: a producer's problem is affected by other producers' actions only through Q and G.
- (a, g) is increasing in P and decreasing in $\bar{u}$.
- Therefore, (a, g) is decreasing in Q and increasing in G.
- Q and G are increasing in (a, g).
- The game has strategic substitutes in a and strategic complements in g.
- Therefore, the set of equilibria may not be a lattice, making comparative statics challenging.
- To deal with this, impose sufficient concavity assumptions (see paper for alternatives).

Comparative Statics: Main Results

Assumption

(concavity)

1. $c(\cdot)$ *is three times differentiable and satisfies*

$$(1-a)\,c'''(a) \geq c''(a) \text{ for all } a.$$

2. $x_j = x$ *for all producers.*

- This assumption ensures concavity of the employer's maximization problem (it was already used in the second part of the first proposition above).

Existence and Comparative Statics

Proposition

Suppose that Assumption (concavity) holds. Then:

1. *An equilibrium exists, the set of equilibria is a lattice, and the smallest and greatest equilibrium aggregates (Q, G) are increasing in γ and decreasing in η.*
2. *If $\tilde{u}(L) = \tilde{u}_0$ for all L, then the smallest and greatest equilibrium aggregates (Q, G) are decreasing in L.*
3. *If $P(QL) = P_0$ for all QL, then the smallest and greatest equilibrium aggregates (Q, G) are increasing in L.*

- If $\tilde{u}(L) = \tilde{u}_0$, then only the Domar effect.
- If $P(QL) = P_0$, then only the neo-Malthusian effect.

Comparing the Two Effects

- Let $(Q^+(L), G^+(L))$ and $(Q^-(L), G^-(L))$ denote the smallest and greatest equilibrium aggregates given labor L, and let us use $(Q^\bullet(L), G^\bullet(L))$ to refer to either one of these two pairs.

Proposition

Suppose that $Q^\bullet(L_0) P'(Q^\bullet(L_0) L_0) > \tilde{u}'(L_0)$ *(where* $Q^\bullet(L_0)$ *is either* $Q^+(L)$ *or* $Q^-(L)$*). Then* $(Q^\bullet(L), G^\bullet(L))$ *is locally decreasing in* L*. Conversely, suppose that* $Q^\bullet(L_0) P'(Q^\bullet(L_0) L_0) < \tilde{u}'(L_0)$*. Then* $(Q^\bullet(L), G^\bullet(L))$ *is locally increasing in* L*.*

- Recall in interpreting this proposition that both $Q^\bullet(L_0) P'(Q^\bullet(L_0) L_0)$ and $\tilde{u}'(L_0)$ are negative.
- "Locally increasing" means that there exists $\delta > 0$ such that $(Q^\bullet(L), G^\bullet(L)) < Q^\bullet(L_0), G^\bullet(L_0)$ for all $L \in (L_0, L_0 + \delta)$ (and $(Q^\bullet(L), G^\bullet(L)) > Q^\bullet(L_0), G^\bullet(L_0)$ for all $L \in (L_0 - \delta, L_0)$).

Interpretation

- When both the Domar and the neo-Malthusian effects are present, local comparative statics are determined simply by which of these two effects are greater.
  1. If $Q(L_0) P'(Q(L_0) L_0) > \tilde{u}'(L_0)$, then the neo-Malthusian effect is greater, and a decline in population reduces coercion.
  2. If $Q(L_0) P'(Q(L_0) L_0) < \tilde{u}'(L_0)$, then the Domar effect is greater, and a decline in population increases coercion.
- Why different effects in the aftermath of the Black Death and during Second Serfdom?
  - Perhaps $Q(L_0) P'(Q(L_0) L_0) > \tilde{u}'(L_0)$ following the Black Death because cities are already important.
  - In contrast, $Q(L_0) P'(Q(L_0) L_0) < \tilde{u}'(L_0)$ in Eastern Europe, because demand for grain from the West increasing prices and cities are not as important, so $\tilde{u}'(L_0)$ small.

Economies of Scales in Coercion

- The "AJR idea": coercion worthwhile only in the colonies were there are large native populations to coerce.
- This can be captured by assuming that producers choose g before they learn whether they are matched with an agent.
- Suppose also that $P(\cdot) \equiv P_0$ and $\tilde{u}(\cdot) = \tilde{u}_0$.
- Because probability of matching for a producer is $1/L$, an equilibrium is a solution to:

$$\max_{(a,g)} L \left(aP_0 x - a \left[(1-a) c'(a) + c(a) + \tilde{u}_0 - \frac{\gamma}{1-\gamma} G - g \right]_+ \right.$$
$$\left. - (1-a) \left[-ac'(a) + c(a) + \tilde{u}_0 - \frac{\gamma}{1-\gamma} G - g \right]_+ \right) - \eta \chi(g),$$

with the interpretation that a is the level of effort that will be chosen following a match with an agent.

Economies of Scales in Coercion (continued)

- Rewrite this as:

$$\max_{(a,g)} aP_0x - a\left[(1-a)\,c'(a) + c(a) + \tilde{u}_0 - \frac{\gamma}{1-\gamma}G - g\right]_+ - (1-a)\left[-ac'(a) + c(a) + \tilde{u}_0 - \frac{\gamma}{1-\gamma}G - g\right]_+ - \frac{\eta}{L}\chi(g).$$

- Same as before except that the cost of guns η is replaced by η/L. Thus:

Proposition

Consider the modified model presented with economies of scale in coercion. Then, an equilibrium exists and the set of equilibria is a lattice. Labor scarcity reduces coercion, that is, a decline in L reduces the smallest and greatest equilibrium aggregates (Q, G). Moreover, the smallest and greatest equilibrium aggregates (Q, G) are increasing in P_0, γ, and x, and decreasing in $\tilde{u}_0$ and η.

Summarizing

Proposition

The smallest and greatest equilibrium values of Q are increasing in $F(\cdot)$ and γ, and decreasing in L, $\tilde{u}$, and η.

Proposition

The smallest and greatest equilibrium values of G are increasing in $F(\cdot)$ and γ, and decreasing in L, $\tilde{u}$, and η.

- In addition:

Proposition

An equilibrium (in mixed strategies) exists.

Summary

- We have seen:
  1. **Price effect:** Labor scarcity increases (Q, G), because $P(QL)$ is decreasing in L and (Q, G) is increasing in P (*Domar channel*).
  2. **Outside option effect:** Let $\tilde{u}(L)$ be decreasing in L (e.g., more workers in the cities or having escaped to the cities). Then labor scarcity decreases (Q, G), because $\tilde{u}$ is decreasing in L and (Q, G) is decreasing in $\tilde{u}$ (*neo-Malthusian channel*).
  3. **Economies of scales in coercion:** Suppose that producers choose g **before** matching. Then labor scarcity decreases (Q, G), because (Q, G) is decreasing in η (*AJR channel*).
- Can we (empirically) say when one effect will be more important?

Coercion and Wages

- An interesting, related paper by Naidu and Yuchtman (2013) looks at the effects of the British Master Servant law, which was only repealed in 1875.
- This law gave employers the ability to criminally prosecute workers who quit and "breached their contract". Prosecutions were extremely common.
- The above ideas suggest that greater labor demand should translate into more prosecutions and the repeal of the law should lead to lower wages.
- This is what Naidu and Yuchtman find. They focus on textile, iron and coal prices as measures of the demand for labor in the three sectors respectively, and then interact with the shares of these industries in the county. They also look at wage changes at the county level as a function of the number of past persecutions after repeal.

Coercion and Labor Demand: Results

Table 2: Reduced Form Sectoral Shocks on Master and Servant Prosecutions

	OLS						*2SLS*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Fraction Textiles 1851 X Log(Cotton Price Ratio)	210.9***			159.3***	145.5***	141.2***	147.2***	127.8*
	(42.39)			(42.02)	(46.24)	(39.05)	(45.04)	(64.94)
Iron County X Log(Iron Price)		76.03***		51.98**	64.58**	67.27**	90.64*	89.83*
		(22.90)		(19.48)	(27.84)	(33.18)	(46.71)	(49.25)
Coal County X Log(Coal Price)			68.32***	41.25***	35.63**	27.50***	25.22*	26.82**
			(15.90)	(10.11)	(14.31)	(8.428)	(14.92)	(12.05)
Log(Population)	145.5***	124.8***	73.26*	79.13**	41.84	54.69	83.75**	39.21
	(50.52)	(42.20)	(36.68)	(35.09)	(36.18)	(115.2)	(36.70)	(38.10)
F-statistic p-value on joint significance				0.000	0.000	0.000	0.000	0.000
District FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Time-Varying Controls	N	N	N	N	Y	Y	N	Y
County-Specific Trends	N	N	N	N	N	Y	N	N
N	3942	3942	3942	3942	3942	3942	3942	3942

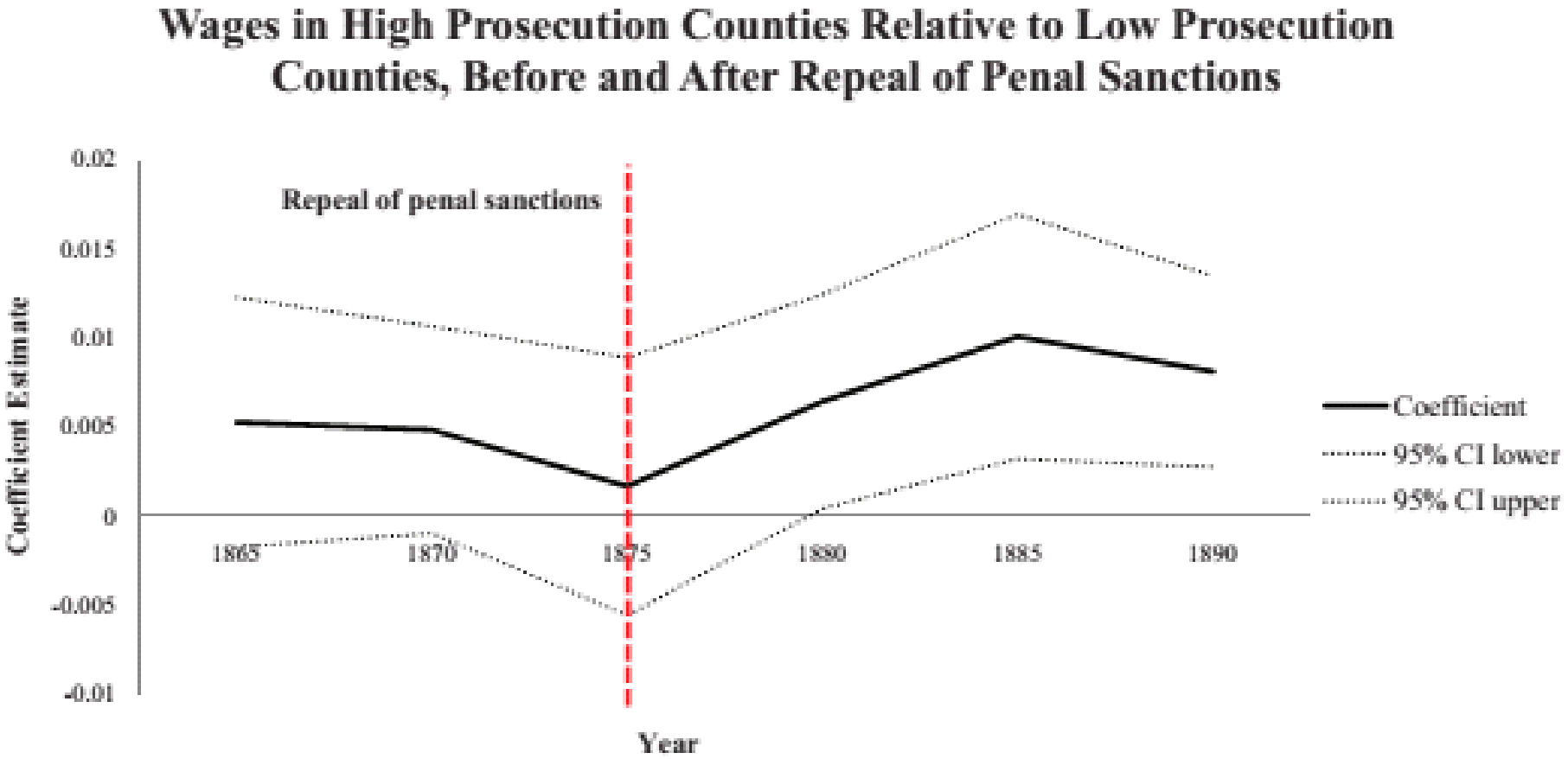
Dependent variable is absolute number of master and servant prosecutions. Standard errors, clustered on county, included in parentheses. Time varying controls are year specific effects of 1851 income, 1851 population density, 1851 proportion urban, and a Wales dummy. Columns (1) through (6) are estimated using OLS; columns (7) and (8) use 2SLS, where distance to Lancashire is used as an instrument for employment share in textiles and iron ore production is used as an instrument for pig iron production. First stage results from columns (7) and (8) are presented in the Appendix. * p<0.1, ** p<0.05, *** p<0.01

Coercion and Wages: Results

Table 5: Effect of Repeal on Wage Levels, by Average Prosecutions

	OLS							*Arellano-Bond*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-1875 X Log(Average Prosecutions)	0.0206**	0.0130*	0.0122*	0.0030**	0.0053***	0.0073***	0.0026**	0.0133**
	(0.0082)	(0.0072)	(0.0061)	(0.0013)	(0.0017)	(0.0024)	(0.0013)	(0.0053)
Population Density			-0.0570		-0.0105	-0.00453	-0.00722	-0.0455*
			(0.0583)		(0.00805)	(0.0124)	(0.00625)	(0.0274)
Proportion Urban			-0.0488		0.0009	0.0038	-0.0012	0.0010
			(0.0461)		(0.0022)	(0.0023)	(0.0018)	(0.0047)
Log(Income)			0.0291		0.0042	0.0034	0.0037	0.0194
			(0.0312)		(0.0035)	(0.0038)	(0.0030)	(0.0136)
Log(Population)	0.1050***	0.0559**	0.0944**	0.0113***	0.0177***	0.0158*	0.0123***	0.0511
	(0.0279)	(0.0219)	(0.0389)	(0.0038)	(0.0059)	(0.0090)	(0.0046)	(0.0343)
Union Membership		0.170	0.0881	0.0648**	0.0170	0.0234	0.0606**	0.0437
		(0.1080)	(0.0955)	(0.0282)	(0.0172)	(0.0235)	(0.0298)	(0.0500)
Lagged Log(Wage)				0.861***	0.849***	0.837***	0.836***	0.813***
				(0.0198)	(0.0125)	(0.0111)	(0.0110)	(0.0207)
Time-Varying Controls	N	Y	Y	N	Y	Y	Y	Y
Labor market controls	N	N	N	N	N	Y	N	N
Post-1875 X county controls	N	N	N	N	N	N	Y	N
County-specific recession effect	N	N	Y	N	Y	Y	Y	Y
N	2860	2860	2392	2808	2392	1685	2392	2392

Coercion and Wages: Results (continued)



Persistent Effects of Coercion

- We saw in the first lecture from Melissa Dell's work that organized coercion, even at the village level, can have very persistent effects.
  - Empirical strategy is based on regression discontinuity design exploiting the fact that only villages within the catchment area were subject to forced labor under the mita system.
- The same pattern emerges in Acemoglu, Garcia-Jimeno and Robinson's (2012) work on slavery in Colombia, using a different strategy.
- Why would coercion have persistent effects lasting several hundreds of years?

Persistent Effects of the Mita

TABLE II

LIVING STANDARDS[a]

	Dependent Variable						
	Log Equiv. Household Consumption (2001)			Stunted Growth, Children 6–9 (2005)			
Sample Within:	<100 km of Bound.	<75 km of Bound.	<50 km of Bound.	<100 km of Bound.	<75 km of Bound.	<50 km of Bound.	Border District
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A. Cubic Polynomial in Latitude and Longitude						
Mita	−0.284	−0.216	−0.331	0.070	0.084*	0.087*	0.114**
	(0.198)	(0.207)	(0.219)	(0.043)	(0.046)	(0.048)	(0.049)
R^2	0.060	0.060	0.069	0.051	0.020	0.017	0.050
	Panel B. Cubic Polynomial in Distance to Potosí						
Mita	−0.337***	−0.307***	−0.329***	0.080***	0.078***	0.078***	0.063*
	(0.087)	(0.101)	(0.096)	(0.021)	(0.022)	(0.024)	(0.032)
R^2	0.046	0.036	0.047	0.049	0.017	0.013	0.047
	Panel C. Cubic Polynomial in Distance to *Mita* Boundary						
Mita	−0.277***	−0.230**	−0.224**	0.073***	0.061***	0.064***	0.055*
	(0.078)	(0.089)	(0.092)	(0.023)	(0.022)	(0.023)	(0.030)
R^2	0.044	0.042	0.040	0.040	0.015	0.013	0.043
Geo. controls	yes	yes	yes	yes	yes	yes	yes
Boundary F.E.s	yes	yes	yes	yes	yes	yes	yes
Clusters	71	60	52	289	239	185	63
Observations	1478	1161	1013	158,848	115,761	100,446	37,421

Persistent Effects of Colombian Slavery

- Different strategy in Acemoglu, Garcia-Jimeno and Robinson (2012).
- Slavery associated with gold-mining, and there is no longer gold-mining in Colombia.
- Thus use the presence of gold mines in the past as instrument for history of slavery.
- But gold-mining municipalities potentially different in terms of geography, area and other factors that non-gold-mining municipalities.
- Control strategy: compare gold-mining municipalities only to neighboring non-gold-mining municipalities (include neighborhood pair fixed effects).

Persistent Effects of Colombian Slavery (continued)

- Prosperity and public goods (part I)

LONG-RUN EFFECT OF SLAVERY ON DEVELOPMENT OUTCOMES: IV MODELS

	Poverty Rate 1993				Secondary Enrollment Rate Average 1992-2002			
	Neighbor-Pair Fixed Effects Models		Random Effects Models		Neighbor-Pair Fixed Effects Models		Random Effects Models	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Had Slaves in 1843	12.938	11.356	14.628	13.142	-0.114	-0.087	-0.127	-0.106
	(3.929)	(3.935)	(7.095)	(6.892)	(0.047)	(0.052)	(0.063)	(0.062)
σ_ε^2			13.374	9.031			0.000	0.000
σ_ν^2			259.23	220.47			0.043	0.039
1st Stage F-statistic	2.190	2.217	3.181	2.345	2.318	2.430	3.069	2.462
p-value	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.001
Geographic Controls	N	Y	N	Y	N	Y	N	Y
Observations	352	352	179	179	336	336	172	172

	Percent Children Vaccinated 2002				Land Gini 2002			
	Neighbor-Pair Fixed Effects Models		Random Effects Models		Neighbor-Pair Fixed Effects Models		Random Effects Models	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Had Slaves in 1843	-0.249	-0.251	-0.247	-0.254	0.087	0.045	0.048	0.040
	(0.066)	(0.074)	(0.097)	(0.107)	(0.017)	(0.015)	(0.024)	(0.021)
σ_ε^2			0.000	0.000			0.000	0.000
σ_ν^2			0.041	0.040			0.007	0.005
1st Stage F-statistic	2.190	2.217	3.181	2.345	2.312	2.200	3.233	1.963
p-value	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.015
Geographic Controls	N	Y	N	Y	N	Y	N	Y
Observations	352	352	179	179	248	248	129	129

Persistent Effects of Colombian Slavery (continued)

- Early historical outcomes.

LONG-RUN EFFECT OF SLAVERY ON INTERMEDIATE DEVELOPMENT OUTCOMES: IV MODELS

	School Enrollment 1918				Vaccine Coverage 1918			
Panel A: Second Stage	Neighbor-Pair Fixed Effects Models		Random Effects Models		Neighbor-Pair Fixed Effects Models		Random Effects Models	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Had Slaves in 1843	-0.017	-0.017	-0.021	-0.022	-0.024	-0.018	-0.043	-0.037
	(0.009)	(0.010)	(0.016)	(0.019)	(0.039)	(0.039)	(0.076)	(0.076)
σ_ε^2			0.000	0.000			0.000	0.000
σ_ν^2			0.001	0.001			0.023	0.020
1st Stage F-statistic	2.251	2.458	2.883	1.852	2.251	2.458	2.883	1.852
p-value	0.000	0.000	0.003	0.026	0.000	0.000	0.003	0.026
Geographic Controls	N	Y	N	Y	N	Y	N	Y
Observations	216	216	111	111	216	216	111	111

	Literacy Rate 1938				Aqueduct Coverage 1938			
Panel A: Second Stage	Neighbor-Pair Fixed Effects Models		Random Effects Models		Neighbor-Pair Fixed Effects Models		Random Effects Models	
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Had Slaves in 1843	-0.080	-0.065	-0.069	-0.056	-0.029	-0.028	-0.024	-0.024
	(0.019)	(0.021)	(0.030)	(0.032)	(0.010)	(0.012)	(0.013)	(0.012)
σ_ε^2			0.001	0.001			0.000	0.000
σ_ν^2			0.011	0.007			0.001	0.001
1st Stage F-statistic	1.949	2.286	2.061	1.492	1.949	2.286	2.061	1.492
p-value	0.000	0.000	0.029	0.097	0.000	0.000	0.029	0.097
Geographic Controls	N	Y	N	Y	N	Y	N	Y
Observations	242	242	123	123	242	242	123	123

Politics of Coercion

- Coercion and politics: most of the time, coercion is not just an individual-level activity undertaken by employers, but chosen and implemented by the state. The above model can be modified to allow for the possibility.
- But more importantly, state structures to implement coercion may be very different from others, and once coercion becomes endemic, this may lead to the development of a different state, and it is the state that persists.
- Alternatively, the presence of coercion can change the economic organization which can have very persistent effect.
- It could also affect within-community relations (e.g., less trust and more conflict).
- Dell's work suggests the possibility of labor coercion crowding out other types of labor demand (for example from haciendas), and perhaps this is a channel of persistence.
- Dell and Acemoglu, Garcia-Jimeno and Robinson also show that

Coercion and Technology

- More generally, coercion can have an impact on the choice of technology.
- Acemoglu (2010): when technologies "(strongly) labor-replacing" low wages discourage technology adoption and development.
    - Example: labor abundance may slow down mechanization of agriculture.

Conclusion

- Labor coercion the "modal" form of transaction in labor markets throughout history.
- General theoretical issues showing when coercion emerges and how it is affected by
  1. price effect;
  2. outside option effect;
  3. economies of scale in coercion.
- Empirical results on persistent effect of coercion and how coercion response to labor demand.
- Much more to be done...