Monopsony Power and its Implications

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Road-map

Motivation and Outline

First Motivation

The introduction to LECON2608 has emphasized that

- There is evidence of persistent wage dispersion that cannot be reconciled with perfect competition on the labor market...
- ... unless unobserved non-monetary attributes of jobs are *common knowledge* and largely firm-specific.

Job-search theory takes for granted that there is "**pure** wage dispersion" (i.e. wage dispersion among workers with identical observable characteristics).
Why is it so is left unexplained.

These slides provide an explanation.
It turns out that the proposed explanation is intimately linked to firms' power on the labor market.

Second Motivation

> *"The United States is embarking, in at least some regions, on an experiment of using high minimum wages to try to increase incomes of workers and to reduce poverty. (...) the debate among researchers about whether minimum wages reduce employment, and if so by how much, remains intense and unsettled." (Neumark, 2019, p. 293-4)*

This empirical debate is rooted in an well-known distinction:

> *"The effects of minimum wages may in principle differ between industries in which employers do and do not have control over the wage rates they pay for labor of given skill and application." (Stigler, 1946, p. 358)*

To "have control over the wage rates", firms need labor market power. **Here we look at why and when employers can have such a power.**

Sources of Firms' Market Power

Firms can have monopsony (oligopsony) power, and hence behave as wage-setters, for a number of reasons:

1. A small number of firms can dominated the hiring *in a given* geographic and occupational labor market.

   Limit case: The Monopsony discussed by introductory textbooks. This limit case requires: Extreme barriers to
   - Entry of additional firms and
   - Geographic and occupational mobility of workers.

   Oligopsony power:
   - Empirical evidence of Labor Market Concentration using online Job Boards in the US (Azar, Marinescu and Steinbaum, 2020).
   - Possibly linked to another evidence: Increase of US firm's market power on the goods markets (De Loecker, Eeckhout and Unger, 2020).

2. *"It is frictions, broadly defined, that give employers monopsony power in the labor market. The most important sources of these frictions are:*

   - *Ignorance among workers about labor market opportunities;*
   - *Individual heterogeneity in preferences over jobs;*
   - *Mobility costs.*

   The view that employers have some market power can hardy be controversial: it is undoubtedly true that a wage cut of a cent does not cause all existing workers to instantaneously leave the employer." (Manning, 2003, p. 360)

These slides will develop a setting exploiting job-search theory in an homogeneous segment of the labor market.

Before, let us briefly discuss the two last bullet points of this quote...

"Individual heterogeneity in preferences over jobs" as a source of monopsony power: Why?

The role for non-monetary attributes of jobs ('job amenities') is back again:

- Compatible with pure competition if
  - There is perfect information about tastes for these attributes
  $\rightarrow$ wages can be contingent on the value of these attributes
  - Economic agents are wage-takers.
  (Remember the theory of compensating wage differentials).
- Card, Cardoso, Heining and Kline (2018) generate monopsony power by assuming instead:
  - Idiocyncratic preferences for firm-specific amenities are not observed by firms $\rightarrow$ no wage contingent on the value of these amenities;
  - Workers are fully-informed about job opportunities;
  - Wages are set by profit-maximizing employers along a firm-specific labor supply relationship.

Turning now to restrictions to mobility,

- There are in particular geographical mobility costs.
- “No-poaching” or “Non-compete” agreements [NCA] prohibit departing employees from moving to new jobs within the industry for a period of time post-employment and subject to geographical limits.
  These formal agreements are allowed to “protect trade secrets”. So, they concern mainly more skilled workers.
  There is however recent evidence in the US that it also applies to a substantial number of less skilled workers (Lipsitz and Starr, 2020, who conclude that “the modal worker bound by an NCA is paid by the hour, with median wages of $14”).

An equilibrium Search model with wage posting

Question: Is it possible to develop a theoretical setting where the **equilibrium** distribution of wages is not degenerate?
(A degenerate distribution is the distribution of a random variable which only takes a single value)

Seminal paper: Burdett and Mortensen (1998) = Job-search model where the focus is on **the behavior of firms (wage formation)** *in the presence of on-the-job search.*

Presentations of this framework can be found e.g. in:

- Cahuc, Carcillo and Zylberberg (2014) (p. 306-314).
- Mortensen (2003) (p. 36-44).
- Rogerson, Shimer and Wright (2005) (p. 978-9).
- Christensen and Kiefer (2009) (p. 378-385).

Assumptions

A1 Rational forward-looking and **homogeneous** risk-neutral agents who only care about their income (hand-to-mouth consumers). All unemployed are entitled to a flat UB, b, with no time limit. No taxes. $z \equiv b - c$.

A2 Job search intensity is fixed. In $[t, t + dt]$, each employer contacts a *finite* number of job-seekers at random.

A3 Job-seekers choose freely to reject or accept a job offer, if any. An accepted wage remains constant all along the employment spell. Rejected offers (i) cannot be recalled, (ii) lead to no sanction.

A4' On-the-job search. λ_u (resp., λ_e) designate the *exogenous* arrival rates of job offers for the unemployed (resp., the employed). Assume that $0 < \lambda_i < +\infty,\ i \in \{e, u\}$.

Assumptions continued

A5' An **endogenous** *distribution* of *wage offers*. Job-seekers know the distribution. "**Wage posting**": Firms choose their wage offer and **commit** to pay that wage. To currently employed workers, firms send wage offers **ignoring their current wage**. The worker's current employer does not make a counter-offer.

A6 Constant exogenous job destruction rate, $0 < q < +\infty$.

A7 A large **given** number of firms and workers. Formally, a continuum of workers and a continuum of firms, each of unitary mass.

$\Rightarrow$ Stationary environment.

We are looking for rational expectations equilibria, i.e., in which

- Firms know the search behavior of the labor force;
- The labor force knows the true distribution of wages.

As seen before, the reservation wage, x, of the unemployed verifies:

$$x = z + (\lambda_u - \lambda_e) \int_x^{+\infty} \frac{\overline{H}(\xi)}{r + q + \lambda_e \overline{H}(\xi)} d\xi \quad \text{with} \quad \overline{H}(\xi) \equiv 1 - H(\xi) \quad (1)$$

$\lozenge$ No employer will offer a wage below x. So, let us assume $w \geq x$.

$\lozenge$ Why would an employer offer more than x?
Intuition:
Posting a higher wage affects the flow of employees
(i) Quitting the firm because they face a better offer and
(ii) Accepting offers by the firm.
For a given firm, profit maximization might be attained indifferently through

- High wages and many employees or
- Low wages and few employees.

$\lozenge$ *The question*: In equilibrium, is $H(w)$ degenerate?

The law of motion of the unemployment rate u :

$$\dot{u} \equiv du/dt = q(1-u) - \lambda_u \cdot 1 \cdot u$$

since all offers will pay $w \geq x$.
In steady state $\dot{u} = 0$. Hence,

$$u = \frac{q}{q+\lambda_u} = \frac{1}{1+k_u} \in (0,1), \quad \text{with } k_u \equiv \lambda_u / q \tag{2}$$

So, the equilibrium unemployment rate is exogenous and hence is not the focus of this model.

Equilibrium flows on the labor market

For any w, The fraction of those employed at a wage w or less, i.e. the wage distribution function $G(w)$, should not be confused with the distribution of job offers $H(w)$.

By the law of large numbers, the flow into the set of workers earning w or less is ($w \geq x$):

$$\lambda_u \cdot 1 \cdot H(w) \cdot u$$

The flow out of the same set is

$$G(w)(1-u)[q + \lambda_e(1 - H(w))]$$

So, after some manipulation,

$$G(w) = \underbrace{\frac{u}{1-u}}_{=1/k_u} \frac{k_u\, H(w)}{1 + k_e\, \overline{H}(w)}, \qquad \text{with } k_e \equiv \lambda_e / q \tag{3}$$

Employment level per firm offering w

Consider a small $\varepsilon > 0$. Taking (2) into account, the total number of workers employed and paid in the interval $[w-\varepsilon, w]$ is

$$(G(w) - G(w-\varepsilon))\,(1-u) = u\,k_u\left[\frac{H(w)}{1+k_e\,\overline{H}(w)} - \frac{H(w-\varepsilon)}{1+k_e\,\overline{H}(w-\varepsilon)}\right]$$

$$= (\ldots) = \frac{k_u\,(H(w) - H(w-\varepsilon))\,(1+k_e)}{(1+k_u)\left(1+k_e\,\overline{H}(w)\right)\left(1+k_e\,\overline{H}(w-\varepsilon)\right)} \tag{4}$$

$H(w) - H(w-\varepsilon)$ firms offer a wage in the same interval. Hence, total employment $\ell(w)$ per firm offering a wage w is

$$\ell(w) \equiv \lim_{\varepsilon\to 0}\frac{(G(w) - G(w-\varepsilon))\,(1-u)}{H(w) - H(w-\varepsilon)} = \frac{k_u(1+k_e)}{(1+k_u)\left(1+k_e\,\overline{H}(w)\right)^2} \tag{5}$$

Firm's profit

The cdf $H(\cdot)$ being given

This literature is used to assume that the discount rate r is small relative to $(\lambda_u, \lambda_e, q)$, so that firms are assumed to maximize their stationary instantaneous profit.
In a firm posting a wage w, this profit, $\Pi(w)$ writes:

$$\Pi(w) \equiv (y - w)\ell(w) = (y - w)\frac{k_u(1 + k_e)}{(1 + k_u)\left(1 + k_e \overline{H}(w)\right)^2} \tag{6}$$

where y designates real output. To avoid an uninteresting case: $y \geq x$.

- A higher wage increases Π through the acceptance and the retention rates (these effects are concealed in the denominator)
- A higher wage lowers Π via the instantaneous profit $y - w$

Notice that *for any* w, the R.H.S. is strictly increasing in $H(w)$.

Wage posting

How does a given firm choose its posted wage?

- Clearly no firm posts $w > y$ and we have built the model under the assumption that firms can compute x, so that $w \geq x$.
- Each employer makes his decision in a noncooperative context in which the other employers' wage policies are taken as given. So, for any given cdf $H(\cdot)$ and taking also x as given, each individual employer posts a wage offer w such that:

$$w = \arg\max_{s \geq x} \{\Pi(s)\} \tag{7}$$

The form of the profit function Π implies that firms set wages partly to limit the extent of quits and to attract ('poach') workers from other firms.

Equilibrium

We are not searching for a wage w given a cdf $H(\cdot)$.
We are searching for a cdf $H(\cdot)$ and its support.

Equilibrium requires that any posted wage yields the same profit, which is at least as large as profit from any other wage.

More formally, **any** equilibrium wage offer $w \geq x$ in the support of the CDF of offers H, must yield the same level of profit, say π:

$$\Pi(w) \equiv (y - w)\frac{k_u(1 + k_e)}{(1 + k_u)\left(1 + k_e\overline{H}(w)\right)^2} = \pi \quad \forall w \ \text{ in the support} \tag{8}$$

An equilibrium solution can be described by a triple (x, H, π) such that x verifies (1), π defined above, and the CDF H is such that

- $\Pi(w) = \pi$ for all w on the support of H
- $\Pi(w) \leq \pi$ out of the support of H

Equilibrium

Let $\underline{w} \geq x$ and $\overline{w} \leq y$ denote the infimum and the supremum of the support of H.

◊ What is the value of the infimum $\underline{w}$?
As $\overline{H}(\underline{w}) = 1$, from (8), the employer offering the lowest wage in the market sets $\underline{w} = x$.

◊ To characterize the distribution $H(w)$ (and, hence, $G(w)$), one knows that in equilibrium

$$\Pi(w) = \Pi(x) \;\; \forall w \in [\underline{w} = x; \overline{w}]$$

i.e. $\forall w \in [x, \overline{w}]$

$$(y - w)\frac{k_u(1 + k_e)}{(1 + k_u)\left(1 + k_e\overline{H}(w)\right)^2} = (y - x)\frac{k_u(1 + k_e)}{(1 + k_u)(1 + k_e)^2} \qquad (9)$$

Equilibrium

Solving this equation explicitly leads to:

$$H(w) = \frac{1+k_e}{k_e}\left[1 - \sqrt{\frac{y-w}{y-x}}\right] \tag{10}$$

From (10) one easily derives:

$$G(w) = \frac{1}{k_e}\left[\sqrt{\frac{y-x}{y-w}} - 1\right] \tag{11}$$

$\Diamond$ What is the value of the supremum $\overline{w}$?
$\overline{w}$ solves (9) in which $\overline{H}(\overline{w}) = 0$. So,

$$\overline{w} = \left(1 - \frac{1}{(1+k_e)^2}\right) y + \frac{1}{(1+k_e)^2} x \tag{12}$$

i.e. $\overline{w}$ is a weighted average of x and y.
As long as $k_e \equiv \lambda_e/q > 0$, one has $\overline{w} > \underline{w}$ since $y > x$.

Equilibrium

All expressions above depend on x defined implicitly in (1).

Letting $r \to 0$ and substituting (10) into (1), it can be shown that:

$$x = \frac{z(1+k_e)^2 + (k_u - k_e)k_e y}{(1+k_e)^2 + (k_u - k_e)k_e} \tag{13}$$

It can be easily verified that $x = z$ if $\lambda_e = 0$, so that $k_e = 0$. Then, from (12), one also see that $\overline{w} = x = z$.[1]

It can also be checked that if $\lambda_u = \lambda_e \neq 0$ (so that $k_u = k_e \neq 0$), $x = z$. Something, we already knew.

[1] A result due to Diamond (1971).

Some technical issues

◊ Suppose a mass point at some $\hat{w}$, such that $x \leq \hat{w} < \overline{w}$.[2]

- For any small ε, a firm posting $\hat{w} + \varepsilon$ would increase its revenue discretely (hiring away any worker contacted paid $\hat{w}$) while paying an ε more (hence $y - w$ declines only marginally).
- So, a wage such as $\hat{w}$ associated to a mass point cannot maximize profits.

◊ Can there be "gaps" in $H(w)$?
A gap between say $\widetilde{w}$ and $\breve{w}$ means $H(\widetilde{w}) = H(\breve{w})$. Then a firm posting $\breve{w}$ could reduce its offer and hence its cost without reducing its flow of entrants or increasing its flow of exits.
Hence, $\breve{w}$ cannot be optimal.

[2] Hence, there is a finite number of workers paid exactly $\hat{w}$.

Monopsony power

In all the previous relationships, the ratio $k_e = \lambda_e / q$ played a key role. See the empirical part for estimates of this ratio.
If *frictions vanish* i.e. if $\lambda_e \to +\infty$, hence $k_e \to +\infty$ at given q, then:

- $\overline{w} \to y$
- $G(w) \to 0$ for all $w < \overline{w}$

Furthermore, $u \to 0$ if $\lambda_u \to +\infty$ at given q (i.e. $k_u \to +\infty$).

So, in the absence of frictions, the search equilibrium has all the properties of perfect competition.
However, perfect competition is only a limit case.

As long as $0 < k_e < +\infty$, one has $\underline{w} = x < \overline{w} < y$. So, *all workers are paid less than their marginal product*. In this sense, they are "exploited" because firms have some *monopsony power*...

Limitations and extensions I

1. Posting a constant wage and committing not to revise it can be criticized (see Coles, 2001). Extensions:
   - A firm would always like to counter an outside offer instead of loosing a worker, if the offered wage is below the marginal product. See Postel-Vinay and Robin (2002). However, the prospect of a wage gain creates incentives to search on the job. There isn't much empirical evidence but it goes against the widespread use of counteroffers (see Barron, Berger and Black, 2006).
   - Often firms do not post a single wage, but post contracts where the wage paid can vary with an employee's tenure (Burdett and Coles, 2003, (introducing risk aversion) and Stevens, 2004). Summary on p. 980 of Rogerson, Shimer and Wright (2005).

Limitations and extensions II

2. Multiple applications - Multiple job offers:
   In continuous time models, the probability that a job-seeker gets more than 1 offer during a small interval of time is negligible.
   In reality, job-seekers can simultaneously apply to more than one job.

   What does this change? The possibility that the job-seekers have more than one offer in hand $\Rightarrow$ more competition between firms. See Albrecht, Gautier and Vroman (2006), Gautier and Wolthoff (2009) and, for a synthesis, Wolthoff (2014).

3. Extensions out of a steady state exist. See e.g. Shi (2009), Menzio and Shi (2010) and Moscarini and Postel-Vinay (2013).

Exercise

1. Show that in equilibrium $G(w)$ statistically dominates $H(w)$ (distribution G dominates distribution H stochastically (at first order) if, for any argument w, $H(w) \geq G(w)$). Interpret !
Hint: Look at the two extremes of the support. Then consider a wage inside the support, and compute $H(w) - G(w)$.
2. Take $r \to 0$, $\lambda_e = \lambda_u$, and look at the impact of a small increase in z.
(a) Show that the support of the equilibrium wage distribution shifts upwards and shrinks (so that the extent of wage inequalities is smaller).
(b) What is the effect on $H(w)$ and $G(w)$ within the support? (Interpret!)

Empirical Analyses

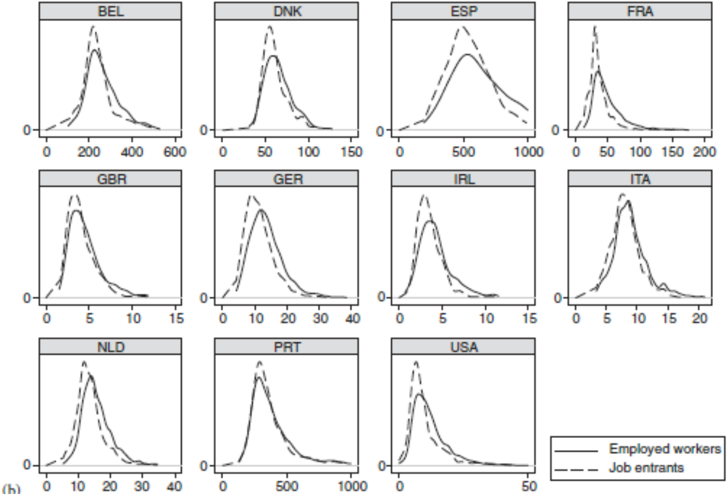
1. Estimating the equilibrium search model

Application of a "structural approach":
Meaning: The econometrician's task consists in estimating the **structural** parameters (e.g. λ_u, λ_e, q) by bringing the predictions of the model to the data.

$\Diamond$ To what extent does the equilibrium search model with wage posting provide a good fit of the ***cross-sectional*** distribution of wages?

- The equilibrium *density function* of wages paid in steady state (11) is increasing and convex in the wage.

  This is at odds with observed distributions of wages (▸ DENSITIES).
- Introducing heterogeneities in y helps to reconcile the properties of the model with the data (Bontemps, Robin and van den Berg, 2000).



Net hourly wage (wages in local currency) in 1994 - 1997. Source: Jolivet, Postel-Vinay and Robin (2006) BACK

- *However, "wage posting fails to describe the empirical relationship between wages and productivity because the relative mildness of between-employer competition toward the top of the productivity distribution inherent to wage posting models implies that those models require implausibly long right tails for productivity distributions in order to match the long right tails of wage distributions." (Bagger, Fontaine, Postel-Vinay and Robin, 2014, p. 1552)*

  Hence, other wage formation mechanisms where firms can counter outside offers do a better job: Postel-Vinay and Robin (2002), Cahuc, Postel-Vinay and Robin (2006).
  But, when and for what types of workers are counteroffers widespread?

◊ A growing equilibrium search literature studies individual wage ***dynamics***: See e.g. Burdett *et al* (2011), Postel-Vinay and Turon (2010), Bagger *et al* (2014).

Estimation of the "index of search frictions"

"Index of search frictions" $k_e = \lambda_e / q$:

Over a given (short) length d of the employment spell, the expected number of offers equals $\lambda_e \cdot d$.

Then, the unconditional expectation of the number of offers equals $\lambda_e \cdot E[d] = \lambda_e / q$ in a simple setting where jobs end only because of a layoff (at constant rate q).

If $\lambda_e / q \to +\infty$, degenerate distribution (competitive case).

Estimations by Ridder and van den Berg (2003), Table 3: λ_e / q from ≈ 5 (France) to ≈ 20 (U.S.).

Estimations by Christensen, Lentz, Mortensen, Neumann and Werwatz (2005), Table 2: $\lambda_e / q \approx 2$ for Denmark.

Estimation of the "index of search frictions"

To improve the fit of the model more recent work extends the model by

- Considering heterogeneous workers and firms
- Endogeneizing search effort and recruiting efforts
- Introducing more complex labor contracts

Then, λ_e/q can be quite different according to the occupation.
For France, variation between 1 and 6.4 according to the sector and the occupation in Table III of Cahuc, Postel-Vinay and Robin (2006).

2. Sensitivity of quits and recruits to the wage?

A simple discrete-time setting with homogeneous workers:

- L_t measures the number of workers employed at time t;
- $q(w_t)$ measures the quit rate of this firm (by assumption a function of the wage paid at t);
- $R(w_t)$ measures the number of workers recruited (by assumption a function of the wage paid at t).

The law of motion of L is:

$$L_t = [1 - q(w_t)]L_{t-1} + R(w_t) \tag{14}$$

Hence in a steady state,

$$L(w) = R(w)/q(w) \tag{15}$$

From (14) (resp., (15)), short- (resp., long-)run elasticity of L w.r.t. w (see e.g. Manning, 2003, p. 32).

Various papers have tried to estimate the firm-level elasticity of the separation rate with respect to the wage. Why? Recall:

> *"In a perfectly competitive market, (...) Any firm, by raising wages ever so little, could get extra help it wanted. If, on the other hand, it cut the wage ever so little, it would find no labor to hire at all in a perfect competitive labor market."*
> *(Samuelson, 1958, p. 559)*

Significant event: A special issue of the *Journal of Labor Economics* (top-field journal) of April 2010 was devoted to such estimations. Ashenfelter, Farber and Ransom (2010) summarize the papers of this special issue by writing:

> *"These estimates are all quite small[3], suggesting significant levels of market power for employers (...) One obvious criticism (...) is the potential for omitted variables in the separations' regressions." p. 207*

[3] Order of magnitude: 1.5,...,4.

> *"The key challenge in quantifying monopsony power is estimating the extent to which separations and recruitment vary when a firm pays a higher versus a lower wage to all its workers, something we refer to as a "wage policy". However, individual worker's wages vary for many reasons that go beyond a firm's wage policy." (Bassier, Dube and Naidu, 2021, p.2)*

In this paper, they first try to isolate "the firm component of pay" based on employer-employee matched data from Oregon over the period 2000-2017.
Next they measure "how separations respond for otherwise similar workers who happen to start new jobs at firms paying different wages".

Conclusion: "These results imply labor supply elasticities of around 3 and 4, respectively. Importantly, use of the firm component of wages increases the labor supply elasticity estimates by a factor of 2.5 to 4 as compared to the standard approach using individual wages." (idem, p. 4)

3.The Impact of Minimum Wages on Employment

Enforced binding minimum wages

- Should reduce employment under pure competition[4];
- Could increase or decrease employment in monopsonistic markets. See file Monopsony.pdf

For whom can minimum wages be binding?
= Important preliminary question.
The most affected workers are presumably (young) low-skilled workers (maybe in specific sectors).

Which outcomes are considered by the empirical literature?
Often levels of stocks (employment (rates)) or changes in stocks; sometimes labor flows (separations and access).

[4] Caveat: If an informal labor market exists, this assertion needs to be qualified.

Protracted controversy:

> *"The debate regarding the U.S. evidence is often characterized as being about whether the elasticity for low-skilled groups is equal to (or more precisely indistinguishable from) zero, or more likely in the range of* -0.1 *to* -0.2*. (...) The largest body of non-U.S. evidence is for the United Kingdom, and the U.K. evidence is mixed." (Neumark, 2019, p. 296, 298)*

Those who conclude "zero (or positive) employment effects" mention monopsony models as an explanation (Card and Krueger, 1995).
A single paper establishes this link:

> *"We find that more concentrated labor markets – where wages are more likely to be below marginal productivity – experience significantly more positive employment effects from the minimum wage" (Azar, Huet-Vaughn, Marinescu, Taska and von Wachter, 2019)*

Identification

Some studies use structurally estimated equilibrium search models to quantify the impact of minimum wages (e.g. Flinn, 2010).
However the bulk of the literature uses reduced-form approaches.
Henceforth, only the latter is considered.

Basic approach to identify the effect of minimum wage (hikes):
Choose *appropriate* controls to provide a counterfactual of what would have occurred in the absence of a change in the minimum wage.

Fierce debate about what are *appropriate* controls!

When geographical variations are exploited (e.g. States in the US),

- Cross-area minimum wage variation could be correlated with unobserved shocks that also drive the employment level of the population of interest. Leading to an omitted variable bias.
- Is the ‘parallel trend’ assumption violated? Have areas’ employment levels specific trends?

In this context, should controls be close areas (e.g. exploiting a border - discontinuity design)?

- Yes for e.g. Card and Krueger (1995) or Dube, Lester and Reich (2016). Reason: Similar unobserved shocks are plausible.
- “If the regions are so damn similar, why do they have different minimum wages?” (Jeffrey Clemens cited by Neumark, 2019).
- What about workers and firms geographical mobility?

Whatever this choice, a standard specification is the so-called two-way fixed effect model:

> *“A continuous difference-in-differences (DD) estimator that compares changes in low-skilled employment in States where the minimum wage increased more to States where it increased less (or not at all).” (Neumark, 2019, p. 300)*

No “untreated” control group. Identification achieved by exploiting the differential timing of the minimum wage changes.

Two-way fixed effect model

Four specifications used by Allegretto, Dube and Reich (2011)

Specification 1

$$E_{ist} = \beta\,\mathrm{MW}_{st} + X_{ist}\gamma + \lambda\,UR_{st} + D_s\theta + D_t\rho + \varepsilon_{ist} \quad \text{where,}$$

- $E_{ist} = 1$ if teen i (aged 16-19) in state s is working in quarter t (otherwise 0); Years covered: 1990, ... 2009. CPS data (US).
- MW_{st} is the ln of the maximum of the federal and the state minimum wages.
- UR_{st} is the state-specific unemployment rate.
- D_s (respectively, D_t) are vectors of state- (respectively time-) dummies.
- X_{ist} a vector of controls including two gender categories, four ethnicity categories, twelve education categories, and marital status categories.
- ε_{ist} iid unobserved heterogeneity.
- β, λ are scalars; γ, θ, ρ are vectors.

Other specifications

Specification 2

Census divisions are groups of states in the US.
The evolution of teens employment appears to be heterogeneous across census divisions. Not captured simply by controls in Spec. 1.
So, in the first specification, $D_t\rho$ is here replaced by division-specific time fixed effects.

Specification 3

To Specification 1, linear state-specific time trends are added.

Specification 4

Includes both the division-specific effects and the state-specific time trends.

Compared to the 1^{st} one, Specifications 2 to 4 narrow the source of identification: E.g., in the 3^{rd} case, by looking at deviations around state-specific (linear) time trends.

Estimated effect of Minimum wage

All teens. Source: Allegretto, Dube and Reich (2011)

Employment:

Specification	(1)	(2)	(3)	(4)
$\hat{\beta}$	-0.047**	-0.015	-0.014	0.019
standard error	(0.022)	(0.034)	(0.027)	(0.024)
Elasticity	-0.118**	-0.036	-0.034	0.047

ln of usual hours worked:

Specification	(1)	(2)	(3)	(4)
$\hat{\beta}$ (elasticity)	-0.074**	-0.054	-0.001	-0.032
standard error	(0.035)	(0.048)	(0.040)	(0.042)

Note: Significance level: ** 5 percent.

Results hotly debated: Neumark, Ian Salas and Washer (2014) vs Allegretto, Dube, Reich and Zipperer (2017),...

Appendix

A precursor: Equilibrium search unemployment under *perfect* competition (Lucas and Prescott, 1974).
Main question : "Why is it that workers *choose* (under some conditions) to be unemployed rather than to take employment at lower wage rates?" (p. 188). Basic assumptions:

- The labor market is segmented in a large number of islands.
- On each island there is a competitive firm subject to idiosyncratic productivity shocks.
- Wages are set competitively to clear the market on each island.
- At the beginning of each period, productivity and the number of workers are revealed on each island.
- A worker who leaves an island to go to another one gets no wage and spends one period unemployed. There is free mobility between islands. No on-the-job search.

This setting is still influential; see e.g. by Alvarez and Shimer (2011). Chap. 28 of Ljungqvist and Sargent (2012) provides an introduction.

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