Should We Allow Non-Competes?

Nico Fernandez-Arias

Macro Workshop, Dec 14, 2017

Motivation

- A non-compete is a clause in an employment contract preventing the employee from working for a competitor until usually 1-2 years after employment ends
- Most states in US enforce (at least for knowledge / tech workers and/or "key employees")
- Prevalent among innovative workers
  - 70% of senior executives (Garmaise 2011)
  - Nearly 50% of engineers (Marx 2011)

Motivation - Policy issue

- Economic literature has tentatively endorsed the view that Silicon Valley, CA displaced Rt. 128, MA as high-tech hub due to non-enforcement (Saxenian 1994, Gilson 1999, etc.)
- Policymakers converging to belief that not enforcing is key to creating high-tech hub
  - 2015 - Hawaii passes law precluding enforcement of non-competes for "technology workers"
  - Several states considering weakening enforcement explicitly in an effort to imitate California map
  - Oct 2016: Obama administration report, "call to action" to state legislatures to reduce enforcement of non-competes
    - ★ Mostly about requiring informing about non-compete requirement and banning non-competes for low-wage workers (e.g. cafeteria workers)

Motivation - Tradeoffs

- Non-competes...
  - Protect intellectual property (Sometimes can't patent, non-disclosure agreements hard to enforce)
  - Prevent knowledge diffusion (reduce production possibilities of the economy)
  - Increase employer incentive to invest in worker human capital
  - Reduce employee incentive to invest in own human capital
  - Reduce worker bargaining power
  - Prevent workers hopping jobs until find a good match
  - Harm reallocation after layoffs
  - May lead to more market concentration
- But...freedom of contract inefficient?
  - No welfare theorems here..so there may be externalities
  - Burden of proof still on those who say freedom of contract is inefficient...
  - In particular since many criticisms **hurt parties to the contract** (key difference to patents)

Existing empirical work

- In non-enforcing regimes:
  - Employment / payroll / business formation grows more in response to exogenous increases in the supply of VC funding (Samila-Sorenson 2011)
  - More workforce mobility (Fallick et al. 2006, Garmaise 2011, Marx et. al 2009)
  - Less market concentration (Kang-Fleming 2017)
  - Employees have better lifetime wage profiles (Chang et al. 2017)
- Knowledge spillovers contribute 20% of productivity growth in IT sector (Tambe-Hitt 2014)

Existing empirical work (cont.)

- Existing work cannot identify aggregate effect if non-enforcing states crowd out enforcing states
  - Analogous to inability to identify aggregate effect of shocks in Autor-Dorn-Hanson 2013 and similar papers
- Direct evidence of crowding out: brain drain from enforcing to non-enforcing (Marx 2015)

Existing theoretical work

- Some work exists...
  - Franco-Filson 2006
  - Shankar-Ghosh 2013
- But shortcomings...
  - No creative destruction $\rightarrow$ misleading Pareto efficiency results
  - No long-run growth (2- or 3-period models)

Proposal

- Write a structural model of R&D-driven productivity growth
  - E.g., high-tech industry like biotech, computer hardware, artificial intelligence, etc.
  - Endogenous knowledge spillovers from employees spinning out firms (which compete in R&D race)
  - Creative destruction
  - Enforcing & non-enforcing regions
- Calibrate to micro data / existing empirical work (e.g. cross-sectional results, brain drain)
  - LEHD probably won't work
  - "New" data: Crunchbase
  - Maybe replace LEHD withu LinkedIn data, but not very optimistic - hard to scrape (could ask, but doubt I will get access)
- Use model to assess effect of non-competes on productivity growth and welfare

Data

- Crunchbase (have obtained)
  - Employer-employee matched data
  - Coverage: mostly startups
  - Worldwide, but US coverage better
  - Information on founders and some C-level employees and board members, funding rounds
- LinkedIn possibly
  - Previous occupation of firm founders
- LEHD (US Census)
  - Plan was to use these data to (1) improve observation of process of employees starting / joining competing startups / firms, and (2) get wage distributions to match
  - California and Massachusetts never approve
  - In addition, would need significant funding ($25,000) to merge datasets by employee name

Model: Workers

- Unit mass continuum of risk-neutral individuals indexed by $i \in I = [0, 1]$, with objective

$$U = \int_0^\infty \exp(-\rho t) c(t) dt$$

  where $c(t)$ is final goods consumption at t.
- Individuals can supply labor to final goods production (l^F), intermediate good production (l^I) and R&D (l^{RD}) such that

$$l_t^F + l_t^I + l_t^{RD} = 1$$

- Aggregate labor market satisfies (where $L_t^k = \int_I l_t^k(i) di$)

$$L_t^F + L_t^I + L_t^{RD} = 1$$

Model: Intermediate goods production

- Continuum of intermediate goods, indexed by $j \in J = [0, 1]$
- Denote quality of good j by q_j, amount produced by k_j
- Each good produced with technology

$$k_j = \overline{q} l_j$$

where $\overline{q} = \int_0^1 q_j dj$ is the average quality level of the economy

- Alternative setup

$$k_j = q_j l_j$$

requires slightly modified final goods production function

Model: Final good production

- Final good is produced using labor and a continuum of intermediate goods $j \in [0, 1]$ with production technology

$$Y(t) = (1-\beta)^{-1} L(t)^{\beta} \left(\left(\int_0^1 q_j(t)^{\beta} k_j^{1-\beta}(t) dj \right)^{1/(1-\beta)} \right)^{1-\beta}$$

$$= (1-\beta)^{-1} L(t)^{\beta} \int_0^1 q_j(t)^{\beta} k_j^{1-\beta}(t) dj$$

  where q_j is quality, k_j is quantity

- Restricts labor share to be related to markup $\mu = 1/(1-\beta)$ but necessary for BGP
- There may be a way to relax this using Oberfield et. al "Balanced Growth Despite Uzawa"

Model: R&D overview

- R&D improves quality of intermediate goods, generates long-run growth
- Incumbent has monopoly on good j production
- Incumbent initially has monopoly on good j R&D
- R&D "spills" knowledge to R&D employees who become entrants after non-competes expire
- Incumbent and entrants perform R&D to improve quality to $(1+\lambda)q_j$
- Upon discovery, become incumbent with monopoly

Model: R&D technology

- z units of labor yields innovations at Poisson rate

$$R_I(z_I; \overline{z}) = \chi_I z_I \phi(\overline{z})$$
$$R_E(z_E; \overline{z}) = \chi_E z_E \phi(\overline{z})$$

  where

$$\overline{z} = \int_0^m z(\ell) d\ell + z_I$$

  is total innovation effort on j, with (endogenous) mass m of entrants indexed by ℓ.
- $\phi(z)$ decreasing, $z\phi(z)$ increasing
- Entrant ℓ can hire $z \leq \xi$ units of R&D labor (in equilibrium $z(\ell) = \xi$)

Model: R&D spillovers

- Individual supplying R&D labor to an intermediate goods firm (or entrant) acquires the knowledge required to enter the race at rate ν per unit of labor
- At Poisson rate v, these workers transition out of competition-restricted status ("Perpetual youth": tractability)
- n_j is mass of workers with knowledge who are still bound by non-competes; m_j is those whose non-competes expired
- Laws of motion

$$\dot{n}_j = \nu l_j^{RD} - v n_j$$
$$\dot{m}_j = v n_j$$

- Note that (q_j, m_j, n_j) is the state of product j

Model: R&D spillovers

Participant in the R&D race for good j begins with monopoly on good j R&D

↓

Hires R&D labor; at rate ν per unit of R&D labor hired, an employee acquires knowledge to open rival R&D lab (but not to compete directly on product market).

↓

This worker becomes part of mass n_j and leaves the lab (replaced by someone who wants the knowledge)

↓

At rate v, agents' non-competes expire, adding to the mass m_j

↓

At some point, either incumbent or entrant wins patent race, restarting the process

Final goods production

$$Y(t) = (1-\beta)^{-1} L(t)^{\beta} \left(\left(\int_0^1 q_j(t)^{\beta} k_j^{1-\beta}(t) dj \right)^{1/(1-\beta)} \right)^{1-\beta}$$

- CRS implies no profits
- CES implies constant markups $\mu = (1-\beta)^{-1}$ in equilibrium
- Closed form solution for final goods wage $\overline{w}_t = \beta^{\beta}(1-\beta)^{1-2\beta}\overline{q}_t$

Worker optimization

- Workers indifferent between occupations (Final goods, intermediate goods, R&D)
- Final goods wage pinned down by $\overline{q}_t$ at $\overline{w}_t = \beta^\beta (1-\beta)^{1-2\beta} \overline{q}_t$
- Intermediate goods wage $w_t^I = \overline{w}_t$
- R&D wage at product j depends on state of the product, which is (q, m, n)
- Indifference condition

$$w_t(q, m, n) + \nu W_t^{NC}(q, m, n) = \overline{w}_t$$

  where $W_t^{NC}(q, m, n)$ is the value of the knowledge (bound by a non-compete)

- Since $w_t(q, m, n) < \overline{w}_t$, workers will switch to a different R&D employer once they attain knowledge (workers are infinitesimal so this goes on forever)

Worker optimization timeline

Allocates labor to R&D and final and intermediate good production

↓

While performing R&D for good j hit by knowledge shock with intensity ν per unit of R&D labor supplied to j

↓

No longer works for good j until next step on ladder (because already has knowledge)

↓

When hit by non-compete expiry shock, and provided $m < M(q)$ threshold mass of entrants, hires ξ units of R&D labor and enters R&D race (continue to work throughout – no worker / entrepreneurship choice)

Intermediate goods firms optimization

- Making the environment stationary: let $\tilde{q}$ denote qe^{-gt} where g is growth rate on BGP
- Value function of **incumbent** $A_t(q, m, n) = e^{gt}A(\tilde{q}, m, n)$
- CES demand structure implies constant markup over marginal cost, flow profit function $\pi(\tilde{q}) = \tilde{\pi}\tilde{q}$ in eq.
- HJB:

$$(\rho - g)A(\tilde{q}, m, n) = \pi(\tilde{q}) - g\tilde{q}A_{\tilde{q}}(\tilde{q}, m, n)$$

$$+ \max_z \Big\{ \chi_I z \phi(z + \overline{z}_E(\tilde{q}, m, n)) \overbrace{\Big(A((1+\lambda)\tilde{q}, 0, 0) - A(\tilde{q}, m, n)\Big)}^{\text{NPV of successful innovation}}$$
$$- w(\tilde{q}, m, n)z + (\nu(z + \overline{z}_E(\tilde{q}, m, n)) - vn)A_n(\tilde{q}, m, n)$$
$$+ vnA_m(\tilde{q}, m, n) - \chi_E \overline{z}_E(\tilde{q}, m, n)\phi(z + \overline{z}_E(\tilde{q}, m, n)) \Big\}$$

- $A_m, A_n < 0$ and $A_{\tilde{q}} > 0$

Intermediate goods firms optimization (cont.)

- Value function of **entrant no longer bound by non-compete** is $W^F(\tilde{q}, m, n)$
- HJB:

$$(\rho - g)W^F(\tilde{q}, m, n) = -g\tilde{q}W^F_{\tilde{q}}(\tilde{q}, m, n)$$

$$+ \max_z \Big\{ \chi_E z \phi(\bar{z}(\tilde{q}, m, n)) \overbrace{\Big(A((1+\lambda)\tilde{q}, 0, 0) - W^F(\tilde{q}, m, n)\Big)}^{\text{NPV of successful innovation}}$$

$$- w(\tilde{q}, m, n)z + (\nu \bar{z}(\tilde{q}, m, n) - vn)W^F_n(\tilde{q}, m, n) + vnW^F_m(\tilde{q}, m, n)$$

$$- (\chi_I z_I(\tilde{q}, m, n) + \chi_E \bar{z}_E(\tilde{q}, m, n)\phi(\bar{z}(\tilde{q}, m, n))W^F(\tilde{q}, m, n) \Big\}$$

- $W^F_m, W^F_n < 0$ and $W^F_{\tilde{q}} > 0$
- Entrants continue to enter until a mass $m = M(\tilde{q})$, defined as the mass of entrants if we assumed (1) free entry and (2) each hires ξ units of R&D labor
- Hence total policy will be $\bar{z}_E(\tilde{q}, m, n) = \xi \min(M(\tilde{q}), m)$

Equilibrium

- An equilibrium consists of: growth rate g, value functions $A(\tilde{q}, m, n), W^F(\tilde{q}, m, n) and W^N C(\tilde{q}, m, n)$, R&D wages $w(\tilde{q}, m,)$, production wage $\overline{w}$, prices and quantities of intermediate goods, research effort policies $z_I(\tilde{q}, m, n)$ and $z_E(\tilde{q}, m, n)$, and production labor allocations L^F and $L^I(j)$ such that:
  - Value functions solve HJBs (with relevant boundary conditions)
  - Research effort policies are optimal
  - R&D wages satisfy indifference condition $w(\tilde{(}q, m, n)) + \nu W^{NC}(\tilde{q}, m, n) = \overline{w}$
  - Final goods firms and intermediate goods firms optimize production, pricing and demand for intermediate goods and labor
  - etc.

Possible extensions or improvements

- Add mechanisms
  - Incentives for worker & firm investment into human capital
  - Reallocation of workers across firms
- Enforcing and non-enforcing regions
  - Test if model can reproduce cross-sectional results (e.g. brain drain)
  - Geography
- When are non-competes used in enforcing regions?
  - E.g., non-competes that harm parties relative to no non-compete shouldn't be signed in equilibrium
  - Assuming all are signed / all are same could exaggerate case against non-competes

Enforcement

back

Figure: Map of enforcement across US states (for technology workers)