Exit vs. Voice

Broccardo et al. (2022), *Journal of Political Economy*

Env Climate discussion group S5

April 16, 2024

Research goals

1. Analyze theoretically whether pressure by stakeholders (“exit” / “voice”) is likely to achieve a socially desirable outcome
    - Exit: investors & consumers (& workers) — divest or boycotts
    - Voice: shareholders — vote or engage with management
2. A model that
    - Internalizes the impact that an exit/voice decision has and assumes that not all investors/consumers are purely selfish
      (*some are socially responsible and derive the consequences for corporate behavior*)

To understand the assumptions

- emitting companies $\neq$ "sinful" products: $\longrightarrow$ less of a moral nature (purely moral view = consider only personal disutility and ignore the impact on others) **In this paper: socially responsible individuals are altruistic** in the sense that they put some weight $\lambda \in [0, 1]$ on the utility of others
- Social responsibility only affects the decision-making process but not the final utility, e.g. wearing a mask in the pandemic. **In this paper: the socially responsible component λ enters at the time a decision is made, but not after the decision is made.**
- How broad is the group of people that an individual feels socially responsible for? **In this paper: the community includes everyone affected by the pollution.**

Basic setup without the pollution problem

Three dates and three groups:

- At t=0: entrepreneurs set up firms
  - with a set-up cost F, which is covered by issuing shares to investors,
  - and investors make up their initial portfolios
- At t=1: firms (entrepreneurs) make production decisions and investors rebalance portfolios
  - with an additional fixed cost C=ε (an aggregate shock with an idiosyncratic component), $\mathrm{E}(C) = 0$, and 0 marginal cost up to a capacity constraint 1
- At t=2: firms (entrepreneurs) produce and consumers consume,
  - with C=$\varepsilon \sim N(0, \sigma^2)$ being realized
  - output is sold in a competitive market and profit is realized
  - some shareholdings end

A competitive free entry equilibrium (1)

(consider a homogenous good and normalize the number of investors and consumers each to be 1; then replicate it r times and take limits $r \to \infty$)

Consumer's utility:

$$U = \underbrace{\rho q - \frac{1}{2}\tau q^2}_{\text{utility derived from consumption}} - \underbrace{pq}_{\text{the cost of buying}},$$

maximization gives the demand curve: $p = \rho - \tau q \Leftrightarrow q = \frac{\rho - p}{\tau}$. (supply before consumption!)

N firms produce up to its capacity constraint 1 each because $p > 0 = \mathrm{E}(C) + MC$.
$\Longrightarrow N = \frac{\rho - p}{\tau}$; each firm makes $\Pi = p - \varepsilon = \rho - \tau N - \varepsilon$ (with $\mathrm{E}(\Pi) = \rho - \tau N$ before t=3).
Free-entry: The market value of each firm at t=0 must be F.

Investor's t=0 portfolio decision: an investment level x at t=0 gives a return of $x\Pi - xF$ at t=2.
$CE = x\Pi - xF - \frac{1}{2}\gamma x^2 \sigma^2$. Investor chooses x to maximize its CE: $x = \frac{\Pi - F}{\gamma\sigma^2}$, with the optimal CE $= \frac{1}{2}\frac{(\rho - \tau N - F)^2}{\gamma\sigma^2}$.

($U = -e^{-\gamma\omega}$ and $CE = \mathrm{E}[x\Pi - xF] - \frac{1}{2}\gamma Var[x\Pi - xF]$) (see, e.g. https://max.pm/posts/ce_lottery/)

A competitive free entry equilibrium (2)

Stock market clearing at t=0: $x = \frac{\rho - \tau N - F}{\gamma\sigma^2} = N \iff N = \frac{\rho - F}{\gamma\sigma^2 + \tau}$ gives the equilibrium number of firms that entrepreneurs set up at t=0.

(assuming $\rho > F$, and so $N > 0$)

Replica economy:

r investors and r consumers, the equilibrium number of firms will be $Nr = r\frac{\rho - F}{\gamma\sigma^2 + \tau}$.
Each of the r investors holds $\frac{1}{r}$ of each of the Nr firms (i.e. full diversification).

Replication simply makes the economy more competitive. (With large r, approximately perfectly competitive; with $r = \infty$, perfectly competitive)

Pollution problem at t=1

Introducing the technologies:

The existing technology is **dirty**.
Each firm produces harm $h > 0$ to the environment at t=2, unaffected by the replication.
The harm spreads and so the harm experienced from one firm by an individual converges to zero as $r \to \infty$.

Paying additional cost $\delta < F$ (so installing the clean technology $\succ$ closing down) to avoid polluting makes a firm **clean**.
A clean firm has a cost of $C^C = \delta + \varepsilon$ versus a dirty firm with $C^D = \varepsilon$.

Purely selfish individuals = nothing changes significantly (intuition: as the pollution impact is trivial for each individual as $r \to \infty$, nobody internalizes the pollution externalities.)

Benchmark: benevolent Planner's solution

This world:

- all individuals are purely selfish
- a benevolent planner dictates what technology (clean or dirty) each firm should adopt at t=1, by **choosing the proportion of clean firms** $\phi = n_c/N$ at t=1 (the only instrument).

Sketch of the solution:

- t=2 independent of the choice ϕ
- to ensure both kinds of firms are held by investors at t=1: $\Pi - V_d = \Pi - V_c - \delta$
- investor's return at t=2:

$$\underbrace{x(\Pi - V_d)}_{\text{net return from the position updated at t=1}} + \underbrace{x_0[\phi V_c + (1-\phi)V_d] - x_0 F}_{\text{market value rise from t=0 to t=1}},$$

- calculate CE of this return and decide $x = \frac{\Pi - V_d}{\gamma\sigma^2}$; stock market clears at t=1: $x = N \Longleftrightarrow V_d = F$
- the planner solves $\max_{\phi\in[0,1]} CE(\phi|\Pi,\gamma,\delta,\sigma) - (1-\phi)Nh$. $\phi = 0$ or $\phi = 1$ depends on if $\delta > h$ or $\delta < h$.

Shareholders' Voting

Assumptions:

- environmental proposals are exogenously put up for a proxy vote
- only voice (no exit at the same time, no boycotts)
- AT t=1: clean firms $\# = \nu N$ and dirty firms $\# = (1-\nu)N$
- A vote takes place on whether one of the dirty firms should become clean (each shareholder votes as if she were pivotal)

Close to the benchmark case of the benevolent Planner's problem!

Equilibrium

Sketch of the solution:

1. t=1: stock market equilibrium: $V_c = F - \delta$ and $V_d = F$ (no divestment at the same time)
2. CE of a fully diversified investor (similar to benevolent solution CE)

$$CE = \frac{(\Pi - F)^2}{2\gamma\sigma^2} - \underbrace{v\delta\frac{\Pi - F}{\gamma\sigma^2}}_{\text{capital loss caused by a fraction } v \text{ of firms becoming clean}}$$

3. marginal CE change due to one more firm becoming clean $= \frac{\partial CE}{\partial v}\Delta v$, goes to zero as $r \to \infty$, given $\Delta v = \frac{1}{Nr}$ [thanks to the full diversification assumption!]
4. the impact on the environment: $h\frac{\partial r n_c}{\partial v}\Delta v = hrN\Delta v = h$
5. the impact on other investors' wealth: $\frac{\partial[(r-1)CE]}{\partial v}\Delta v = -\frac{r-1}{Nv}\delta\frac{\Pi - F}{\gamma\sigma^2} = -(1-\frac{1}{r})\delta$
6. To weigh between the personal capital loss and benefit to the world: if to vote clean, $-\frac{1}{r}\delta + \lambda[h - (1-\frac{1}{r})\delta] > 0$ ($\Longrightarrow h > \delta$ when $\lambda > 0$)

The propositions say: **if the majority of investors are socially responsible, then majority rule will deliver a socially optimal outcome** (just like what the planner would do)

Other voice options

- **Vote by significant shareholder**
  Intuition: weigh the net social benefit of a vote for clean against the reduced return on her portfolio (now multiplied by her stake) $\longrightarrow$ more likely to vote dirty when it is socially inefficient
- **Engage through an intermediary**
  expensive proposal + mutual fund using engagement as a marketing strategy = question: whether atomistic socially responsible investors are willing to put their money in the Green Fund?
  Intuition: relax the information burden
  Model: if a fraction v of investors' wealth is placed with the fund, a fraction v of firms will adopt the clean technology.
  Conclusion: All socially responsible investors will invest in the Green Fund if $h > \delta$.
- **Takeovers** ("amoral drift", mitigated by development in legal decisions in e.g. US)
  Suppose that engagement leads a company to choose clean ($V_c = F - \delta$).
  A bidder makes an unconditional tender offer for the company at a price p such that $V_c < p < V_d < F$.
  If more than 50% of the shares are tendered, he plans to freeze out non-tendering shareholders at price p' such that $V_c < p' < p$.
  $\longrightarrow$ Even a socially responsible investor will tender.

Exit 1: divesting

The economy is in the limit $r = \infty$ while considering $r \to \infty$ for analyzing the individual decisions.

Changes:

- social responsibility: $\lambda \in [0, 1]$ on the welfare of those affected, and the distribution of λ has a finite support $[\lambda_1, ..., \lambda_n]$ (in ascending order) with probabilities $\pi_1, ..., \pi_n$.
- a fraction μ of investors announce divestment from dirty firms completely at t=1 (assuming visible announcement and ability to commit)
- firms (value-maximizing managers) observe announcements and decide if to stay dirty or become clean at t=1
- no consumer boycott yet

To characterize a Nash equilibrium:

- derive the product market and capital market equilibrium under the assumption that a fraction μ of investors divest
- check that a fraction μ of investors do indeed want to divest

Equilibrium (1)

Sketch of the solution:

1. t=2 independent of μ because each firm will supply at its capacity constraint of 1
2. at t=1 value-maximizing means that clean and dirty firms have the same value V
3. Divestors choose $x = \frac{\Pi - \delta - V}{\gamma\sigma^2}$ (only have shares in clean firms) and a mass μ demand μx of clean firms, whereas The rest of the market will not invest in clean firms because $\Pi - V > \Pi - \delta - V$. stock market clears for clean firms $\Longrightarrow \mu x = n_c$
4. Similarly, stock market clears for dirty firms: $(1-\mu)\frac{\Pi - V}{\gamma\sigma^2} = n_d$ and the whole stock market clears: $N = n_c + n_d \Longleftrightarrow \Pi - V - \mu\delta = N\gamma\sigma^2$.
5. From t=0 stock market clearance $\frac{\Pi - F}{\gamma\sigma^2} = N$, we have $V = F - \mu\delta$.
Intuition: divestment leads to a fall in the demand for dirty shares, causing V to fall. But the fall is less than δ because otherwise the demand > supply.
6. number of clean firms: $n_c = \mu N - \frac{\mu\delta(1-\mu)}{\gamma\sigma^2}$: 1) less than proportional to the number of divestors, 2) increasing in $\gamma\sigma^2$, meaning that the impact of divestment is larger if the environment is riskier or investors are more risk averse (from the price fall)

Equilibrium (2)

- Corner solution when $N < \frac{\delta}{\gamma\sigma^2}$, μ=0 or low, or $\gamma\sigma^2$ sufficiently low: equilibrium with no divestor, *because nondivestors will absorb any divested stock with minimal price impact and as a result, no firms will become clean.*
- Interior solution exists if $N > \frac{\delta(1-\mu)}{\gamma\sigma^2}$ (for any $\mu > 0$ if $N > \frac{\delta}{\gamma\sigma^2}$)
  $\longrightarrow$ **now consider this case!**

Next, determine whether an investor wants to divest:

1. compare the CE of a divestor with the CE of a nondivestor:
   By divesting, an investor loses $\frac{\delta}{2\gamma\sigma^2}[2\Pi - 2F - \delta(1-2\mu)]$.
   A low $\gamma\sigma^2$ reduces the impact of divestment but also reduces the cost of divesting!
2. then compare the loss above with the impact of divestment on the environment and on other people's utilities (*in replica economy and then take limits as $r \to \infty$*):
   the internalized damage created by the investor's decision not to divest

$$= \underbrace{\lambda}_{\text{to the extent the investor cares}} \left[\underbrace{N - \frac{\delta(1-2\mu)}{\gamma\delta^2}}_{\text{change in number of clean firms}} \right] h, \quad \text{increasing in } \lambda$$

Quick summary of results for divestment

- definition of a boycott equilibrium (a θ^* such that the previously described conditions hold for each case): can be $\theta^* = 0$, $\theta^* = 1$ or those with $\lambda > (\geq)\lambda^*$.
- main propositions:
  1. A boycott equilibrium exists.
  2. When $\lambda_n h < \delta$, $\theta = 0$ is an equilibrium. When $\lambda_n h < \frac{3}{4}\delta$, $\theta = 0$ is the unique equilibrium.
  3. When $\lambda_n h < \delta$, (a majority of consumers with $\lambda \leq 1/4$) + ($h < 2\delta$) = unique equilibrium of $\theta = 0$
  4. 2 more on the existence of non-zero boycott equilibria: 1) $= \bar{\theta}$ (moral boycotters) when the majority are consequentialist, or 2) large population being very socially responsible (almost willing to personally bear the cost)
  5. conditions s.t. every equilibrium is non-zero divestment equilibrium

Exit 2: Consumer Boycotts

Additional assumptions:

- consumers know the technology behind the good they buy
- a boycott is not anticipated at t=0 when the firm is set up (N is given by $N = \frac{\rho - F}{\gamma\sigma^2 + \tau}$) but it becomes a factor at t=1
- a fraction θ of consumers boycott the dirty product and buy only clean items at a price p_c; the other consumers are either indifferent (if $p_c = p_d$) or buy only dirty items (if $p_d < p_c$, which will be the case)
- n_c clean firms and $n_d = N - n_c$ dirty firms

Equilibrium (1)

Recall the demand curve $q = \frac{\rho - p}{\tau}$.

Output market clears: $\theta(\frac{\rho - p_c}{\tau}) = n_c$, $(1-\theta)\frac{\rho - p_d}{\tau} = n_d$, $\longrightarrow$ $p_c = \frac{\theta\rho - \tau n_c}{\theta}, p_d = \frac{(1-\theta)\rho - \tau n_d}{1-\theta}$

In the interior, at t=1: $\mathrm{E}\Pi_c(= p_c - \delta) = \mathrm{E}\Pi_d(= p_d)$ ($p_d < p_c$, otherwise unstable)

(Clean goods sell for a higher price, and in the case where both dirty and clean firms operate, this higher price offsets the increased cost δ of producing clean goods to the point where the profits and hence market values of clean and dirty firms are the same.)

$$\Longrightarrow \frac{\theta\rho - \tau n_c}{\theta} - \delta = \frac{(1-\theta)\rho - \tau n_d}{1-\theta}$$

Solve for the numbers of firms:

$n_c = \theta N - \frac{\delta\theta(1-\theta)}{\tau}$, $n_d = (1-\theta)N + \frac{\delta\theta(1-\theta)}{\tau}$

(The impact of boycotting is similar to the impact of divesting: boycotters impact the equilibrium level of clean firms less than proportionally)

Equilibrium (2)

- Corner solution when $N < \frac{\delta}{\tau}$, $\theta = 0$ or low (when demand curve has too small a slope): equilibrium with no boycotters, *because nonboycotting consumers will absorb any goods with minimal price impact and as a result, no firms will become clean.*
- Interior solution exists if $N > \frac{\delta}{\tau}$
  $\longrightarrow$ **now consider this case!**

Next, determine whether a consumer wants to boycott:

1. compare the CE of a boycotting consumer with the CE of a non-boycotting consumer: By boycotting, a consumer loses $\frac{1}{2\tau}[(2\rho - p_d - p_c)(p_c - p_d)]$.
   A low $\gamma\sigma^2$ reduces the impact of divestment but also reduces the cost of divesting!
2. then compare the loss above with the impact of divestment on the environment and on other people's utilities (*in replica economy and then take limits as* $r \to \infty$): the internalized damage created by the consumer's decision not to boycott

$$= \underbrace{\lambda}_{\text{to the extent the consumer cares}} \quad \underbrace{h\,\frac{\partial n_c}{\partial \theta}\left(= N - \frac{\delta}{\tau}[1-2\theta]\right)}_{\text{change in number of clean firms}}, \quad \text{increasing in } \lambda$$

Quick summary of results for boycotts

(almost identical to the results of divestment)

- definition of a divestment equilibrium (a μ^* such that the previous described conditions hold for each case): can be $\mu^* = 0$, $\mu^* = 1$ or those with $\lambda > (\geq)\lambda^*$.
- the cutoff λ^* is decreasing in μ; and increasing in $\gamma\sigma^2$ if $\mu > 1/2$
- main propositions:
  1. A divestment equilibrium exists.
  2. When $\lambda_n h < \delta$, $\mu = 0$ is an equilibrium. When $\lambda_n h < \frac{3}{4}\delta$, $\mu = 0$ is the unique equilibrium.
  3. When $\lambda_n h < \delta$, (a majority of investors with $\lambda \leq 1/4$) + $(h < 2\delta)$ = unique equilibrium of $\mu = 0$
  4. 2 more on the existence of non-zero divestment equilibria: 1) $= \bar{\mu}$ (moral investors) when the majority are consequentialist, or 2) large population being very socially responsible (almost willing to personally pay for the cleaner technology)
  5. conditions s.t. every equilibrium is non-zero divestment equilibrium

Other relevant discussions

- **Awareness and social pressure campaigns:**
  exit $>$ voice in 1) informing and changing people's preferences, 2) helping a motivated minority to pressure people into behaving socially, even if their $\lambda = 0$
- **Visibility and commitment:** important issues
- **Social Entrepreneurs:**
  What if some of the entrepreneurs are socially responsible? Anticipate the harm at $t = 1$ and try to influence their firms to act in a socially responsible way?
  (difficult to achieve in the model because of the free-entry assumption)

The end!