"The Political Economics of Green Transitions"

by Besley and Persson (2023)

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Env Reading Group

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Introduction

- **A green transition is a substantial transformation of consumption and production patterns:**
  - Firms gradually switch toward producing goods with green technologies;
  - Households switch toward consuming these alternatives;
- **Traditional Path: implementing a carbon tax. Based on two postulates:**
  1. Transitions go through extrinsic incentives;
  2. Social planner is able to commit to an entire policy path;
- **This paper proposes an alternative route:**
  1. Intrinsic incentives: a green transition as a process whereby the share of those who hold green values endogenously rises over time.
  2. Limited commitment: policies are determined by political forces. Are sequentially chosen policies support a green transition?

Main Insighte

Find a contradiction to static Coase theorem and the political Coase theorem.

1. Without policy, externality cannot be ruled out.
2. agents should agree to implement efficient policies regardless of the distribution of bargaining power among them.

1. Under laissez-fair, the complementatrity between consumers and technology can result in a market-driven green transition.
2. Equilibrium policy may not lead to green transition and enen it does, the speed of the green transition may be too slow.

Model

- A continuum 1 of varieties, $i \in [0,1]$: green ($i \in [0,\gamma]$) and brown ($i \in [\gamma,1]$). $\gamma \leq \overline{\gamma} < 1$, $\overline{\gamma}$ is the green technology frontier.
- Marginal cost of brown goods is χ and that of green goods is $\chi + \varsigma$, $\varsigma > 0$.
- Consumers hold one of two identities: green ($\Gamma = 1$) and brown ($\Gamma = 0$). Share of green consumers μ. Preferences

$$\text{(Green)} \qquad \frac{1}{1-\sigma}\left[\int_0^{\gamma}(1+g)^{\sigma}y(i)^{1-\sigma}di + \int_{\gamma}^{1}(1-g)^{\sigma}Y(i)^{1-\sigma}\right] + x - \lambda\overline{Y} \qquad (1)$$

$$\text{(Brown)} \qquad \frac{1}{1-\sigma}\left[\int_0^{\gamma}y(i)^{1-\sigma}di + \int_{\gamma}^{1}Y(i)^{1-\sigma}\right] + x - \lambda\overline{Y} \qquad (2)$$

- Households' budget constraint is

$$R \geq x + \int_0^{\gamma} p(i)y(i)\mathbf{d}i + \int_{\gamma}^{1} P(i)Y(i)\mathbf{d}i \qquad (3)$$

Timing

1. Shares of green consumers μ and green firms γ are inherited from the previous period.
2. Price-setting, production, and consumption decisions are made;
3. Technology transitions among firms determine γ';
4. Value transitions among consumers determine μ'.

Statics

- Market demands:

$$y(i) = [1 + \mu g] p(i)^{-\frac{1}{\sigma}}, \quad Y(i) = [1 - \mu g] P(i)^{-\frac{1}{\sigma}} \tag{4}$$

The market demand for green (brown) variety goes up (down) in μ.

- Price: constant markup over marginal cost:

$$P = \frac{\chi}{1-\sigma}, \quad p = \frac{\chi + \varsigma}{1-\sigma} \tag{5}$$

- Profits are

$$\pi(i,\mu) = \sigma\kappa(\varsigma)[1 + \mu g] - mi, \quad \Pi(\mu) = \sigma\kappa(0)[1 - \mu g], \quad \kappa(x) = \left(\frac{\chi + x}{1-\sigma}\right)^{\frac{\sigma-1}{\sigma}} \tag{6}$$

Dynamics: Value Transition

- Value transition (the evolution of μ):

$$\frac{\mu' - \mu}{\mu} = \varkappa \Delta' \tag{7}$$

where $\varkappa > 0$ *reflects conditions such as social mixing.*

- Δ is the expected gain from holding green relative to holding brown:

$$\Delta' \equiv \hat{\delta}(\gamma') = \frac{\sigma g}{1-\sigma}[\gamma' \kappa(\varsigma) + (1-\gamma')\kappa(0)] \tag{8}$$

Expected gain of green values goes up linearly in the expected share of green goods.

- Assumption: $\hat{\delta}(\overline{\gamma}) > 0 \Leftrightarrow \overline{\gamma} > \frac{\kappa(0)}{\kappa(\varsigma)+\kappa(0)}$

Dynamics: Technology Transitions

- Firm i uses a green technology next period if

$$\pi(i,\mu^{'}) \geq \Pi(i,\mu^{'}) \Leftrightarrow \sigma \left\{ \mu^{'} g[\kappa(\varsigma)+\kappa(0)] + [\kappa(\varsigma)-\kappa(0)] \right\} \geq mi \tag{9}$$

- Assumption: Brown production exists even if $\mu^{'} = 1$:

$$[(1+g)\kappa(\varsigma) - (1-g)\kappa(0)]\sigma < m\overline{\gamma} \tag{10}$$

- Equilibrium green firm share

$$\hat{\gamma}(\mu^{'}) = \max \left\{ 0, \sigma \frac{(1+\mu^{'} g)\kappa(\varsigma) - (1-\mu^{'} g)\kappa(0)}{m} \right\} \tag{11}$$

The green-firm share rises linearly in $\mu^{'}$.

- If the market for green is too small, no firm goes green:

$$\mu^{'} < \frac{\kappa(0)-\kappa(\varsigma)}{g[\kappa(0)+\kappa(\varsigma)]} \tag{12}$$

Equilibrium

- Equilibrium

$$\Delta' = \hat{\delta}\left(\hat{\gamma}(\mu')\right) \tag{13}$$

$$= \max\left\{-\frac{\sigma g \kappa(0)}{1-\sigma}, \delta_0 + \delta_1 \mu'\right\}, \quad \delta_0 < 0, \delta_1 > 0 \tag{14}$$

- Complementarity: More green consumers → green technology makes more expect profit → more firms go green → holding green values have higher utility relative to holding brown → more consumers decide to go green

Equilibrium

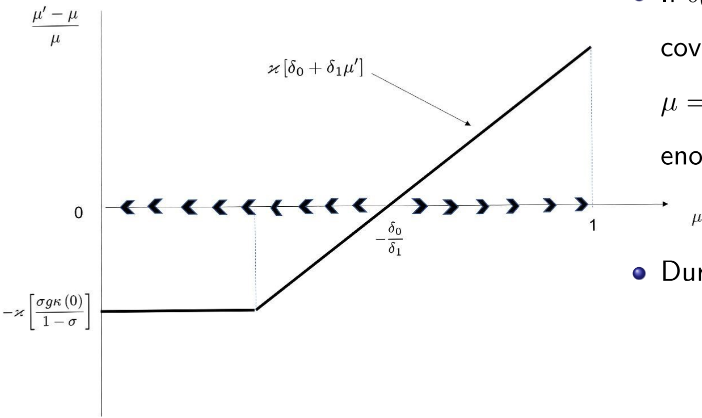

Figure 1: Divergent Dynamics under Laissez-Faire

- If $\delta_0 + \delta_1 > 0$, a laissez-faire economy coverges to a green steady state with $\mu = 1$ iff initial green values are large enough that $\mu \geq -\frac{\delta_0}{\delta_1}$
- During green transition, pollution falls:

$$\overline{Y} = (1-\gamma)(1-\mu g)\kappa(0)^{\frac{1}{1-\sigma}} \qquad (15)$$

Welfare

- Utilitarian welfare:

$$\Omega(\mu) = \hat{\gamma}(\mu)(1+\mu g)w(\varsigma) + (1-\hat{\gamma}(\mu))(1-\mu g)W(\lambda) + I - \frac{\hat{\gamma}(\mu)^2 m}{2} \quad (16)$$

where$w(\varsigma)$ and $W(\lambda)$ are gross "social surpluses" for green and brown good.

- Aggregate welfare is defined as

$$\Omega(\mu_s) + \sum_{j=s+1}^{\infty} \Omega(\mu_j) \quad (17)$$

- If $w(\varsigma) > 0 > W(\lambda)$, then welfare is higher when $\tilde{\mu} > \mu$. The green steady state is welfare superior: when green goods are socially valuable and brown goods are not, it is always move fully toward green production.

Model

- Two-party competition around green and brown taxes $\{t, T\}$ with probabilistic voting. The sole motivation of each party is to win elections.
- Each party D proposes a tax platform for the current period, $\{t^D, T^D\}$. Tax revenue are distributed back to all consumers in equal amount.
- Swing voters: vote for their favorable platform. Loyal voters: vote for one party independent of policy.
- Same proportion of swing voters among green and brown consumers.
- *Swing voters are subject to idiosyncratic and aggregate popularity shocks. The distribution of these shocks are known.*

Timing

Add electoral competition:

1. Shares of green consumers μ and green firms γ are inherited from the previous period;
2. (a) Parties announce electoral platforms $\{t, T\}$ (production taxes); (b) idiosyncratic and aggregate shocks are realized and determine the election outcome;
3. Price-setting, production, and consumption decisions are made;
4. Technology transitions among firms determine γ';
5. Value transitions among consumers determine μ'.

Static Politics

- Taxes increases the marginal cost: $\chi + T$; $\chi + \varsigma + r + t$
- Utilitarian welfare:

$$\Omega(\mu, t, T) = \hat{\gamma}(\mu)(1 + \mu g)w(\varsigma + t) + (1 - \hat{\gamma}(\mu))(1 - \mu g)W(T, \lambda) + I - \frac{\hat{\gamma}(\mu)^2 m}{2} \tag{18}$$

- Since parties cannot make commitment of future policies $\{t^{'}, T^{'}\}$ at period s, they cannot affect the expected payoffs at period $s + 1$.
- Each party maximizes current utilitarian objective function $\Omega(\mu, t, T)$.
- Two party choose the same optimal tax:

$$T = (1 - \sigma)\lambda - \sigma\chi, \qquad t = -\sigma(\chi + \varsigma) \tag{19}$$

Correct the damages from pollution and the distortions from monopoly.

Some Assumptions

- $\chi + \varsigma$ is the social marginal cost of a green good and $\chi + \lambda$ is the social marginal cost of a brown good.
- Assume $\lambda > \varsigma$: social marginal cost is higher for brown goods;
- Denote $k = \kappa(\varsigma + t)$ and $K = \kappa(T)$. Then $k > K$: brown taxes are high enough to make profits higher for green goods than brown goods.

Equilibrium

- Value transition s and technology transitions in the laissez-faire economy continues to apply.
- Equilibrium

$$\Delta^{'} = \hat{\delta}_0 + \hat{\delta}_1 \mu^{'}, \hat{\delta}_1 > 0 \tag{20}$$

- Why are there no $\max$ sign? Because unlike the laissez-faire economy, there is always some green-goods production $\hat{\gamma}(\mu) > 0$
- If $\lambda - \varsigma$ is large enough, $\hat{\delta}_1$ can be positive;
- $\hat{\delta}_0$ and $\hat{\delta}_1$ depend on policy: $k^{'}$ and $K^{'}$.

Equilibrium

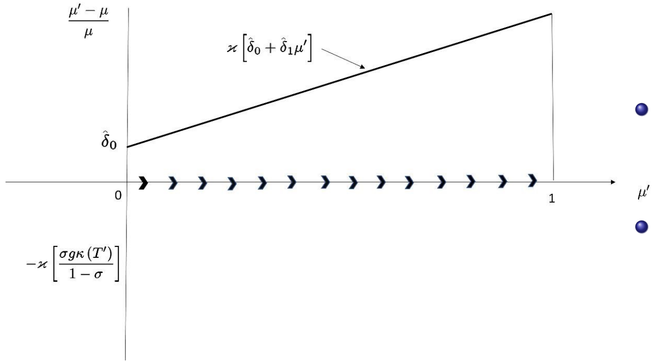

Figure 2: Convergent Dynamics

- If $\hat{\delta}_0 + \hat{\delta}_1 > 0$, converges to a green steady state if $\hat{\delta}_0 > 0$;
- If $\hat{\delta}_0 + \hat{\delta}_1 > 0$ and $\hat{\delta}_0 < 0$, same as laissez-faire.
- Compared to laissez-faire, if the gap between λ and ς is large enough, then policy can ensure a green transition;
- If the gap is not large enough, then the critical share is lower than under laissez-faire.

Role of $\lambda - \varsigma$

- People can rationally expect all future policy.
- If the externality is higher, people expect next period's politician to set higher taxes on brown firms.
- More firms and consumers go green.

Welfare

- Condition 2

$$\frac{(1+\sigma)\sigma}{m}\left[(k^{'})^2-(K^{'})^2\right]-K^{'}>0 \tag{21}$$

Even though $\mu = 0$, the negative effect on their welfare due to a greener economy is offset by the smaller pollution externality. $\rightarrow$ A full green transition is socially desirable.

- If Condition 2 holds, welfare would be higher during a green transition if parties could commit to one-period-ahead tax rates $t^{'} \leq -\sigma(\chi+\varsigma)$ and $T^{'} \geq (1-\sigma)\lambda-\sigma\chi$

Conculsion

- Under laissez-fair, the complemenatrity between consumers and technology can result in a market-driven green transition. But it can also result in a "trap" where welfare would be higher on an alternative path;
- The incentive-compatible policy path generated by politics may not lead to a green transition in cases when this is socially deriable.
- In an economy that has embarked on a green transition, policy makers would like to alter future policies to speed up the transition but cannot do so in the absence of commitment.

References

Besley, T. and Persson, T. (2023). The political economics of green transitions. *The Quarterly Journal of Economics*, 138(3):1863–1906.