Intermediated Trade

Pol Antràs and Arnaud Costinot

Harvard and MIT

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Introduction

- The theory of international trade has paid scant attention to market institutions.
- How supply meets demand is generally not specified in those models.
- In the real world, intermediaries or "market-makers" play a central role in materializing the gains from exchange outlined by standard trade theories (greater separation between demand and supply).
- Public opinion does not exactly view these intermediaries as the unsung heroes of globalization...
- .. but rather portrayed as villains that exploit producers in less developed countries and siphon all gains from trade away from these economies and towards developed countries.
- Oxfam International: "without roads or transport to local markets, without technical backup, credit, or information about prices, the vast majority of farmers are at the mercy of itinerant traders offering a 'take it or leave it' price".

Outline of the Paper

- Develop a stylized but explicit model of market institutions, and to use this model to shed light on the role of intermediaries in:
  - bringing to life the gains from international trade, as well as in
  - affecting the world distribution of these gains.
- Starting point: simple Ricardian model with two geographically separated islands, North and South, and two homogeneous goods, coffee and sugar.
- Each island is populated by a continuum of farmers who must decide, at any point in time, whether to grow coffee or sugar.
- Key new feature: farmers do not have direct access to centralized or Walrasian markets where goods can be costlessly exchanged.
- They need to find traders (who have access to Walrasian markets) but there exist (standard) search frictions.
- The measure of traders active in each island is pinned down by a free entry condition

Main Results

- Model solves for relative prices, intermediation levels and margins charged by traders in each island.
- We use this simple model to contrast the implications of;
    1. changes in the integration of Walrasian markets (shallow integration), which allow traders from different islands to exchange their goods, and
    2. changes in the access to these Walrasian markets (deep integration), which allow farmers to trade with traders from different islands.
- Compared to a standard Ricardian model, we find, among other things, that:
    - intermediation always magnifies the gains from trade under shallow integrations;
    - but may lead to aggregate losses from trade under deep integration
- We also discuss optimal policy in our environment and compare it to some salient fair trade proposals.

Literature Review

- Intermediaries in closed-economy (and mostly partial-equilibrium) models
  - Rubinstein and Wolinsky (1987), Biglaiser (1993), Spulber (1996)
- Search-theoretic approaches to the analysis of labor markets
  - Diamond (1982), Mortensen and Pissarides (2004), Hosios' (1990)
- Burgeoning empirical literature on the role of intermediaries in world trade
  - builds on Rauch (2001), Anderson and Van Wincoop (2004), and Feenstra and Hanson (2004)
  - includes Ahn et al. (2009) and Blum et al. (2009)
- Complementary theories of intermediation in open-economy setups
  - Rauch and Watson (2004), Bardhan et al. (2009) and Chau et al. (2009)

Basic Framework: Farmers

- Consider an island inhabited by a continuum of infinitely lived agents consuming two goods:

$$V = E\left[\int_0^{+\infty} e^{-rt} v\left(C(t), S(t)\right) dt\right].$$

- v is increasing, concave, homogeneous of degree one and satisfies the standard Inada conditions.
- An exogenous measure N_F of the island inhabitants are engaged in production: *farmers*
  - can produce $1/a_C$ of coffee **or** $1/a_S$ of sugar per unit of time;
  - goods are not storable.
- Farmers do not have direct access to a centralized/Walrasian market where their output can be exchanged for that of other farmers.

Basic Framework: Traders

- Farmer needs to find a *trader*, and doing so takes time.
- Traders have access to a frictionless centralized (Walrasian) market in which both goods are exchanged competitively.
  - denote by $p \equiv p_C / p_S$ the relative price of coffee in that market.
- Pool of potential traders on the island is large.
- Active trader must incur an effort cost equal to τ at each date, but stands to obtain some remuneration when intermediating a trade for a farmer.
- Inactive traders are involved in an activity that generates no income but also no disutility of effort.
- The measure N_T of traders is pinned down by free entry.

Basic Framework: Search and Matching

- Farmers and traders can be in two states, matched (M) or unmatched (U).
  - let u_F and u_T denote the mass of unmatched farmers and traders at any point in time.
- Unmatched farmers and traders come together randomly. Number of matches per unit of time is given by a CRS, increasing, concave function $m(u_F, u_T)$ satisfying Inada conditions.
  - $\theta \equiv u_T / u_F$ is a measure of "intermediation" in the market and a sufficient statistic for the matching rates of both agents; $\mu_F(\theta)$, $\mu_T(\theta) = \mu_F(\theta)/\theta$.
- We also assume that existing matches are destroyed at an exogenous Poisson rate $\lambda > 0$.

Basic Framework: Bargaining

- When a farmer and a trader form a match, they negotiate the terms of exchange of the output in the hands of the farmer.
- We posit that generalized Nash bargaining leaves traders with a fraction β of the ex-post gains from trade.
- Symmetric information $\Longrightarrow$ efficient bargaining.
- The Nash bargaining consumption levels of a farmer-trader match with good i solve

$$\max_{C_{F_i}, S_{F_i}, C_{T_i}, S_{T_i}} \left(V_{T_i}^M - V_T^U\right)^{\beta} \left(V_{F_i}^M - V_{F_i}^U\right)^{1-\beta}$$

$$\text{s.t.} \quad pC_{F_i} + S_{F_i} + pC_{T_i} + S_{T_i} \leq (p/a_C) \cdot \mathcal{I}_C + (1/a_S)(1 - \mathcal{I}_C),$$

where $\mathcal{I}_C = 1$ if the farmer carries coffee and $\mathcal{I}_C = 0$, otherwise.

Basic Framework: Timing of Events

- Each date t is divided into three periods.

1. Matched farmers decide which goods to produce.
2. Matched farmers and traders bargain over the exchange of goods.
3. Contemporaneously:
    - Matched traders carry out transactions in the Walrasian market, consumption takes place;
    - New matches are formed among unmatched agents;
    - A fraction of existing matches is dissolved exogenously.

Autarky Equilibrium: Definition

Definition

We define the equilibrium at any point in time of an isolated island of the type described above as:

(i) a relative price, p;
(ii) a measure of traders N_T;
(iii) a share γ of coffee farmers;
(iv) a vector of consumption levels, $(C_{F_i}, S_{F_i}, C_{T_i}, S_{T_i})$ for $i = C, S$;
(v) a level of intermediation θ; and
(vi) measures of unmatched farmers and traders, u_F and u_T,

such that:

(i) agents choose their occupations to maximize their utility;
(ii) consumption levels are determined by Nash bargaining;
(iii) matches are created and destroyed according to Poisson process; and
(iv) the Walrasian market clears.

Autarky Equilibrium: Equilibrium Conditions

- Naturally, $V_{F_C}^M = V_{F_S}^M = V_F^M$ and $V_{T_C}^M = V_{T_S}^M = V_T^M$.
- The value functions must satisfy the following Bellman equations:

$$\begin{aligned} rV_F^U &= \mu_F(\theta)\left[V_F^M - V_F^U\right] + \dot{V}_F^U, \\ rV_F^M &= v(C_F, S_F) + \lambda\left(V_F^U - V_F^M\right) + \dot{V}_F^M, \\ rV_T^U &= -\tau + \mu_T(\theta)\left[V_T^M - V_T^U\right] + \dot{V}_T^U, \\ rV_T^M &= v(C_T, S_T) - \tau + \lambda\left(V_T^U - V_T^M\right) + \dot{V}_T^M. \end{aligned}$$

- Nash bargaining implies that, at any point in time, we must have

$$\begin{aligned} V_T^M - V_T^U &= \beta\left(V_T^M + V_F^M - V_T^U - V_F^U\right); \\ \frac{v_C(C_F, S_F)}{v_S(C_F, S_F)} &= \frac{v_C(C_T, S_T)}{v_S(C_T, S_T)} = p; \\ pC_{F_i} + S_{F_i} + pC_{T_i} + S_{T_i} &= (p/a_C)\cdot\mathcal{I}_C + (1/a_S)(1-\mathcal{I}_C). \end{aligned}$$

Autarky Equilibrium: Equilibrium Conditions (cont.)

- Market clearing in Walrasian markets requires at any point in time:

$$\begin{aligned} \gamma \bar{C}_C + (1-\gamma)\,\bar{C}_S &= \gamma / a_C, \\ \gamma \bar{S}_C + (1-\gamma)\,\bar{S}_S &= (1-\gamma)\,/ a_S, \end{aligned}$$

  where $\bar{C}_i \equiv C_{F_i} + C_{T_i}$ and $\bar{S}_i \equiv S_{F_i} + S_{T_i}$.
- The last set of equilibrium conditions relate to the evolution of the measure of matched and unmatched farmers and traders in the island.
  - Free Entry

$$V_T^U = 0.$$

  - Law of motion for unmatched farmers:

$$\dot{u}_F = \lambda\,(N_F - u_F) - \mu_F\,(\theta)\,u_F.$$

  - Measure of active traders:

$$N_T - u_T = N_F - u_F.$$

Autarky Equilibrium: Characterization

- Only relative price p of coffee consistent with equilibrium is

$$p = a_C / a_S.$$

- Equilibrium values of γ, $\bar{C}$ and $\bar{S}$ are also analogous to standard model.
- Key: search frictions affect the two sectors symmetrically (our focus is not on new sources of comparative advantage).
- Joint instantaneous utility enjoyed by a matched farmer-trader pair is thus given by $v(\bar{C}, \bar{S}) - \tau$ and is time invariant.
    - we can write $v(p) \equiv v(\bar{C}, \bar{S})$.

Autarky Equilibrium: Characterization (cont.)

- We can now move to a discussion of the terms of trade in bilateral exchanges.
- Let $\alpha \in (0, 1)$ the share of $\bar{C}$ and $\bar{S}$ that is captured by the trader (this share must be common for both goods):

$$\alpha = \beta - \frac{(1-\beta)(\theta-1)\tau}{v(p)}. \tag{1}$$

- Note that α is decreasing in the ratio $\theta = u_T / u_F$ and increasing in β.
- The share α is monotonically related to the (percentage) margin charged by traders

$$\frac{p - p^{bid}}{p} = \frac{\alpha [1 + p\psi(p)]}{1 + \alpha p\psi(p)} > 0.$$

Autarky Equilibrium: Characterization (cont.)

- We still need to characterize the dynamics of θ, the value functions, and the measures N_T, u_T, and u_F.
- It turns out that θ and all the V's immediately jump to their steady-state values (only rational expectations equilibrium).
- In particular, the level of θ is (implicitly) given by

$$\frac{v(p)-\tau}{\tau}=\frac{r+\lambda+(1-\beta)\,\mu_F(\theta)}{\beta\mu_T(\theta)}.$$

- Intermediation is higher in economies with higher $v(p)$, lower τ, and higher primitive bargaining power of traders, β.
- The dynamics of u_F are instead globally stable and u_F slowly converges to its SS value.
- Higher SS intermediation translates into a lower u_F and higher N_T.
- It also translates into higher V_F^U, V_F^M, and V_T^M ($V_T^M=\tau/\mu_T(\theta)$ by free entry).

Shallow Integration

- Let us refer to previous island as "South", and suppose it opens up to trade with another island, which we call "North".
- We let the two islands differ in:
  1. Production technologies:
  $$a_C / a_S < a_C^* / a_S^*.$$
  2. Intermediation costs: τ and τ^*.
  3. Primitive bargaining power of their traders: β^* and β.
  4. Size: for the most part we treat South as a small open economy.
- Shallow Integration: farmers are only able to meet traders from their own island, but traders from both islands now have access to a common Walrasian market.

Shallow Integration: Equilibrium Conditions

- The relative price of coffee under shallow integration, p^W, jumps up:

$$p^W = a_C^* / a_S^*.$$

- All Southern farmers will immediately specialize in coffee production, which will raise the indirect utility all matched farmer-trader pairs from $v(p)$ to $v\left(p^W\right) > v(p)$ (standard mechanism in Ricardian model).
- Traders' margins, α^W, and the level of intermediation, θ^W, will immediately jump to their new steady state values given by:

$$\frac{v\left(p^W\right) - \tau}{\tau} = \frac{r + \lambda + (1-\beta)\,\mu_F\left(\theta^W\right)}{\beta\mu_T\left(\theta^W\right)}$$

$$\alpha^W = \beta \cdot \frac{r + \lambda + \mu_T\left(\theta^W\right)}{r + \lambda + (1-\beta)\,\mu_F\left(\theta^W\right) + \beta\mu_T\left(\theta^W\right)}.$$

Effects on Intermediation, Growth, and Distribution

- Because $v\left(p^W\right) > v\left(p\right)$, we have that $\theta^W > \theta$ and shallow integration raises the intermediation level.
- Output will jump on impact, but also along the transition, as the number of matched farmers in the economy increases.
- The magnitude of this "growth effect" depends on the initial level of intermediation as well as the properties of the matching technology.
  - if the matching elasticity $\varepsilon \equiv \frac{d \ln m(u_F, u_T)}{d \ln u_T}$ is non-increasing in the level of intermediation, then *ceteris paribus*, islands with lower levels of intermediation always grow faster after shallow integration (true for all CES matching functions).
- The higher level of intermediation, improves the outside option of farmers and this translates into a reduction of traders' margins.

Welfare Consequences

- All value functions will immediately jump to their new steady-state value after shallow integration.
- Because V_F^U, V_F^M, and V_T^M are increasing in the level of intermediation and $V_T^U = 0$, we can conclude that all agents in the economy are (weakly) better off, and shallow integration generates Pareto gains from trade (same as Ricardian model).
- Social welfare $W(t)$ is equal to

$$W(t) = u_F(t) V_F^U(t) + [N_F - u_F(t)] \left[V_F^M(t) + V_T^M(t) \right],$$

- A fortiori, $W(t)$ goes up with shallow integration. We can express it as:

$$W(t) = \Omega(t) \cdot \frac{v[p(t)]}{r},$$

  where both $\Omega(t)$ and $v[p(t)]$ go up with shallow integration.
- The integration of Walrasian markets thus leads to a "magnified" increase in social welfare relative to standard model.

Deep Integration: Assumptions

- We now allow traders to search for farmers in both islands (though they can only search for farmers in one of these two islands).
  - maintain random matching (metaphor for immobility of farmers)
- In order to better illustrate our results, we assume that shallow integration has already happened ($p^W = a_C^* / a_S^*$ in both countries).
- We now need to impose more structure on the differences in τ and τ^*, which were "immaterial" before.

1. Northern traders have a better intermediation technology ($\tau > \tau^*$).
2. Northern agents tend to have high primitive bargaining power relative to Southern agents ($\bar{\beta} > \beta$).
   - reduced form, but could be microfounded appealing to higher risk aversion, impatience or credit constraints.

- We explicitly allow for endogenous destruction of matches (ignore in presentation).

Deep Integration: Effect on Entry and Intermediation

Lemma

If deep integration occurs at some unexpected date t_0, then with probability one, new matches only involve Northern traders in both islands for all $t > t_0$.

- Because of lower τ^* and higher $\bar{\beta}$, Northern traders are more profitable.
- Note that not all Southern traders are (necessarily) wiped out (existing pairs may efficiently decide to stay together).
- But we must now have

$$\frac{v\left(p^W\right) - \tau^*}{\tau^*} = \frac{r + \lambda + \left(1 - \bar{\beta}\right)\mu_F\left(\theta^N\right)}{\bar{\beta}\mu_T\left(\theta^N\right)}.$$

- Level of intermediation is again higher with deep integration.
  - this again generates growth (and probably output convergence).

Deep Integration: Distributional Consequences

- Effect on α^N is ambiguous:

$$\alpha^N = \bar{\beta} - \frac{(1-\bar{\beta})\left(\theta^N - 1\right)\tau^*}{v\left(p^W\right)}.$$

Higher intermediation level vs. lower bargaining power of farmers.

- Margins of new pairs go down when $\bar{\beta} = \beta$ and $\tau > \tau^*$, but they go up when $\bar{\beta} > \beta$ and $\tau = \tau^*$.
- The effect on α^S is also ambiguous

$$\alpha^S = \beta - \frac{(1-\bar{\beta})\left[\frac{\beta}{\bar{\beta}}\theta^N - 1\right]\tau^*}{v\left(p^W\right)}. \tag{2}$$

- Higher intermediation level increases outside option of farmers, but $\bar{\beta}/\beta$ decreases it (we'll come back to this).
- Ranking of α^N and α^S is equally ambiguous.
    - $\alpha^N > \alpha^S$ when $\bar{\beta} > \beta$ and $\tau = \tau^*$, but $\alpha^N < \alpha^S$ when $\bar{\beta} = \beta$ and $\tau > \tau^*$.

Deep Integration: Welfare Consequences

- Our first result is that deep integration always creates winners and losers.
- Among matched Southern traders and farmers, only effect of deep integration is change in V_F^U, which is of the opposite sign to change in α^S.
- When α^S goes down, matched and unmatched farmers are better off, while matched Southern traders are worse off (and vice versa).
- Now social welfare at time t is

$$\begin{aligned} W(t) &= V_F^U(t)\left[u_F(t) + \left(\frac{\lambda}{r+\lambda}\right)[N_F - u_F(t)]\right] \\ &\quad + [N_F - u_F(t)]\left[\frac{v(p^W) - \tau}{r+\lambda}\right]. \end{aligned}$$

- So key is what does deep integration do to α^S (i.e., V_F^U)?
- In other words, α^S is a sufficient statistic for effect of deep integration on aggregate welfare.

Deep Integration: Welfare Consequences (cont.)

- As mentioned before, effect of deep integration on α^S is ambiguous.
- **Case I:** $\bar{\beta} = \beta$ and $\tau > \tau^*$.
  - Increase in intermediation with no change in primitive bargaining weight $\rightarrow$ unmatched farmers are better off, so V_F^U goes up and α^S goes down.
- **Case II:** $\bar{\beta} > \beta$ and $\tau = \tau^*$
  - Increase in intermediation, but lower bargaining power
  - First force dominates when , $\bar{\beta}$ and β are low relative to $\varepsilon \equiv \frac{d \ln m(u_F, u_T)}{d \ln u_T}$;
  - Second force necessarily dominates when $\bar{\beta} > \beta > \varepsilon$ and aggregate welfare will be lower with deep integration (link to Hosios' 1990).

Deep Integration: Intuition

- The source of these potentially perverse welfare results is *not* rent-shifting between the two islands (world welfare goes down as well). Also, $\alpha^N > \alpha^W$ is consistent with aggregate welfare going up.
- When $\beta \geq \varepsilon$, the equilibrium in the Southern island under shallow integration is **inefficient** because it features a disproportionate entry of traders given the matching frictions.
- Source of inefficiency is **trading externality** underlying the search friction in goods markets.
    - negotiations between a trader and a farmer not only affect their division of surplus, but also affect the entry of traders and thus the probabilities for unmatched farmers and traders of finding a match;
    - but these effects are naturally not internalized.
- When $\bar{\beta} > \beta > \varepsilon$, deep integration aggravates this problem (even though intermediation goes up). Bhagwati's (1971).

Deep Integration: Intuition

- Why would farmers trade with Northern traders when they are made worse off?
- Again, trading externality (random matching) is key.
- Each Southern farmer individually has an incentive to trade with Northern traders. This is true both:
  - *ex ante* (no incentive to commit not to trade with a Northern trader);
  - *ex post* (participation constraint of Southern farmers is always satisfied).

Policy: Price Controls and Taxes

- Can welfare losses be avoided, if so how?
- Suppose that the Southern government is convinced that $\bar{\beta} > \beta > \varepsilon$.
- Then just force Northern traders operating in South to buy coffee from farmers at a relative price no lower than

$$p_f = \frac{1 - \tilde{\alpha}}{1 + \tilde{\alpha} p^W \psi\left(p^W\right)} p^W,$$

  where $\tilde{\alpha}$ and $\tilde{\theta}$ are the efficient values of α and θ.
- This will work, but a few caveats are obvious:
  1. If $\varepsilon > \bar{\beta} > \beta$ you want maximum (not minimum) prices!
  2. The above policy requires discriminating between Northern and Southern traders (otherwise create inefficient separations).
  3. Informationally intensive: ε, $v\left(p^W\right)$, $m(\cdot)$, τ^*,...
- **Alternative I:** track changes in α^S, but again requires discrimination.
- **Alternative II:** just constraint $\alpha^N \leq \alpha^W$ and losses are avoided.
- **Alternative III:** tax entry of traders (achieve discrimination).

Policy: Market Design

- Suppose that the government of the Southern island can create two segmented matching markets.
  - say it can force Southern and Northern traders to search for farmers in the Eastern and the Western part of the island, respectively.
  - and this information can be made common knowledge.
- In such an environment, if farmers could freely locate their farms in either part of the island, should we still expect aggregate losses from deep integration?
- Answer: with mild "subgame perfect" refinement (Acemoglu and Shimer, 1999), "NO"
- Equilibrium will feature the entry of Northern traders only if they *increase* aggregate welfare in the Southern island.
- Results are stylized, but they hint at the beneficial effects of providing farmers with information.

Concluding Remarks

- We have developed a simple model to study the role of intermediaries in world trade.
- We have shown that different types of integration interact with goods market frictions in distinct ways and call for very different policy responses.
- Our model of intermediation in trade is special along several dimensions, but our approach of using dynamic bargaining and matching techniques to model international transactions can be explored and pursued in several fruitful directions.
  1. Allow for multiple layers of intermediation, perhaps by introducing search frictions between local traders and foreign ones.
  2. Introduce ex-ante market power by traders (coalitions).
  3. Introduce risk aversion by farmers (effects on specialization decison).
  4. Model heterogeneity among farmers.