Unpleasant Middlemen

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Abstract

The question of how certain types of market-intermediating middlemen can be held in low regard is addressed. A model in which pure rent-seeking middlemen emerge endogenously is provided. Individuals differ according to their persuasiveness and according to their productivity. Those who are highly persuasive but relatively unproductive are the people most likely to become middlemen. However, only productivity differentials are shown to be essential for the emergence of middlemen.

1 Introduction

Used-car salesmen, real estate agents, ticket scalpers and, closer to home, publishers are all types of middlemen that we love to hate. The aim of this paper is to shed light on why middlemen tend to be held in such low regard. The aim here is to provide a stylized model of a market in which middlemen emerge endogenously and show that it is the most persuasive individuals that actually choose intermediation over production.

Evidence that certain types of middlemen are held in low regard is largely circumstantial but pervasive. When Hubert Humphrey asked "Would you buy a used-car from this man?" he was questioning the integrity of Richard Nixon, not that of used-car dealers.[1] Ollivier [2000] had different groups of people rank occupations and found that real estate agents were consistently placed low in terms of prestige and perceived usefulness to society relative to occupations requiring similar levels of education. Despite retailing a similar product at similar prices, "fair trade" coffee suppliers have been able to acquire a significant portion of the coffee market entirely because it "cuts out the middleman" While the agricultural policy of the European Union is designed to protect the economic viability of farmers, no legislation has been proposed to protect the livelihoods of the middlemen threatened by the growth of the internet. The idea here is that this popular attitude toward middlemen emerges from frequent transactions with them which tend to leave the consumer feeling that the gains from trade were not divided equally.

A variant of Masters [2007], based on the Diamond [1982] 'coconut' model, is developed. Individuals cycle between production and trading which occur

[1] Specific to automobile traders see Marti et al [2000] who also cite a 1999 Gallup survey of professional honesty that placed car dealers at the bottom.

in separate locations. Trading is driven by the unpalatability of one's own output and takes place in an anonymous market. Production is instantaneous but costly. To become a middleman an individual simply has to forego consumption once, and remain in the market (or trading island). Future trading opportunities then involve 2 edible goods. The middleman persuades a trading partner to give up his whole good for part of the one she is holding. She consumes the remainder of the divided good and leaves with the partner's good intact - ready to trade again. In Masters [2007] individuals differ only according to their costs of production. The current paper incorporates an additional source of heterogeneity: that of persuasiveness. As the terms of trade are determined by Nash Bargaining, persuasiveness here is synonymous with bargaining power.

The point is not to provide a specific model of a particular market where intermediation is known to occur. Rather, the point is to see, in the context of a stylized model of a market where middlemen emerge endogenously, who it is that actually chooses intermediation over production. In that sense the analysis is analogous to that of Kihlstrom *et al* [1981]. They show how equilibrium sorting leads more risk-averse agents to hold less of a risky asset in their optimal portfolios.

The analysis shows that it is the most persuasive and the least productive individuals who become middlemen. Perhaps less obvious is that heterogeneity in persuasiveness alone is not sufficient to support the existence of middlemen. The reason is that no matter how persuasive an individual is, the fact that trade is voluntary means that she cannot make her trading partner worse off than if there were no trade. At a minimum therefore, the middleman has to offer the producer enough to cover the production cost associated with replacing the item traded. Beyond that, any gains from trade are negotiable. What this means is that middlemen effectively do pay production costs. Middlemen simply take advantage of the existence of people in the market who have lower production costs than themselves. Given that middlemen emerge at all, however, this paper provides a context in which it is the most persuasive that are the first to do so.

Equilibria with middlemen are inefficient in the sense that the allocation under a ban on middlemen (with appropriate lump-sum transfers) Pareto dominates the equilibrium allocation. The reason for this is that middlemen simply clog up the market. When individuals choose that profession, they do not take account of the effect of their choice on other market participants. Heterogeneity in persuasiveness introduces an *if-you-cannot-beat-them-join-them* effect. If the set of individuals who are currently middlemen are more persuasive than you are, the returns to being a middleman are higher than when the existing middlemen are equally or less persuasive than you are. As it is the more persuasive people that choose to be middlemen first, some people can end up choosing that profession when they would not have otherwise done so.

The literature on the role of middlemen in matching environments with search frictions is summarized in Masters [2007]. The current paper is the first to introduce differential bargaining power. However, of note here is Duffie *et al* [2006] as they motivate trade by introducing shocks to individual discount rates. In the non-cooperative approach to bargaining, discount rate influences bargaining power. This is used to vary the individual gains from trade in particular meetings rather than to determine who becomes a middleman.

2 Model

2.1 Environment

The economy comprises a large number (formally a continuum) of risk neutral individuals who live for ever. The population is normalized to 1. They exist in continuous time and they discount the future at a common rate r.

Following Diamond [1982], to provide a motive for trade, individuals get no utility from the consumption of their own output but get u per unit of anyone else's output consumed. Trade occurs in a decentralized anonymous market characterized by random matching. Any participant meets another with Poisson arrival rate β.[2] Only whole goods can be brought to market and individuals can only carry one good at a time. Goods can, however, be divided for the purpose of consumption but any part of the good not eaten immediately rots.

Production takes no time. A proportion π of the population are highly productive and can produce their good at a cost $c = \underline{c}$ which is normalized to 0. For the rest of the population, $c = \bar{c} \in [0, u)$. To rule out long-term relationships, it is assumed that individuals have to leave the market to produce. Only when they have a good in hand may they re-enter by which point their connection with their previous trading partner is lost.

2.2 Exchange

In any meeting between individuals the outcome is determined according to Generalized Nash bargaining. A thorough treatment of Nash Bargaining is

[2] Technically, either r or β are redundant. Both have been kept in for expositional clarity.

found in Osborne and Rubinstein [1990]. It is well known however that subject to feasibility constraints, individual rationality and Pareto efficiency, the generalized Nash bargaining allocation assigns shares of the match surplus according to relative bargaining powers.

As consumption and production are instantaneous, at every point in time, everyone is in the market. They can, however, be in one of 2 possible states: producer or middleman. A producer is any one holding a good they have produced themselves. A middleman is anyone holding a good produced by someone else. Why someone might want to hold onto an edible good will become clear later, but these possible states mean that in terms of their inventories, only three types of meeting are possible; between two producers, between two middlemen, or between one middleman and one producer.

When 2 middlemen meet there are no gains from trade (i.e. no match surplus) so they ignore each other and look for alternative trading partners. When two producers meet they swap their inventories; any other outcome would be inefficient. When a middleman and a producer meet there are potential gains from trade. The middleman arrives with an edible good and expects to leave with an edible good (the one previously carried by her trading partner). The producer arrives with a good which he gives up. Because exchange is voluntary, the gains from trade have to take into account the cost of restoring his producer's status.[3] The match surplus is therefore $u - c$. Where c is the producer's production cost. Consequently, letting θ represent the bargaining power of the middleman, she gets to consume the

[3] The Nash bargaining outcome is not forced upon participants against their will. Anyone is free to leave his current potential trading partner and look for another. The individual rationality constraint built into Nash bargaining means that the specified outcome is always weakly preferred to taking this "outside option".

share $\theta\,(u-c)\,/u$ of the good she brought to the match. The remaining share,

$$[(1-\theta)(u-c)+c]\,/u \tag{1}$$

is consumed by the producer.[4]

For the purpose of this paper, I introduce heterogeneity among individuals as to their persuasiveness at the bargaining table. In particular, a proportion τ of the population are deemed tough. The remainder, the ineffectual, will be called wimps. Clearly, persuasiveness only matters in meetings between middlemen and producers. When two individuals of the same persuasiveness bargain, the symmetric Nash allocation applies; $\theta=\frac{1}{2}$. When their types differ, the tough negotiator gets a share $\phi\geq\frac{1}{2}$ of the match surplus. So, when the middleman is the tough person, $\theta=\phi$. When the producer is the tough person $\theta=1-\phi$.

In what follows, attention is restricted to independent distributions of attributes so that $\pi\tau$ of the population are tough with high-productivity (Type ht), $\pi(1-\tau)$ are wimps with high-productivity (Type hw), $(1-\pi)\tau$ are tough with low-productivity (Type lt), and $(1-\pi)(1-\tau)$ are wimps with low-productivity (Type lw).

[4] A concern here is that the producer might try to refuse to bargain over the good carried by the middleman alone. He, the producer, might say that both goods should be on the table. It turns out that such considerations lead to exactly the same outcome (see Masters [2007]). This occurs because consumption of both goods involves the middleman having to revert next time around to producer status. Negotiations have to take that adjustment into account.

3 Market Equilibria

I assume that individuals in the model take the bargaining outcomes in every possible scenario as given. They maximize the expected present value of their lives by choosing from state-contingent (Markov) strategies. An individual's state is represented by his choice of profession; producer or middleman. The aggregate state of the economy is the proportion of each type of individual who are middlemen. The equilibria sought will be Markov perfect in pure stationary strategies.

Strategies for each Type ik, $i \in \{h, l\}$, $k \in \{t, w\}$, are a mapping from aggregate states and the individual's state into the set of possible actions. As the bargaining outcomes are taken as given, the set of actions are limited to what an individual does when he acquires a good through trade. The two possibilities are simply consume it or hold on to it.

As there are 4 types of individual in the model, there can only be 5 classes of equilibria. These are:

1. The Diamond Class; where everyone immediately consumes any good acquired in trade. There is one possible equilibrium in this class.

2. Class I; where one type of individuals are middlemen. There are 4 possibilities for equilibria within this class, those associated with each type of individuals being the middlemen.

3. Class II; where two types of individuals are middlemen. There are 6 possibilities for equilibria within this class, those associated with each combination of pairs of individual types being the middlemen.

4. Class III; where three types of individuals are middlemen. There are 4 possibilities for equilibria within this class, those associated with each

type of individual being the producers.

5. Class IV; everyone is a middleman. There is one possible equilibrium in this class.

The following proposition reduces the possible number of equilibria consistent with the preceding taxonomy from 16 to 4.

Proposition 1 *High productivity individuals (i.e. those with* $c = 0$*) will never choose to be middlemen.*

Proof. Let V_{hk}^m, V_{hk}^p, be respectively the value to being a middleman and a producer for a high productivity individual of persuasiveness $k \in \{t, w\}$ when all like types also hold onto edible goods. Then, for a Class I equilibrium in which Type ht are middlemen:

$$rV_{ht}^m = \beta \left[\pi\tau 0 + \tfrac{1}{2}(1-\pi)\tau(u-\bar{c}) + \pi(1-\tau)\phi u + (1-\pi)(1-\tau)\phi(u-\bar{c})\right] \tag{2}$$

This is a standard asset value (Bellman) equation. As in the event of any meeting the individual ends up in the same state she started in, there are no "capital gains" terms. The left hand side is the flow value to being a middleman. In such an equilibrium a middleman (who is of Type ht) meets any other individual at rate β. The probability that the other is also Type ht is $\pi\tau$. In that case there is no trade as both are middlemen. The probability that the other is Type lt is $(1-\pi)\tau$ in which case the surplus, $u-\bar{c}$, is divided equally between them. The probability that the other is Type hw is $\pi(1-\tau)$ in which case the middleman gets a share ϕ of the surplus, u. The probability that the other is Type lw is $(1-\pi)(1-\tau)$ in which case the middleman gets a share ϕ of the surplus, $(u-\bar{c})$.

Individual deviation to production would yield:

$$rV_{ht}^{p} = \beta\left[\tfrac{1}{2}\pi\tau u + (1-\pi)\tau u + \pi(1-\tau)u + (1-\pi)(1-\tau)u\right] \tag{3}$$

In the eventuality of meeting a middleman this individual gets half of the surplus, u. In any other meeting, this individual swaps goods with her trading partner, consumes, produces and re-enters the market.

For the Class I equilibrium in which Type hw are middlemen, by similar logic we have:

$$\begin{aligned} rV_{hw}^{m} &= \beta\left[\pi\tau(1-\phi)u + (1-\pi)\tau(1-\phi)(u-\bar{c})\right. \\ &\quad \left. +\pi(1-\tau)0 + \tfrac{1}{2}(1-\pi)(1-\tau)(u-\bar{c})\right] \end{aligned} \tag{4}$$

Individual deviation to production would yield:

$$rV_{hw}^{p} = \beta\left[\pi\tau u + (1-\pi)\tau u + \tfrac{1}{2}\pi(1-\tau)u + (1-\pi)(1-\tau)u\right] \tag{5}$$

Element by element comparison of (2) with (3) and (4) with (5) shows that high productivity individuals are always better off in production than as middlemen.

Now consider Class II, III or IV equilibria. Whichever type of individual are the middlemen, it is preferable to meet them as a producer than as a middleman. Meeting anyone who is a producer yields the same utilities as calculated above for such encounters. For high productivity individuals, therefore, production is always a profitable deviation from being a middleman. Equilibria in which they are middlemen do not exist in the space of permissible parameter values. ■

When contemplating life as middleman, individuals have to consider whether their production costs are higher or lower than their average trading partner. If their costs are lower, then being a middleman is a bad idea. No matter how persuasive they are, they can only get some share of a good net the producer's production cost. High productivity producers are better off consuming whole goods and producing than being middlemen. This result means that we can rule out Class III and Class IV equilibria completely. Only one of the Class II equilibria remains viable along with 2 of the Class I equilibria and the Diamond equilibrium.

Identification of the regions of the parameter space for which the remaining possible equilibria exist proceeds by considering conditions under which each type of individual would prefer to deviate from the specified behavior given everyone else conforms. The next Proposition helps reduce the extent of the analysis by showing that the boundaries of the parameter regions at which an individual deviates from being a producer (when everyone else of his type are producers) are identical to the boundaries at which that individual would deviate from being a middleman (when everyone else of his type are being middlemen).

Proposition 2 *For individuals of any type the return to being a middleman (versus producing) is not affected by the extent to which the rest of their own type are middlemen.*

Proof. Consider the net utility gain to person 1 from a meeting with person 2. Let their costs of production be c_1 and c_2 respectively. Then, a producer/producer meeting yields $u - c_1$. A producer/middleman meeting yields $\hat{\theta}(u-c_1)$ where $\hat{\theta}$ is the share of any surplus going to person 1 based on their relative persuasiveness. A middleman/producer meeting yields $\hat{\theta}(u-c_2)$ and a middleman/middleman meeting yields 0. For person 1, the difference between being a producer and being a middleman when person 2 is a producer is $(u - c_1) - \hat{\theta}(u - c_2)$. Meanwhile, the difference between being a producer and being a middleman when person 2 is a middleman is $\hat{\theta}(u - c_1)$. If person 2 is the same type as person 1, $c_2 = c_1 = c$ and $\hat{\theta} = \frac{1}{2}$ so the difference between being a producer and being a middleman is $\frac{1}{2}(u - c)$ regardless of person 2's state. ■

Essentially the symmetry associated with meetings between like types of individuals drives this result. Whether or not I am middleman, I am worse off from meetings with other individuals of my own type when they are middlemen compared to when they are producers. However, the difference in the value to being a producer versus being a middleman does not depend on how many of my type are middlemen.

3.1 The "Diamond" equilibrium

In a Diamond equilibrium, everyone cycles continuously through production, trade and consumption where trade involves a one-for-one swap of goods. Let V_{ik}^D represent the value to being a Type $ik \in \{h, l\} \times \{t, w\}$ individual when everyone's behavior is consistent with this equilibrium. Then:

$$\begin{aligned} rV_{ht}^D &= rV_{hw}^D = \beta u \\ rV_{lt}^D &= rV_{lw}^D = \beta(u - \bar{c}). \end{aligned} \tag{6}$$

This equilibrium exists as long as no individuals are better off by holding onto an edible good than they are from eating it, producing and re-entering the market.

Proposition 3 *There exists a critical value $c_t(\phi)$ of the production cost for low productivity individuals such that given ϕ, whenever $\bar{c} \leq c_t(\phi)$ everyone prefers to consume goods acquired in trade. When $\bar{c} = c_t(\phi)$ the tough bargainers are indifferent between being a middleman and being a producer.*

Proof. From Proposition 1, only deviations by low productivity individuals need to be considered. Let V_{lk}^{mD} represent the value to a Type lk, $k \in \{t, w\}$ individual of holding on to a good, produced by someone else when the rest of society behaves as specified by the Diamond equilibrium. The value to being a lifelong middleman for $k = t$ and w are respectively,[5]

$$\begin{aligned} rV_{lt}^{mD} &= \beta\left[\tfrac{1}{2}\pi\tau u + \tfrac{1}{2}(1-\pi)\tau(u-\bar{c}) + \right. \\ &\quad \left. \pi(1-\tau)\phi u + (1-\pi)(1-\tau)\phi(u-\bar{c})\right] \end{aligned} \tag{7}$$

$$\begin{aligned} rV_{lw}^{mD} &= \beta\left[(1-\phi)\pi\tau u + (1-\phi)(1-\pi)\tau(u-\bar{c}) + \right. \\ &\quad \left. \tfrac{1}{2}\pi(1-\tau)u + \tfrac{1}{2}(1-\pi)(1-\tau)(u-\bar{c})\right] \end{aligned} \tag{8}$$

Becoming a middleman is worthwhile if the discounted present value exceeds that of eating the good, producing and re-entering the market. That is, if $V_{lk}^{mD} > u - \bar{c} + V_{lk}^{D}$. As, from (7), $V_{lt}^{mD} > V_{lw}^{mD}$ and $V_{lw}^{D} = V_{lt}^{D}$ it is the tough (low productivity) individuals that have the most to gain from being a middleman. They will deviate from Diamond equilibrium behavior whenever $\Gamma(\phi, \bar{c}) > 0$ where,

$$\Gamma(\phi, \bar{c}) \equiv \frac{\beta\pi\bar{c}}{2}\left[2\phi(1-\tau) + \tau\right] - (u - \bar{c})\left\{r + \frac{\beta}{2}\left[2 - 2\phi(1-\tau) - \tau\right]\right\} \tag{9}$$

Since $[2 - 2\phi(1-\tau) - \tau] \geq [2 - 2(1-\tau) - \tau] = \tau$, the term in the curly brackets is always positive. ■

A middleman consumes less at every meeting than she would as a producer but trade with a high-productivity individual means she can effectively avoid any production cost. If production costs for the low productivity individuals are high enough, then they will become middlemen. As middlemen

[5] A consequence of the unimproveability result from dynamic programming is that considering one time or indefinite deviations from the specified strategy will yield the same results

have to bargain for any income, when $\bar{c} = c_t$ it is the most persuasive of the low productivity individuals who are inclined to become middlemen.

The up shot is that the Diamond equilibrium exist as long as $\bar{c} \leq c_t(\phi)$ where $c_t(\phi)$ is the value of $\bar{c}$ that solves $\Gamma(\phi, \bar{c}) = 0$ from equation (9)

3.2 Class I Equilibria

From Proposition 1 we know that only 2 equilibria where one type of individuals act as middlemen are potentially viable. Consider first the possibility that the highly persuasive but low-productivity individuals are middlemen. We will call this the Type It equilibrium

Proposition 4 *The Type It equilibrium exists whenever* $\bar{c} \in [c_t(\phi), c_w(\phi)]$ *where* $c_w(\phi)$ *is the value of* $\bar{c}$ *that solves* $\Psi(\phi, \bar{c}) = 0$ *and*

$$\Psi(\phi, \bar{c}) \equiv \frac{\beta\pi\bar{c}}{2}[2(1-\phi)\tau + (1-\tau)] - (u - \bar{c})\left\{r + \frac{\beta}{2}[1 - \tau(2\phi - 1)(1 - 2\pi)]\right\} \tag{10}$$

Proof. Let V_{ik}^{It} represent the value to being a Type ik individual in the Type It equilibrium. Then for the middlemen,

$$\begin{aligned} rV_{lt}^{It} &= \beta\left[\tfrac{1}{2}\pi\tau u + \tfrac{1}{2}(1-\pi)\tau 0 + \pi(1-\tau)\phi u + (1-\pi)(1-\tau)\phi(u - \bar{c})\right] \\ &= \tfrac{1}{2}\beta\pi[\tau + 2\phi(1-\tau)]u + \beta(1-\pi)(1-\tau)\phi(u-\bar{c}) \end{aligned}$$

Everyone else is a producer. So,

$$rV_{ht}^{It} = \beta\left\{1 - \tfrac{1}{2}(1-\pi)\tau\right\}u \tag{11}$$

$$rV_{hw}^{It} = \beta\left\{1 - \phi(1-\pi)\tau\right\}u$$

$$rV_{lw}^{It} = \beta\left\{1 - \phi(1-\pi)\tau\right\}(u - \bar{c})$$

As high productivity individuals will never choose to be middlemen, only deviations by low productivity individuals need to be considered. From Propositions 2 and 3, Type lt individuals would prefer to be producers whenever $\bar{c} > c_t(\phi)$.

Let V_{lw}^m be the value to low productivity wimps of holding onto a good acquired in trade. Then,

$$\begin{aligned} rV_{lw}^m &= \beta\left[\pi\tau(1-\phi)u + (1-\pi)\tau 0 + \tfrac{1}{2}\pi(1-\tau)u + \tfrac{1}{2}(1-\pi)(1-\tau)(u-\bar{c})\right] \\ &= \tfrac{1}{2}\beta\pi[2(1-\phi)\tau + (1-\tau)]u + \tfrac{1}{2}\beta(1-\pi)(1-\tau)(u-\bar{c}) \end{aligned}$$

They prefer to act as middlemen only if $V_{lw}^m > u - \bar{c} + V_{lw}^{It}$, or equivalently if $\Psi(\phi, \bar{c}) > 0$. As

$$[1 - \tau(2\phi - 1)(1 - 2\pi)] > 0$$

there is a critical value $c_w(\phi)$, between 0 and u, of $\bar{c}$ above which the low productivity wimps would become middlemen. ■

Proposition 4 does not establish that equilibrium Type It exists for any configuration of parameters as $[c_t(\phi), c_w(\phi)]$ could be empty. The next Lemma establishes that $c_w(\phi) > c_t(\phi)$.

Lemma 5 $\Psi(\phi, c_t(\phi)) < 0$ *on the interior of the parameter space.*

Proof: See appendix.

The other Class I equilibrium that Proposition 1 permits is low productivity wimps being the middlemen. This will be referred to as the Type Iw equilibrium. Let $\tilde{c}$ be the threshold value of $\bar{c}$ at which, in the Diamond equilibrium, low productivity wimps find it preferable to hold on to a good acquired in trade rather than eat it. Proposition 3 tells us that $\tilde{c} > c_t(\phi)$.

Now, from Proposition 2 the threshold value of $\bar{c}$ at which Type lw individuals would deviate from the Type Iw equilibrium into production is also $\tilde{c}$. That is a necessary condition for the existence of Type Iw equilibrium is that $\bar{c} \geq \tilde{c}$.

For this equilibrium to be viable we also need to consider the Type lt individuals. (Recall that high productivity individuals will never choose to be middlemen and so we can ignore them.)

Proposition 6 *For $\bar{c} \geq \tilde{c}$, the Type lt individuals will never comply with Type Iw equilibrium behavior.*

Proof. Let V_{ik}^{Iw} represent the value to being a Type ik individual in the Type Iw equilibrium. Then for the middlemen,

$$\begin{aligned} rV_{lw}^{Iw} &= \beta\left[(1-\phi)\pi\tau u + (1-\phi)(1-\pi)\tau(u-\bar{c})\right. \\ &\quad \left. + \tfrac{1}{2}\pi(1-\tau)u + (1-\pi)(1-\tau)0\right] \\ &= \tfrac{1}{2}\beta\pi\left[2(1-\phi)\tau + (1-\tau)\right]u + (1-\phi)(1-\pi)\tau(u-\bar{c}) \end{aligned}$$

Everyone else is a producer. So,

$$rV_{ht}^{It} = \beta\left\{1-(1-\phi)(1-\pi)(1-\tau)\right\}u$$

$$rV_{hw}^{It} = \beta\left\{1-\tfrac{1}{2}(1-\pi)(1-\tau)\right\}u$$

$$rV_{lt}^{It} = \beta\left\{1-(1-\phi)(1-\pi)(1-\tau)\right\}(u-\bar{c})$$

Let V_{lt}^{m} be the value to being a middleman to a Type lt individual when all other lt type individuals continue to be producers. Then,

$$rV_{lt}^{m} = \beta\left[\tfrac{1}{2}\pi\tau u + \tfrac{1}{2}(1-\pi)\tau(u-\bar{c}) + \phi\pi(1-\tau)u + (1-\pi)(1-\tau)0\right]$$

Also let V_{lw}^{p} be the value to production for the Type lw individual. Then

$$V_{lw}^{p} = \beta\left\{1-\tfrac{1}{2}(1-\pi)(1-\tau)\right\}(u-\bar{c})$$

Now

$$r\left(V_{lt}^{It}-V_{lw}^{p}\right)=\frac{\beta}{2}\left(2\phi-1\right)\left(1-\pi\right)(1-\tau)(u-\bar{c})$$

and

$$r\left(V_{lt}^{m}-V_{lw}^{Iw}\right)=\frac{\beta}{2}\left[\left(2\phi-1\right)\pi\tau u+\left(2\phi-1\right)\left(1-\pi\right)\tau(u-\bar{c})+\left(2\phi-1\right)\pi(1-\tau)u\right]$$

As $\bar{c}\geq\tilde{c}$ implies $V_{lw}^{Iw}\geq V_{lw}^{p}$,

$$V_{lt}^{m}\geq V_{lt}^{It}+\frac{\beta\left(2\phi-1\right)\pi u}{2}$$

Which means that a Type lt individual will always prefer to be a middleman over producing in a Type Iw equilibrium. ■

The implication here is that a Class I equilibrium in which the middlemen are low productivity wimps cannot exist. This is because the low productivity tough bargainers generally do better as middlemen than do the wimps. Whenever the environment is such that the wimps would want to be middlemen so do the tough bargainers.

3.3 Class II Equilibrium

Proposition 4, established that when the low productivity tough bargainers are acting as middlemen that values of $\bar{c}>c_w(\phi)$ would induce low productivity wimps to become middlemen too. Moreover, Proposition 2 implies that the number of low productivity wimps who are middlemen does not affect their propensity to choose that profession. This means that the Class 2 equilibrium that entails all low-productivity individuals being middlemen will uniquely exist for any $\bar{c}$ in the range $(c_w(\phi),u)$.

3.4 Mixed Strategy Equilibria

A mixed strategy equilibrium occurs if for some probability in $(0, 1)$ that any type of individual chooses one profession over the other, those same individuals are also indifferent across the professions. Proposition 2 also implies that mixed strategy equilibria can exist for the special parameter configurations $\bar{c} = c_t(\phi)$ and $\bar{c} = c_w(\phi)$. When $\bar{c} = c_t(\phi)$ we know that the low productivity tough bargainers are indifferent between the two states when either all of them are middlemen or all of them are producers. But, as the propensity for own type to be a middleman does not affect the returns to choosing one profession over another, the Type lt individuals should be indifferent for every proportion of their own type being middlemen. For those particular parameter configurations, there is therefore a continuum of mixed strategy equilibria associated with every probability between 0 and 1 that the Type lt person holds on to a good acquired in trade. Similarly, when $\bar{c} = c_w(\phi)$, there are a continuum of mixed strategy equilibria associated with every probability between 0 and 1 that the Type lw person holds on to a good acquired in trade.

Also Proposition 2 implies that there can be no mixed strategy equilibria except when $\bar{c} = c_t(\phi)$ or $\bar{c} = c_w(\phi)$. This is because, from the forgoing, away from these parameter configurations every one has a strictly preferred profession. As that preference does not depend on own type propensity to follow one profession or another no amount of mixing will bring about the indifference required to support a mixed strategy equilibrium.

4 Discussion

We conclude that:

- the Diamond equilibrium exists whenever $\bar{c}$ is in the range $[0, c_t]$.
- the Type It equilibrium (of Class I) exists whenever $\bar{c}$ is in the range $[c_t, c_w]$.
- the Class II equilibrium in which all low productivity individuals are middlemen exists whenever $\bar{c}$ is in the range $[c_w, u]$.
- except at the boundaries to the implied regions of the parameter space, each equilibrium uniquely represents the outcome of the model.

4.1 Comparative Statics

Figure 1 shows how c_t and c_w vary with ϕ. The regions marked D, I, and II correspond to the values of $\bar{c}$ and ϕ for which the unique equilibrium trading patterns are respectively Diamond (no middlemen), Class I (low-productivity tough guys are middlemen) and Class II (all low-productivity individuals are middlemen). The following features of Figure 1 are general and readily verified.

(i) $\hat{c} \equiv c_t(\frac{1}{2}) = c_w(\frac{1}{2}) = u(\gamma + 1)/(\gamma + 1 + \pi)$ where $\gamma = 2r/\beta$.

(ii) $c_t(\phi)$ is decreasing and concave.

(iii) $c_w(\phi)$ is increasing and convex.

(iv) $c_t(1) > 0$

(v) $c_w(1) < u$.

That $c_t(\frac{1}{2}) = c_w(\frac{1}{2})$ should be clear, when $\phi = \frac{1}{2}$ there is no distinction between tough guys and wimps, - the Class I equilibrium exists for $\bar{c} = \hat{c}$ only as one of the continuum of mixed strategy equilibria. That $\hat{c} > \frac{1}{2}u$, is because with $\phi = \frac{1}{2}$, a middleman at most consumes half of the negotiable good. Had

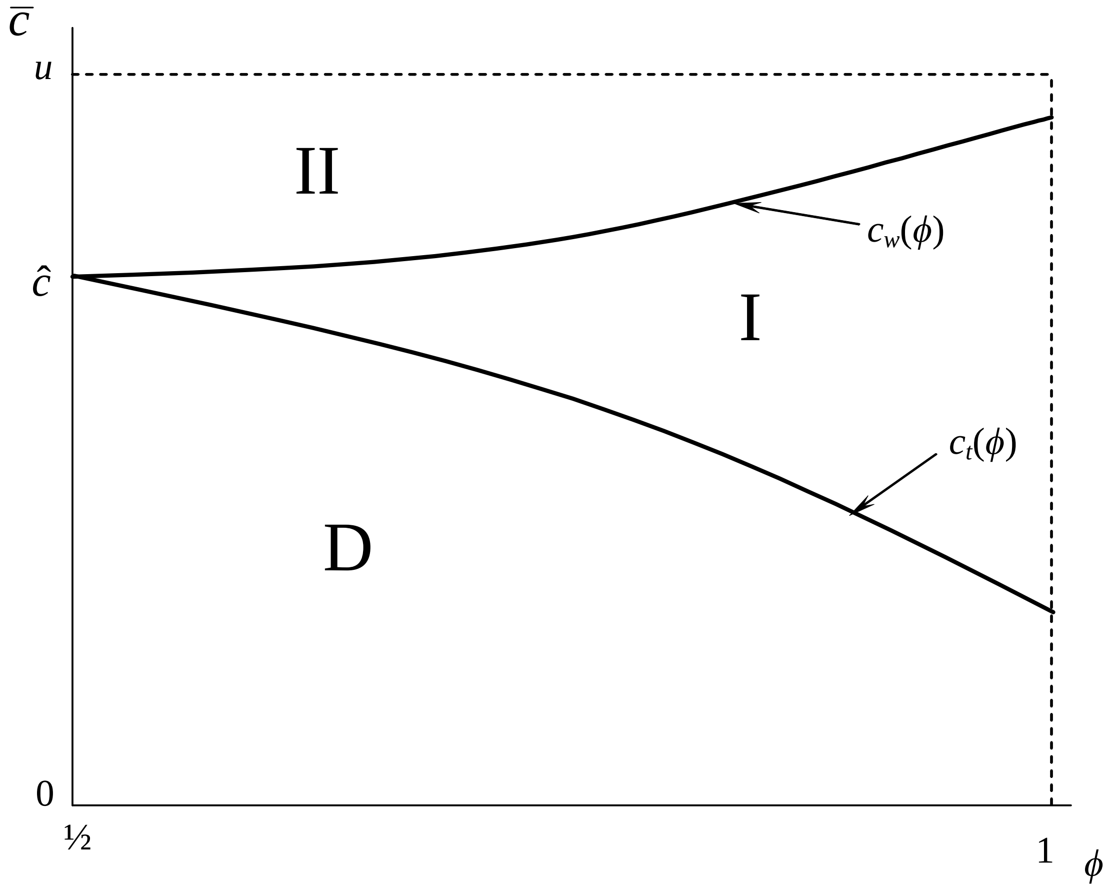

Figure 1: Critical values of the production cost parameter, $\bar{c}$, for existence of each class of equilibrium against the bargaining power, ϕ of the tough bargainers.

she chosen to produce, she would consume $u - \bar{c}$ at the same meeting. That c_w is decreasing in ϕ reflects the increased ability of tough bargainers to extract rents from wimpish high-productivity individuals. Conversely, as ϕ increases, wimps are decreasing in their ability to extract rents from tough high-productivity individuals.

Perhaps the most noteworthy general feature of Figure 1 is that $c_t(\phi)$ is strictly positive for every parameter configuration. This means that even when $\phi = 1$, bargaining power alone cannot support equilibria with middlemen. This is because at each encounter a middleman gets to eat some share of a good net of production costs. Someone with low production costs is always better off producing. But, people with relatively high production costs can become middlemen to take advantage of other people's low costs. If everyone has the same production costs such an opportunity can never arise.

The parameter $\gamma = 2r/\beta$ summarizes the extent of trading frictions in the model. High values of γ mean encounters with potential trading partners are quite rare. It is simple to show that both c_t and c_w are increasing in γ at every value of ϕ. Reduced trading frictions, therefore, favors the emergence of middlemen. This is because they rely on frequent trading to survive. If the chance of future trading opportunities falls, middlemen would be more inclined to consume their inventory.

There is a large literature on what happens in matching markets as search frictions disappear.[6] This debate has important implications for the search approach to economics. If the manifestations of search disappear with the frictions, innovations, such as the internet, could render this approach to modelling economic phenomena obsolete. In the current model, as trading

[6] See Rubinstein and Wolinsky [1985], Gale [1987], Duffie *et al* [2006], and Mortensen and Wright [2002].

frictions disappear (i.e. as $\gamma \to 0$), c_t and c_w uniformly converge from above to $\tilde{c}_t$ and $\tilde{c}_w$ that exist at every value of ϕ between $\frac{1}{2}$ and 1. The functions $\tilde{c}_t(\phi)$ and $\tilde{c}_w(\phi)$ have similar properties to $c_t(\phi)$ and $c_w(\phi)$.[7] So, if middlemen were operative in the market before an innovation to matching they will certainly be there afterwards. This is because, what happens in the trading environment has strong implications for production. While traders' outside-options improve with reduced market frictions, the benefit to trading with anyone goes up by the same amount. As a consequence, the terms of trade (prices) are invariant to the extent of frictions. This is in sharp contrast to Duffie *et al* [2006]. They find that the intermediary's bid-ask spread declines with search frictions. In their model individual propensity to desire the services of an intermediary are not influenced by the rate at which they can be met.[8] In the current environment, because the production implications of falling search frictions are taken into account, activities that emerge as a means of overcoming search frictions will not decline as the frictions diminish.[9]

As τ (the proportion of the population who are tough bargainers) increases, the number opportunities for gouging wimps falls. In terms of Fig-

[7]The functional forms are

$$\begin{aligned}
\tilde{c}_t(\phi) &= \frac{u(2 - 2\phi(1-\tau) - \tau)}{2 + (\pi - 1)\left[2\phi(1-\tau) + \tau\right]} \\
\tilde{c}_w(\phi) &= \frac{u[1 - \tau(2\phi - 1)(1 - 2\pi)]}{1 + \pi + \tau(1-\pi)(1-2\phi)}
\end{aligned}$$

Verification that properties (ii) through (v) hold is straightforward.

[8]However, even when the buying and selling prices converge in this way, it does not mean that the limiting economy has no intermediaries. As long as their matching rate rises in proportion to that of the rest of the population, their profits need not disappear.

[9]Shevchenko [2004] gets a similar result, in a model of shopkeepers. As search frictions diminish, the returns to diversification, increase and shops get bigger.

ure 1, increases in τ lead to anti-clockwise movements of both the c_t and c_w curves around $\hat{c}$ which remains fixed. As the share of individuals who are highly productive, π, goes up, the value to being a producer is unaffected but for a middleman the average quality of meetings rises - both c_t and c_w (and $\hat{c}$) are decreasing in π.

4.2 Rubinstein Bargaining

The generalized Nash bargaining solution is ubiquitous in the search and matching literature. A common justification for using this approach is that the implied allocation can be supported as a sub-game perfect equilibrium of an alternating offers (non-cooperative) game-theoretic analysis of bargaining (see Binmore *et al* [1986]). In fact, the appropriateness of this justification depends on the particular modelling environment. In this subsection I will explore the extent to which the Nash allocation, as employed here, can be supported by Rubinstein bargaining. An additional benefit to this analysis is that it provides more concrete notion of where "persuasiveness" comes from.

The protocol is as follows. In each round with probability ψ person 1 gets to make an offer. Person 2 will either accept or reject the offer. If the offer is accepted trade occurs on the basis specified in the offer. If the offer is rejected there is a delay of length Δ. In that time they face a Poisson arrival rate δ of breakdown. Breakdown means that both individuals return to search. If no breakdown occurs, they move on to another round of bargaining. We look at stationary subgame perfect equilibria of the game as Δ converges to zero. What guides the analysis is that in any equilibrium, the acceptance strategies will have the reservation property. That is, individuals will accept offers that yield a present value of expected utility that makes them at least as well off as rejection of the offer and waiting for the next round. They reject any other offer. This means that any party wanting to make an acceptable offer will choose his counterpart's reservation offer.

The parties to any negotiation can begin in 3 possible pairs of states.

(i) Both producers: Let V_i be the value of being in his current state for individual $i = 1, 2$. Also let ω_i be the offer made by individual $i = 1, 2$. The nature of the offer is the amount of the good individual i is willing to give up in order that his partner hand over the whole good she is carrying. As the remainder would simply go to waist, when person 1 makes the offer we have

$$\begin{aligned} \omega_1 u - c_2 + V_2 &= \frac{1-\Delta\delta}{1+r\Delta}\{\psi(\omega_1 u - c_2 + V_2) + (1-\psi)(u - c_2 + V_2)\} \\ &\quad + \frac{\Delta\delta V_2}{1+r\Delta} + o(\Delta) \end{aligned}$$

where c_i is the production cost for person i and $o(.)$ is any function such that $\lim_{h\to 0} o(h)/h = 0$. So,

$$(r+\delta)\Delta(\omega_1 u - c_2 + V_2) = (1-\psi)u(1-\omega_1) + \Delta\delta V_2 + o(\Delta)$$

As $\Delta \to 0$, $\omega_1 \to 1$. By symmetry $\omega_2 \to 1$ and the outcome is a simple swap of the goods.

(ii) Both middlemen: It should be clear that regardless of the frequency with which individuals get to make offers, the limiting outcome as the time between rounds goes to zero is that both leave with whole goods. Whether they swap them or not is moot.

(iii) Middleman-producer meetings: Let person 1 be the middleman then an offer ω_1 refers to the amount of the good held by the middleman that the producer gets to consume in return for the whole good carried by the producer. An offer ω_2 (made by the producer) is also the amount of the good held by the middleman that the producer gets to consume in return for the whole good carried by the producer. So

$$\begin{aligned}
\omega_1 u - c_2 + V_2 &= \frac{1-\Delta\delta}{1+r\Delta}\left\{\psi\left[\omega_1 u - c_2 + V_2\right] + (1-\psi)\left[\omega_2 u - c_2 + V_2\right]\right\} \\
&\quad + \frac{\Delta\delta V_2}{1+r\Delta} + o(\Delta) \\
(1-\omega_2)u + V_1 &= \frac{1-\Delta\delta}{1+r\Delta}\left\{\psi\left[(1-\omega_1)u + V_1)\right] + (1-\psi)\left[(1-\omega_2)u + V_1\right]\right\} \\
&\quad + \frac{\Delta\delta V_1}{1+r\Delta} + o(\Delta)
\end{aligned}$$

which imply

$$\begin{aligned}
r\Delta V_2 + (r+\delta)\Delta(\omega_1 u - c_2) &= (1-\Delta\delta)(1-\psi)u\left[\omega_2 - \omega_1\right] + o(\Delta) \\
r\Delta V_1 + (r+\delta)\Delta(1-\omega_2)u &= (1-\Delta\delta)\psi u\left[\omega_2 - \omega_1\right] + o(\Delta)
\end{aligned}$$

So that as $\Delta \to 0$, $\omega_1 \to \omega_2 \to \omega^*$. If $\delta \gg r$ then dividing and taking the limit as Δ approaches zero implies the approximate relation

$$\psi(\omega^* u - c_2) = (1-\psi)(1-\omega^*)u$$

which means that

$$\omega^* \simeq \frac{(1-\psi)u + c_2}{u} \tag{12}$$

That is, as long as the Poisson arrival rate of exogenous breakdown in the bargaining is large relative the common discount rate then, from (1), the Nash bargaining power θ of the middleman can be (approximately) interpreted as the probability with which she gets to make an offer in each round of bargaining.[10]

[10]Notice that if the expected time to an exogenous breakdown is 1 day and discounting occurs at the rate 5% per year, the ratio $\delta/r = 7300$.

4.3 Welfare and the role of unpleasantness

It has been shown that other than when $\bar{c} = c_t(\phi)$ or $c_w(\phi)$, equilibrium is unique. This generally precludes welfare comparisons. However, it is possible to ask whether any market intervention can generate efficiency gains.

As all individuals are risk neutral and utility is transferable, equal weight utilitarian welfare is simply aggregate flow output (in utils). Let Y_D represent this welfare measure when everyone's behavior is consistent with that specified by the Diamond equilibrium (i.e. no middlemen). Then, regardless of the parameter values, adding up the individual contributions to welfare yields,

$$\begin{aligned} Y_D &= \beta\{\pi\tau u + (1-\pi)\tau(u-\bar{c}) + \pi(1-\tau)u + (1-\pi)(1-\tau)(u-\bar{c})\} \\ &= \beta\{\pi u + (1-\pi)(u-\bar{c})\} \end{aligned}$$

Now let Y_I be the welfare measure associated with the low productivity tough bargainers being middlemen (and everyone else being a producer). Adding welfare contributions according how much and how often each type gets to eat yields,

$$\begin{aligned} Y_I &= \beta\{\pi\tau[\pi\tau + \tfrac{1}{2}(1-\pi)\tau + \pi(1-\tau) + (1-\pi)(1-\tau)]u \\ &\quad +(1-\pi)\tau[\tfrac{1}{2}\pi\tau u + \phi\pi(1-\tau)u + \phi(1-\pi)(1-\tau)(u-\bar{c})] \\ &\quad +\pi(1-\tau)[\pi\tau + (1-\phi)(1-\pi)\tau + \pi(1-\tau) + (1-\pi)(1-\tau)]u \\ &\quad +(1-\pi)(1-\tau)[\pi\tau + (1-\phi)(1-\pi)\tau \\ &\quad +\pi(1-\tau) + (1-\pi)(1-\tau)](u-\bar{c})\} \\ &= Y_D - \beta(1-\pi)\tau(u-\bar{c}) \end{aligned} \tag{13}$$

Similarly, if Y_{II} is the value of total welfare when all low productivity individuals are middlemen,

$$Y_{II} = Y_D - \beta(1-\pi)(u-\bar{c}) \tag{14}$$

As equations (13) and (14) apply for all parameter values they also apply where the Class I and Class II equilibria exist. In each case therefore, it should be clear that a ban on middleman behavior leads to welfare gains. Moreover, for values of $\bar{c}$ sufficiently close to $c_t(\phi)$ the ban on middlemen will be Pareto improving. This is because producer and middlemen alike are made worse off by the existence of other middlemen.

When $\bar{c}$ is large enough that the value to avoiding production at all exceeds the loss associated with all Type lt individuals being middlemen, then a ban on middlemen can make the lt individuals worse off. However, in that case equation (13) indicates that a set of transfers are available to ensure that everyone prefers the ban on middlemen to the *laissez faire* equilibrium. Equation (14) implies that when parameters are such that the Class II equilibrium exists, transfers exist such that everyone can be at least as well off under a ban as in the *laissez faire* economy.

A usual caveat is that such statements refer to steady state values of welfare and imposing a ban on middleman activity could cause transitional dynamics that make some people worse off. However, in this environment, the transition is instantaneous and only beneficial: the middlemen simply consume their inventories.

Hosios [1990] provides a typology of externalities that can arise in search and matching environments. Externalities arise when the private returns to decisions people make differ from the social returns. In this economy only 2 types of decision are being made. These are: whether to trade with any individual or not and, whether to be a middleman or a producer. The former decision corresponds to Hosios's acceptance externality which is not at work here; given the number of middlemen and producers, trade is efficient. Meetings between two producers result in the consumption of 2 goods, meetings between middlemen and producers result in the consumption of 1 good and, meetings between two middlemen result in no consumption. Given middlemen do not produce, this is as much as can be achieved. The decision to become a middleman corresponds to Hosios's entry/exit externality and is the source of inefficiency in this model. When an individual decides to become a middleman she does not take account of the effect of her decision on anyone else's well-being.

Another issue is that if transfers are required, how might a government identify who to make transfers to. While individual types have been assumed to be observable to each other. The government may not be so discerning. When only the Type lt individuals are inclined to become middlemen the recipients should be those who had to change profession. But this test may not work when both types of low productivity individuals are inclined to be middlemen. The low productivity tough bargainers have more to loose from the ban but would receive the same compensation as the wimps.

It is worth noting that equations (13) and (14) do not include ϕ. This is because the size of ϕ only controls the division of the surplus between individuals and not the size of the surplus *per se.* However, ϕ does change the value to being a middleman, and therefore the threshold values of $\bar{c}$ at which middlemen emerge. This means that the relative toughness of the tough bargainers over the wimps does affect welfare through the influence it has on individual propensity to become a middleman.

Persuasiveness also impacts outcomes through an if-you-cannot-beat-them-join-them effect.

Corollary 7 *(to Proposition 2) The existence of the tough bargainers as middlemen makes the wimpish low productivity individuals more inclined to be middlemen themselves.*

Proof. Suppose (from the proof of Proposition 2) that, $c_2 = c_1 = c$. In general, when Person 2 is a producer meeting him as a producer yields $(1-\hat{\theta})(u-c)$ utils to person 1 over meeting him as a middleman. When Person 2 is a middleman, meeting him as a producer yields $\hat{\theta}(u-c)$ over meeting him as a middleman. As $\hat{\theta}$ is Person 1's share of the surplus, Person 2 being more persuasive means $\hat{\theta} = 1 - \phi < \frac{1}{2}$. The advantage to production over being a middleman at such meetings is therefore smaller when the existing middlemen are typically tougher than the person who contemplates a change in profession. ■

In terms of the foregoing analysis, this means that $c_w(\phi)$, the threshold value of $\bar{c}$ at which the low productivity wimps choose to become middlemen, is lower than it would be if the low productivity tough bargainers were not already acting as middlemen. This is because when a middleman meets another, there is no trade - the outcome is the same regardless of individual persuasiveness. However, as a producer, the more persuasive the middleman you meet, the less you get out of the meeting.

4.4 Extensions

In order to focus on the role of persuasiveness on who becomes a middleman, this paper has considered an environment in which there are only 4 types of individual. A possible extension would be to allow for a two dimensional continuum of types in production costs and persuasiveness. For each production cost this would imply a level of persuasiveness at which being a middleman is more profitable than production. The if-you-cannot-beat-them-join-them effect would enter multiplicatively. That is, as the set of individuals who *a priori* we would expect to be middlemen are also the most persuasive individuals, other marginally persuasive people would also move away from production further incentivizing the next group to reconsider their choice of profession and so on.

Other forms of heterogeneity are also possible. Variation in the utility from consumption would be isomorphic to variation in production costs. People could vary in terms of their discount rates. More patient individuals would surely be more likely to be middlemen as choosing that profession requires postponing consumption of an edible good in order to improve future bargaining positions. It is well known that in Rubinstein bargaining, more patient individuals get more of the pie. In this context, variations in the discount rate would confuse variations in impatience with variations in persuasiveness.[11]

In the paper, intermediaries were all of the same type and so it was not possible to address how some types of middlemen (e.g. shopkeepers) might not be as disliked as others (e.g. used car sales people). A possible extension of the model is to allow for reputation effects through repeated interactions. Such a model should predict that it is those dealers with whom we have the least frequent dealings that are least able to take advantage of any goodwill and therefore tend to drive harder bargains.

[11] Shevchenko and Wright [2004] provide a comprehensive analysis of a monetary search model which introduces several forms of heterogeneity.

5 Conclusion

This paper examines a stylized environment in which middlemen emerge endogenously. People become middlemen to avoid production costs. It is shown that if anyone becomes a middleman, it will be the best bargainers. In this model as they provide no additional service, middlemen are pure rent-seekers. However, the larger point is that even if their activities are socially beneficial, we would expect to find the more persuasive individuals acting as intermediaries.

6 Appendix

Proof of Proposition 5: From (9),

$$c_t = \frac{u\,A}{B}$$

where $A \equiv \gamma + 2 - Y$, $B \equiv \gamma + 2 - (1-\pi)Y$, $Y \equiv 2\phi(1-\tau) + \tau$ and $\gamma = r/2\beta$. So that from (10)

$$\frac{\Psi(\phi, c_t)}{u} = \frac{(\pi X + C)A}{B} - C \tag{15}$$

where $X \equiv 2\tau(1-\phi) + 1 - \tau$, and $C \equiv \gamma + 1 - \tau(2\phi - 1)(1 - 2\pi)$.

The following should be clear:
$X \in [0,1]$, $Y \in [1,2]$, $A \in [\gamma, \gamma+1]$, $B \in [\gamma, \gamma+1]$, $C \in [\gamma, \gamma+2]$ and $\gamma \in (0, \infty)$. We need to show that the sign of $F \equiv (\pi X + C)A - BC$ is negative. First notice that the terms of F that contain γ are

$$\gamma[A + \pi X + C - C - B] = -\gamma[\pi(Y - X)] < 0$$

so the terms containing γ can be ignored. Setting $\gamma = 0$.

$$F = \pi(AX - CY)$$

and

$$AX - CY = 2(2\phi - 1)[\tau(1-\pi)\{\tau + 2\phi(1-\tau)\} - 1]$$

The contents of the square brackets are decreasing in π and increasing in ϕ, which cannot therefore exceed $\tau(2-\tau) - 1$ which achieves a maximum of 0 at $\tau = 1$. ■

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