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Netwerk Algemene en Kwantitatieve Economie

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PREFACE

The signals that have reached me so far suggest that the second **NAKE Day**, which was held on October 23rd at the University of Amsterdam, was a success. There were 75 paper presentations (as compared to, effectively, 78 last year), there were no last-minute pull-outs (as compared to 2 in net terms last year), sessions were well-attended, the discussions were lively, and there was a very good audience for a very good NAKE Lecture (like last year). At a time when most people start to mentally prepare themselves for the weekend's activities, NAKE Lecturer **Eric van Damme** managed to fascinate and entertain a large audience by talking about the "Challenges to Dutch Microeconomists."

Thinking back on the NAKE Day, the only thing that really puzzled me (and still gnaws at me) is the almost complete absence of "ministry" economists. Where were they? Notwithstanding this minor puzzle, this year's experience encourages us to continue the NAKE Day in its current format. The next NAKE Day will be held on Friday October 22nd, 1999, and the keynote speaker will be Lans Bovenberg (Tilburg University). Let us just hope that the "lost" will be "found" next year.

In this *NAKE Nieuws* you find the best reports on two (of four) lecturers of the June workshop which was held at Wageningen Agricultural University. **Linda Veldman** (RUG) reports on "Vertical Contracting" by Michael D. Whinston and **Corjan Brink** (LUW) writes on "Political Sustainability of Redistribution and the Reform of Social Security" by Pierre Pestieau. Both Linda and Corjan have managed to strike a fine balance between the material that was covered in class during the workshop and the additional readings that were set by the lecturers. In that sense it is apparent from their reports that the learning experience does not end once the workshop is finished.

We have once again managed to line up four lecturers of very high quality for the forthcoming (twenty-fifth) NAKE Workshop to be held December 7-11 at the Erasmus University Rotterdam. Elsewhere in this *NAKE Nieuws* you find details on the courses, registration forms, etcetera. Professor **Avner Greif** (Stanford University) will give the economic history lectures on the topic of "The Institutional Foundations of Market Formation in the Late Medieval Period." People sometimes ask me how I get to know and invite the right kind of people for our workshops. Well, in Greif's case the story is simple. A number of NAKE fellows had already directed my attention at Greif's recent work. I read some of it and concluded that he would suit just fine. Subsequently, last December's NAKE lecturer, Professor Ariel Rubinstein intervened on NAKE's behalf and pointed out to Greif (when the latter was visiting Tel Aviv University) what NAKE was and what the idea behind the workshops is. Greif accepted my invitation by return (E-) mail. Networking for you!

Who else will be at the Rotterdam workshop? Professor **Michael Hanemann** (University of California at Berkeley) gives the lectures on environmental economics and Professor **John McMillan** (University of California at San Diego) will talk on "Lessons from Transition Economies." Last but not least, Professor **Ian Walker** (Keele University) will give lectures on "The Econometrics of Labour Supply in the Short and the Long Run." Frequent visitors to the NAKE Homepage will know that, originally, Professor Richard Blundell (University College London) was to speak at this workshop. Unfortunately, he has had to postpone his participation until December 1999 due to circumstances beyond his control. He and Walker have, however, coordinated the content of their respective lecture series so that the Blundell-Walker series can be seen as a double bill. The first installment, by Ian Walker, will have a strong policy focus. The second installment, by Blundell, will be more on micro-econometrics and non-parametric methods.

The second half of our Utrecht program is almost upon us. On page 31 of this *NAKE Nieuws* you find a list of courses that are scheduled for the first half of 1999. The selection should be broad enough for everybody to find something to her/his liking. Registration for these courses proceeds via the NAKE Homepage.

Ben Heijdra

NAKE WORKSHOP

7 - 11 December 1998

Erasmus University Rotterdam

During the week of Monday, December 7th to Friday, December 11th, the Netherlands Network of Economics (NAKE) will organize a Ph.D. workshop. Four distinguished economists will teach intensive courses on transition economics, environmental economics, economic history, and (applied) econometrics. Each course consists of five lectures spread out over five days.

Courses

Avner Greif, Stanford University
"The Institutional Foundations of Market Formation in the Late Medieval Period"

Michael Hanemann, University of California at Berkeley
"Environmental Economics"

John McMillan, University of California at San Diego
"Lessons from Transition Economies"

Ian Walker, Keele University
"The Econometrics of Labour Supply in the Short and the Long Run"

Course outlines will be placed on the NAKE Homepage as soon as they are available. Register for the workhop by filling out the form located in the middle of this *NAKE Nieuws* and returning it to the NAKE secretariat **by 13 NOVEMBER at the latest**.

PROVISIONAL PROGRAMME NAKE WORKSHOP
ROTTERDAM, 7 - 11 DECEMBER 1998

Monday December 7	**Tuesday December 8**
09.30 - 10.30 registration/coffee 10.30 - 11.45 Hanemann 12.00 - 13.15 Walker *13.15 - 14.15 Lunch* 14.15 - 15.30 McMillan 15.45 - 17.00 Greif *17.00 - 18.00 Welcome reception*	09.00 - 10.45 Walker 11.15 - 13.00 Hanemann *13.00 - 14.15 Lunch* 14.15 - 16.00 Greif 16.15 - 18.00 McMillan
Wednesday December 9	**Thursday December 10**
09.00 - 10.30 Hanemann 10.45 - 12.15 McMillan *12.15 - 13.30 Lunch* 13.30 - 15.00 Walker 15.15 - 16.45 Greif 16.45 - 18.15 Private consultations	09.00 - 10.45 McMillan 11.15 - 13.00 Hanemann *13.00 - 14.15 Lunch* 14.15 - 16.00 Greif 16.15 - 18.00 Walker *20.00 workshop dinner*
Friday December 11	
09.00 - 10.30 Walker 10.45 - 12.15 Hanemann *12.15 - 13.30 Lunch* 13.30 - 15.00 Greif 15.15 - 16.45 McMillan *16.45 - ... Closing drinks*	

REGISTRATION

Participation in the workshop is free for AIO's/OIO's of the institutions participating in NAKE, and includes tea, coffee, lunches, reception, as well as dinner on Thursday. The participants cover the costs of accommodation, breakfast, and the course readers. These costs, together with travel expenses, can however be declared at the faculties. Hotel rooms are available in **Hotel Emma.** It is possible (and advisable) to share a room. Approximate prices are **ƒ 140,- to ƒ 170,-**.

The number of participants in the workshop is subject to a finite upper bound. NAKE students have precedence, and the date of receipt of the registration form is also taken into consideration. Since firm arrangements must be made for lunches, dinner, accommodation etcetera, you must notify the NAKE secretariat in case of any alterations to your plans. You register by filling out the form on the middle page (as completely AND LEGIBLY as possible) and returning it to the NAKE secretariat **by 13 NOVEMBER latest**. Upon registration you will receive written confirmation together with readers for the courses, hotel information, etcetera.

A number of AIO/OIO's will be presented with the NAKE diploma during the workshop dinner on Thursday evening.

PRIVATE CONSULTATIONS

During the workshop it is possible for participants to have a one-to-one talk with one (or more) of the lecturers. Students who wish to confer with one of the lecturers about their research are invited to hand in a brief (one-page) description of the research (-proposal) they would like to discuss. Each consultation will be approximately 30 minutes.

METHOD OF ASSESSMENT AND CREDITS

The NAKE workshops are obligatory for all first- and second-year graduate students following the NAKE programme. Hence, each student must attend at least four workshops. For three workshops the student must submit a written summary of the lectures of one course. This report must be based both on the notes taken during the workshop and on the assigned literature. These reports are assessed by the organiser(s) of the workshop. All (NAKE) students are expected to attend all sessions on offer during the workshop.

With regard to study intensity, participation in the workshop (including the assessment by means of the written report) is worth 2 "Study Points" (SP); 1 SP = 40 hours.

ADDRESSES AND INFORMATION

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Michael D. Whinston
Vertical Contracting

Report by Linda Veldman, University of Groningen

1 Introduction

This is a report on the lectures on vertical contracting given by professor Michael D. Whinston at the NAKE Workshop in Wageningen, June 1998.

In the real world, mutually imperfect competitive markets are observed. That is, imperfections occur for buyers as well as for sellers. Possible explanations for these imperfections are:

- a small number of buyers and/or sellers;
- buyers and sellers being locked in a relationship *ex post*, that is, strategic interaction.

Vertical contracting refers to such vertical relationships between a buyer and a seller, where both the buyer and the seller are firms. The first part of the report (section 2) discusses bilateral relationships between a single buyer and a single seller. Section 3 introduces a third party to the model, that can be either a buyer or a seller, leading to externalities and therefore inefficiencies. Section 4 concludes.

2 Bilateral Relationships

Consider the case of a single buyer (B) and a single seller (S). The relationship between the buyer and the seller involves many decisions, for example with respect to the product to be traded, the quantity of the product that will be traded, and the level of investments in product innovation or process innovation. The relationship can be distinguished by whether information

is symmetric or asymmetric, and by the extent to which decisions are contractable. Non-contractable decisions are those that are impossible to verify. There are also intermediate decisions, that can be verified over time, but not initially, or that are verifiable, but the contingencies under which they will be made cannot be verified. If information is asymmetric or decisions are (partly) non-contractable, there are imperfections in the relationship between the buyer and the seller. Sections 2.1 and 2.2 discuss these problems, and the contracts that can be used to solve them. Section 2.3 shows how a contract can be used to reach the first-best solution when trade is not always efficient. Finally, section 2.4 presents a bilateral model of vertical integration, based on asset-ownership structure.

2.1 Asymmetric Information

Suppose the seller S is a monopolist manufacturer with known production cost c, the buyer B is a local monopolist retailer who eventually has to sell the product to a single consumer with reservation price or valuation v. Assume that at most one unit of the product is demanded. Consider the price p set by S. The seller will never set a price lower than cost. The seller can make a profit by setting p above c. However, when $p > v$ the seller will make no sales.

The first-best solution is of course that a sale to the consumer occurs whenever the consumer's valuation v is larger than or equal to the production cost c. Consider the situation where $p > v > c$. Since $v > c$, a sale to the consumer should occur, but since $p > v$, the sale will not occur. What causes this inefficiency? Once the seller sets a price, the retailer sees this price as its marginal cost. The chain of monopolists leads to a vertical externality. This problem is called the 'Double Marginalization Problem'.

A possible solution to the Double Marginalization Problem is a contract that specifies a so-called two-part-tariff. This contract sets $p = c$, such that B has the right incentives *ex post*. However, since with this price S does not make any money, the contract will also specify a fixed fee that transfers the entire surplus to S (because S is a monopolist). With this contract, trade will be efficient. In practice, this contract may not be possible, because the information may still be imperfect *ex post*, or because the parties may be unable to specify in the contract *ex ante* the kind of product that will be traded.

2.2 Non-Contractable Investments

Assume that investments are non-contractable, and suppose that trade is in the intermediate category: trade can only be verified *ex post*. Again, at most one unit of the product is demanded. First, the investment levels b of B and s of S are chosen. Second, the state of nature θ (with distribution function $f(\theta)$ on the interval $[\underline{\theta}, \overline{\theta}]$) is realized. Third, the parties can bargain, and fourth, the product is traded (if the parties agreed to trade). Assume fifty/fifty bargaining, that is, the price p of the trade is determined such that each party receives half of the available surplus. Note that v and c are now functions that depend on the investment levels and the realized state of nature: $v = v(b, \theta)$, $c = c(s, \theta)$, with derivatives $v_b(\cdot) > 0$ and $c_s(\cdot) < 0$.

The first-best solution to this problem consists of the efficient level of trade and the efficient levels of investment *ex ante*. Trade occurs if and only if $v(b, \theta) \leq c(s, \theta)$. The efficient level of trade maximizes the expected surplus (where the expectation is taken over all values of θ for which trade occurs) minus the investment levels. In this situation, however, absent a contract, fifty/fifty bargaining leads to inefficiency. Both the buyer and the seller maximize *half* of the expected surplus minus their own investment level. Therefore, although the social first order conditions consider the entire surplus of investment, the private first order conditions only consider half of it. The investment levels interact through the region of integration used in computing the expected surplus. This results in the so-called 'Hold-Up Problem': B (S) is held up by S (B) when making investments. Underinvestment occurs for both the buyer and the seller. (Hart [7], Williamson [12].)

The situation can be improved by writing a contract *ex ante* to protect investment. Consider a Specific Performance Contract (that can be imposed by the court) that specifies the level of trade and the price p. *Ex post*, there can be two situations. If $v \geq c$, the contract is efficient and there will be no renegotiation. The payoff from the contract for B is $v - p$, and the payoff from the contract for S is $p - c$. If $v < c$, the trade specified in the contract would lead to a negative surplus and the parties renegotiate to no trade. This shows that *ex post* the parties turn to efficient trade.

If trade is always efficient (that is, $v \geq c$ always holds) with this contract, the investment levels chosen by B and S are the efficient levels of investment. This shows that the contract removes the problem of underinvestment by letting the payoffs depend on v and c separately. The investment levels b and s do not interact anymore, since the set of values of θ for which trade is efficient is now the interval $[\underline{\theta}, \overline{\theta}]$, that is, independent of investment levels. However, it is also possible that trade is not always efficient. This case is

discussed in the next section.

2.3 Inefficient Trade

Consider again the non-contractable investments from section 2.2. The conclusion from that section is: if trade is always efficient, the first-best solution is reached. What happens if trade is not always efficient?

Assume $v < c$. Trade is not efficient, and therefore it is clear that this fixed-price contract leads to overinvestment. Recall that without a contract, underinvestment occurred. As Edlin and Reichelstein [6] show, an intermediate contract can be found such that the first-best solution for investment is reached. This is always possible for the case in which only one firm invests. Let x denote the probability of trade specified in the contract. Suppose only B invests. With a probability of x, the payoff for B is $v - p$ if $v \geq c$ and

$$(v - p) + \frac{1}{2}(c - v) = \frac{1}{2}v + \frac{1}{2}c - p$$

if $v < c$, where the second term on the left-hand side is half of the payoff of the bargaining. With a probability of $1 - x$ there is no trade, and the payoff for B is $\frac{1}{2}(v - c)$ if $v \geq c$ and 0 if $v < c$. This shows (recall that $v = v(b, \theta)$ and $c = c(s, \theta)$) that the marginal benefit of investment is given by

$$xv_b(\cdot) + (1 - x)\frac{1}{2}v_b(\cdot) = \frac{1}{2}(1 + x)v_b(\cdot)$$

if $v \geq c$ and by

$$x\frac{1}{2}v_b(\cdot) + (1 - x)0 = \frac{1}{2}xv_b(\cdot)$$

if $v < c$. The marginal benefit of investment of the two extreme cases $x = 0$ (no contract; underinvestment) and $x = 1$ (fixed-price contract; overinvestment) can easily be derived from this. With efficiency, the marginal benefit is $v_b(\cdot)$ if $v \geq c$ and 0 if $v < c$. The intermediate contract can now be found by balancing under- and overinvestment effects. For the case in which both firms invest and the functions $v(b, \theta)$ and $c(s, \theta)$ can be written as $v(b, \theta) = \overline{v}(b) + g(\theta)$ and $c(s, \theta) = \overline{c}(s) + h(\theta)$, efficient trade can be reached by setting x equal to the probability that trade occurs in the first-best.

There are several ways of handling the situation in which trade is not always efficient. Some examples are given below.

- *Renegotiation design* Suppose only one firm has bargaining power. If both firms invest, the first-best solution can always be reached, that is, without additional assumptions (Aghion, Dewatripont and Rey [2]).

- *Indexed contracts* Suppose the state of nature θ can be written as $\theta = (\theta_1, \theta_2)$, where θ_1 is observable (verifiable) and θ_2 is not. Suppose that for a given value of θ_1, trade is either always optimal or never optimal. Then efficient trade can be reached by indexing the contract to θ_1 (there is no renegotiation and no hold-up with this contract) (MacLeod and Malcolmson [10]).

- *Other assumptions on feasible contracts* Assume the court cannot verify which party refuses to trade, and therefore cannot force the trade. The court can only enforce payment when trade occurred. This leads to (weak) underinvestment. In general, the first-best cannot be reached. In the specific case where p is smaller than the lowest possible consumer valuation $\underline{v}$ but larger than the highest possible production cost $\overline{c}$, however, trade will be efficient. (Hart and Moore [8], MacLeod and Malcolmson [10].)

- *Other types of investment* Suppose S's (B's) investment does not only affect S's (B's) payoff, but also B's (S's) payoff. This changes the results of the model. As an example, consider the extreme case $v = v(s, \theta)$, $c = c(b, \theta)$. Without a contract, with fifty/fifty bargaining, underinvestment occurs. With a fixed-price contract however, both parties will not invest at all. The fixed-price contract is therefore worse than no contract. It can be shown that there is no contract that does better than having no contract (Che and Hausch [5]).

2.4 Vertical Integration: The Bilateral Case

It is often said that integration can internalize externalities. But if this is true, why is not every firm integrating (eventually leading to a world consisting of only one firm)? One ad-hoc justification that can be given is that with increasing firm size administrative or bureaucracy costs rise. Further, it is possible that integration is not optimal, because Double Marginalization (section 2.1) may actually be beneficial for a firm. If retail prices are strategic complements, rivals may be less aggressive when the firm does not integrate. The explanation that will be discussed in more detail in this section is that integration does not shift all decisions. The reason is that the the owner of the integrated firm now becomes the manager of the firm, and many decisions are therefore still made by the same person.

Assume contracts are incomplete and integration does not shift all decisions (Hart [7], Chapter 2). Suppose there are two assets, where U is the upstream

asset (owned by the seller S) and D is the downstream asset (owned by the buyer B). As in the model of section 2.2, B and S can invest, and v and c are as before. No *ex ante* contracts can be written in this model. *Ex ante*, the parties can only trade assets. This can be seen as the most extreme form of incomplete contracts. Let A_i denote the set of assets owned by i (A_i can be empty), where $i = B, S$. Assume that the union of A_B and A_S is $\{U, D\}$ and the intersection of the two sets is the empty set. Integration gives one control over the asset(s) of the other firm (that is, the set of assets of the integrated firm is $\{U, D\}$), which affects the payoff in the case the two parties cannot reach a deal (this 'disagreement payoff' is assumed to depend upon the level of investment of the firm, the state of nature and the set of assets owned). It does *not* alter who is making the investment (since owners are changed into managers) and it does not change who works and who does not work (since the managers still have some market power; they will have to agree to work). Further, assume that the joint surplus of trade is strictly greater than the joint surplus of not trading, that is, trade is always efficient; for both firms, the marginal revenue of investment is strictly larger with trade than without, and is weakly larger when the firm holds more assets; and the surplus of bargaining is split fifty/fifty.

The first-best solution is analogous to that of section 2.2. However, an inefficiency occurs. First, note that trade is always efficient, so the parties will always agree to trade. It can be shown that the sellers payoff increases when an asset is shifted from B to S. Now look at the investment phase. From the first-order conditions for b and s, several conclusions can be drawn:

- each party's optimal choice is independent of its rival's choice;
- underinvestment occurs;
- the more assets are owned by a firm, the higher the level of investment of the firm.

Suppose now that initially, $A_S = \{U\}$ and $A_B = \{D\}$, but the upstream asset is shifted to the buyer. Then B's investments will go up, whereas S's investments will go down. Therefore, it is not obvious that they will integrate.

In some special cases, this trade-off (almost) disappears, and integration is strictly improving the situation.

> **Proposition:** *If only one party, say party i, invests, then it is optimal to have $A_i = \{U, D\}$, $i = B, S$.*

Clearly, if both parties invest but one party's investment has almost no effect, integration will also be optimal.

> **Proposition:** *Suppose that S is* essential *in the sense that B's disagreement payoff is independent of the set of assets owned, then it is optimal to set $A_S = \{U, D\}$.*

The reason for optimality of vertical integration in this situation is that there is no effect on b of a change in A_B. Of course, this proposition also holds with B and S reversed.

> **Proposition:** *Suppose U and D are perfectly* complementary *assets in the sense that owning one of the assets instead of none does not increase the disagreement payoff (that is, if you do not own both assets, it does not help you to own an asset), then it is optimal that either B or S owns both assets.*

The following proposition shows a case in which it is clearly optimal *not* to integrate:

> **Proposition:** *Suppose assets are* independent *in the sense that both B and S are specialized in using one of the assets, and shifting the other asset towards the firm does not change the firm's disagreement payoff, then it is optimal to set $(A_B, A_S) = (\{D\}, \{U\})$.*

Two main conclusions can be drawn from the model. First, predictions of ownership forms for specific situations can be derived. Second, it shows a general philosophy on vertical integration, saying that integration is not always optimal.

3 Multilateral Settings

The simplest way to model multilateral relationships in vertical contracting is to assume that there are now two buyers and one seller, or two sellers and one buyer. The introduction of a third party introduces externalities that lead to inefficiencies. That is, in situations where two parties would reach the first-best (efficiency), three parties suffer from an inherited inefficiency. This is explained in section 3.1. Section 3.2 shows the effects of vertical integration in the presence of two buyers, and section 3.3 discusses exclusive dealing contracts.

3.1 Ex Post Bargaining

Assume there are two sellers, S_1 and S_2, and one buyer, B, and $x_i \geq 0$ is the number of units sold by S_i to B. Thus, more than one unit of the product can be traded now. The production cost of each seller as well as the consumer valuation depends on both x_1 and x_2, that is, $c_i = c_i(x_1, x_2)$ for $i = 1, 2$, and $v = v(x_1, x_2)$.

Suppose B makes a private offer to each seller of the form (x_i, T_i), where T_i is the trade payment. The private information may lead to multiple equilibria. Assume $v(\cdot)$ is additive:

$$v(x_1, x_2) = v_1(x_1) + v_2(x_2)$$

Hart and Tirole [9] consider the special case where $c(x_1, x_2) = c(x_1 + x_2)$. Assume passive conjectures; look for a Perfect Bayesian Equilibrium such that S_i's belief about S_{-i}'s offer is unaffected by S_i's offer. In equilibrium, both offers (x_i^*, T_i^*) are accepted. The buyer has to be reducing the payoff of both sellers to zero, because otherwise the buyer could raise T_i for buyer S_i who's payoff is positive. The maximization problem for the buyer given the equilibrium offer to S_2 is given by

$$\max_{x_1} v_1(x_1) + v_2(x_2^*) - T_2^* - c_1(x_1, x_2^*)$$

which is equivalent to

$$\max_{x_1} v_1(x_1) - c_1(x_1, x_2^*)$$

which is exactly the bilateral maximization problem. From this, it is clear that in any equilibrium, bilateral bargaining occurs *ex post*. Efficiency would require solving the problem

$$\max_{x_1, x_2} v_1(x_1) + v_2(x_2) - c_1(x_1, x_2) - c_2(x_1, x_2)$$

Therefore, there is an inherited inefficiency in each equilibrium of the two-sellers problem, whereas in the case of no externalities (that is, only one seller), there would be efficiency.

A different approach assumes that the sellers make offers to the buyer. In that case, there are no externalities and the efficient (first-best) quantities result. Another approach considers alternating offers, also with no externalities (Bolton and Whinston [3]).

3.2 Vertical Integration: The Multilateral Case

Now assume that there are two buyers, B_1 and B_2, and a single seller S that has one unit of the product to sell. Section 3.2.1 concentrates on the *ex ante* investment effects of vertical integration (Bolton and Whinston [4]). An approach of integration based on its *ex post* effects (Hart and Tirole [9]) is discussed in section 3.2.2.

3.2.1 Ex Ante Investment Effects

Assume no production cost and assume the two buyers do not compete on the *output* markets. Each buyer's valuation is a function of his investment level given the state of nature. Note that there are no externalities in this model. In the first-best solution, the highest valuer gets the good.

Consider the non-integration case. First, b_1 and b_2 are chosen, then the state of nature is realized and finally, the buyers make an offer to S. Each buyer earns the difference between his valuation and the valuation of the other buyer if this amount is positive, and zero otherwise. The marginal return of investment is obviously 100 % of the amount invested if trade occurs, and 0 % if trade does not occur for this buyer, which is exactly what it should get in the first-best. Therefore, non-integration leads to efficient investment (assuming positive investment).

What happens when B_1 and S merge? How much does B_2 have to pay to obtain the good in this situation? B_2 must pay the opportunity cost, which is equal to the valuation of B_1 and which depends on b_1 and the state of nature. B_2 will only buy the good if its valuation is greater than B_1's valuation. The allocation of the good under vertical integration of B_1 and S is therefore the same as under non-integration. The payoff for B_2 also seems to be the same as before. Integration, however, leads to overinvestment by the integrated firm. Even if B_1 will never buy the good the firm has an incentive to invest (set $b_1 > 0$) because this raises the amount that B_2 has to pay. Once the investment shifts, it is less often efficient for B_2 to buy and his payoff decreases. This shows that integration raises the joint payoff of B_1 and S, although non-integration is efficient (Bolton and Whinston [4]).

3.2.2 Ex Post Effects

Assume that the two buyers are homogeneous Cournot competitors facing the inverse demand function $p(X) = p(x_1 + x_2)$, where x_1 and x_2 are the

quantities bought by B_1 and B_2. There is no investment and no uncertainty, but there are externalities because the valuation of each buyer B_i is $p(X)x_i$ and therefore depends on x_{-i}. These externalities lead to bilateral maximization, as in section 3.1. Assuming $c = \tilde{c}x_1 + \tilde{c}x_2$, where $\tilde{c}$ is a constant, this implies that x_i^* is a solution to

$$\max_{x_i} p(x_i + x_{-i}^*)x_i - \tilde{c}x_i$$

that is, the equilibrium quantities are the Cournot-duopoly equilibrium quantities.

By integrating with B_1, S can restore the monopoly profit (which is higher than the Cournot duopoly profit). After integration, only B_1 buys from S, and because of the monopoly, the consumers are worse off.

3.3 Exclusive Dealing

An exclusive dealing contract is a contract between a buyer and a seller that prohibits one party to the contract from dealing with other agents. There are two ways of modelling exclusive dealing contracts. First, supplier S can have a first-mover advantage over the external source E, and the buyer B may give S an exclusive. Second, S and E both write contracts, of which exclusivity may be an element. Here, consider the first case.

3.3.1 The Chicago View

Assume S has fixed unit production cost $\overline{c}$. B's valuation v follows the distribution given by $f(v)$, and the quantity B wants to buy is defined by $x(p) \equiv Pr\{v > p\} = 1 - F(p)$, where $F(\cdot)$ is the cumulative distribution function. E has fixed unit production cost $\underline{c} < \overline{c}$, but when it enters, it has to pay an entry cost F. Assume that $(\overline{c} - \underline{c})x(\overline{c}) > F$.

B and S can sign an exclusive contract; that is, S makes a take-it-or-leave-it offer to B of an amount in return for signing. Then, E can enter. If it does, it pays the amount F. There are two possibilities. If an exclusive is signed or E does not enter, S sets the price equal to the monopoly price

$$p^M = \text{argmax}(p - \overline{c})x(p)$$

and earns the monopoly profits. If no exclusive is signed and E enters, E makes sales at price $\overline{c}$, making a profit of $(\overline{c} - \underline{c})x(\overline{c}) - F > 0$, and S makes

no sales (because of Bertrand competition). To see what happens, solve the model backwards.

S can deter entry by writing the exclusive. But how much does S have to pay to B to get the contract signed? Note that the following two situations have to be compared: monopoly position of S where S's constant unit production cost is $\overline{c}$; and E selling at a price $\overline{c}$. This shows that S has to pay the monopoly loss of consumer surplus to B. However, a well known result from monopoly theory is that this loss of consumer surplus is greater than the monopoly profits that S earns. Therefore, the seller will not pay that amount to B, and the conclusion of the Chicago model is that in equilibrium, no exclusive is signed, and exclusive contracts are not used for anti-competitive purposes. This conclusion has important implications for policy. However, other models lead to different conclusions.

3.3.2 Creating a Barrier to Entry

Aghion and Bolton [1] present a model that leads to a different conclusion. In their view, an exclusive dealing contract *can* be used for anti-competitive purposes. Partial exclusion can, according to their model, lead to rent extraction from the external source E.

Assume at most one unit of the good is demanded; the buyer's valuation is $v = 1$, the cost of production of S is $c_S = \frac{1}{2}$ and that of E is c_E, which is uniformly distributed on the interval [0.1]. The main difference with the previous model is the kind of contract that can be signed *ex ante*. S offers B a contract that specifies the price p_1 if B buys, and the price (or penalty) p_0 if B does not buy from S ($p_1 \geq p_0$). After B has decided whether or not to sign the contract, E observes the realization of c_E and decides whether to enter. Then, if E enters and a contract was signed, E names a price p_E and B decides who to buy from; if no contract was signed, E and S make simultaneous offers.

The first-best solution assumes no contract and implies that E makes the sale if and only if $c_E \leq \frac{1}{2}$. If $c_E > \frac{1}{2}$, E does not enter, S sets the monopoly price $p_S = 1$ and the consumer surplus for B is zero. If $c_E \leq \frac{1}{2}$, E enters and Bertrand competition leads to a price of $p_E = \frac{1}{2}$ and a consumer surplus equal to $v - p_E = \frac{1}{2}$. Therefore, the expected value of S's profit as well as the expected consumer surplus equal $\frac{1}{4}$.

With the contract, if E enters, the effective cost of buying from S is $p_1 - p_0$, and the cost of buying from E is p_E. E makes the sale if and only if $c_E \leq p_1 - p_0$, and if E makes the sale, the price will be $p_E = p_1 - p_0$. This shows

that if $p_1 - p_0 = \frac{1}{2}$, the outcome is identical to the case of no contract. The key question is whether there is a contract that raises the joint payoff of B and S. If so, S will offer B the contract, such that B still earns $\frac{1}{4}$ and S will earn all the extra payoff. Consider the contract that earns B and S together the most. Their total payoff can be written as

$$\Delta(1-\Delta) + \frac{1}{2}(1-\Delta)$$

where $\Delta \equiv p_1 - p_0$. Maximizing this payoff over Δ gives the optimal value $\Delta^* = \frac{1}{4}$. Compared to the case of no contract (equivalent to setting $\Delta = \frac{1}{2}$), the optimal solution implies commitment to a lower effective price; E will enter less often. However, complete excluding ($\Delta = 0$) is useless: it leads to the same payoff for B and S as in the case of no contract.

3.3.3 Externalities in the Chicago Model

Consider the original Chicago model (section 3.3.1), but now assume two buyers. First, S offers x_1 (the amount S will pay B_1 if he accepts the offer) to B_1 and B_1 accepts or rejects the offer. Then, S makes an offer (x_2) to B_2 and B_2 can accept or reject it. Then, as in the original model, E decides whether or not to enter. Assume that

$$2(\overline{c} - \underline{c})x(\overline{c}) > F > (\overline{c} - \underline{c})x(\overline{c})$$

The first part of the equation shows that when no exclusives are signed, E enters, and the second part shows that when at least one exclusive is signed, E does not enter. To find the equilibrium, again solve backwards.

First, consider B_2's decision. If B_1 has accepted the offer, there will be no competition and B_1 will sign if $x_2 \geq 0$. If B_1 has not accepted, B_2 signs if x_2 is greater than or equal to the loss of consumer surplus from monopoly. Now look at S's decision when facing B_2. If B_1 has accepted, S offers $x_2 = 0$. If B_1 has not accepted, S will offer x_2 equal to the loss of consumer surplus of monopoly, since S can now earn two times the monopoly profits when deterring entry (which can reasonably be assumed to be greater than the loss of consumer surplus). From this, it is clear that exclusion will happen with probability one, caused by the externality introduced by the additional buyer. What does B_1 decide? Since both signing and not signing (in that case, B_2 signs) will lead to monopoly, B_1 is willing to sign for any $x_1 \geq 0$. From this version of the Chicago model, it can be concluded that full exclusion is optimal.

4 Conclusions

This overview shows that there are many different ways of modelling vertical contracting, leading to different conclusions and therefore different implications for policy. One should bear in mind that many of the conclusions depend critically on the specific assumptions made. An important remark that should be made here is that the models do not only describe vertical relationships *between* firms, but also *within* firms, for example between departments or units of the same firm.

Although small changes in assumptions can lead to different conclusions, there are some general, main lessons to be learned from the various models. For example, it is shown that integration is not always optimal. Further, although exclusive dealing contracts are often assumed to be used for anti-competitive purposes, it may well be the case that in equilibrium, they will not be used, or even more extreme, that they may be used for *pro*-competitive purposes, by protecting investment (Segal and Whinston [11]).

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Pierre Pestieau

"Political Sustainability of Redistribution and the Reform of Social Security"

Report by Corjan Brink, Wageningen Agricultural University

Introduction

The lectures of Pestieau dealt with the future of the 'Welfare State.' [1] In the Western economies, much of the discussion about the welfare state is not so much concerned with the existence of public expenditure programs, since it is considered as a part of our civilisation. The discussion concentrates on the size and the form of these programs. Most economists concentrate on the costs (charges) and benefits of the welfare state and the trade-off between equity and efficiency. In his lectures, Pestieau dealt with the issues of voting, political sustainability, and support for public expenditure programs.

In Europe, total public expenditures increased considerably since the 1970s. There are however huge differences between various countries. These differences are partly the result of differences in levels of GDP per head. The general increase in GDP per head in European countries during the past decades has been associated with increasing social spending. However, when plotting the level of public spending against GDP per head in the various countries, clearly there are several outliers. This can be explained by differences in preferences of the countries.

The two main sectors in total public spending are health and retirement. The effects of these programs on the poverty rate may vary between different countries. Although one should expect the poverty to be decreased by the WS, this is not necessarily the case. Moreover, it is not possible to draw conclusions about the effectiveness of public spending on the basis of the resulting poverty rate in a country, since the priority of a country does not have to be to fight

[1] In this report, with the concept of Welfare State I refer to the whole set of programs that is covered by public spending.

poverty. According to Pestieau (see, e.g., Casamatta, Cremer et al., 1997), public expenditure programs may have different objectives. They may aim at just a relief of poverty (minimal view which requires low payroll taxes) or at a reduction of the uncertainty faced by all individuals (more generous view which attracts more political support). Public spending programs can be distinguished with respect to their rate of redistribution. The universalistic ('Beveridgean') programs are based on flat benefits and consequently have a high degree of redistribution. The social insurance (' Bismarckian') programs are characterised by earnings related benefits. Therefore, it is important to look not only at the *size* of social expenditures (generosity), but also at the level of *redistribution*. The level of redistribution accounts for the difference between private and public provision of the good or service.

Political support for Social Insurance

In general in Europe, private insurance is much less important than social insurance. There are some outliers like Ireland and the UK that have a relatively high percentage of GDP spent on private insurance in relation to the percentage spent on social insurance. Epple and Romano (1996) describe a regime where a good (in their analysis health care) provided by the government may be supplemented by private purchases. They pose several questions concerning whether the government will fund provision of the good, what level of public provision will be chosen, and what will be the effect on aggregate consumption. Casamatta et al. (1997) deal with a social insurance possibly supplemented by a private insurance.

Concerning the choice of the level of public provision, Atkinson (1995) discusses the choice of a tax rate in the case of majority voting where everyone votes between two tax rates only on the basis of the resulting level of utility. In the case of single-peaked preferences for each individual, the median voter theorem [2] applies which states that the majority voting outcome reflects the preferences of the median voter (see also Rosen, 1995, ch. 7).

Epple and Romano (1996) develop a model that includes two goods, health services h (either publicly provided (g) or privately purchased (s)) and the numeraire good b. Income y is spent on paying taxes yt and purchasing b and s, so $b = y(1-t) - s$ and $g = t\bar{y}$ (government budget constraint) with $\bar{y}$ being the average income level. The level of g is determined by

[2] The median voter is defined as the voter whose preferences lie in the middle of the set of all voters'preferences.

majority vote and is the same for everybody. It is not possible for the individuals to sell a part of g in order to be able to purchase more of the numeraire good, so there will be some agents who are constrained by the public health program (they get more health services than is optimal and purchase zero units of s), while the other individuals are not constrained (they purchase supplementary health services s and to them public provision of g is equivalent to an income supplement).

Epple and Romano (1996) show that individuals with an income lower than the average income level prefer a positive level of government expenditure whereas individuals with a higher than average income achieve highest utility for $g = 0$. Therefore, according to the median voter theorem, equilibrium government provision of health services is positive if the median income is less than average and zero if the median income is more than average. This result is due to the redistributive effect of the public expenditures, which causes the tax price of health care to households with income less than the mean to be below the market price. The mixed regime (i.e. government provision may be supplemented by private market purchases) is preferred by a majority to the alternatives of market only and government onl provision. First, it includes the situation where health services can be obtained only privatel (i.e. $g = 0$). Second, under a mixed regime individuals with positive demand for private health services ($s > 0$) are better off than in a regime where private purchases are prohibited while those individuals with $s = 0$ are not worse off.

Epple and Romano (1996) also show that it is not always the voter with median income who determines the level of government provision. When the marginal rate of substitution between t and g increases with income not the voter with median income is pivotal, but the voter with income level y_l such that voters with income less than y_l plus voters with income greater than $\bar{y}$ constitute half of the population.

Casamatta et al. (1997) deal with the issue of voting, political sustainability, and support for social insurance. They analyse a setting where private insurance in addition to social insurance is potentially available, but may be prohibited. In their model they adopt a 'two-stage political economy approach'. At the first (constitutional) stage of the process an agreement is made about the type of the social insurance, and at the second stage decisions are made by majority voting about the actual tax rate and benefit levels (see also Atkinson, 1995). Moreover, social insurance is financed by a proportional payroll tax and there are three types of individuals (1, 2, and 3) with different income levels ($w_1 < w_2 < w_3$). All individuals have identical preferences over disposable income and insurance benefits and they all face the same

probability to have to rely on insurance benefits (although in reality there seems to be a negative correlation between income and the probability to become sick, unemployed, and disabled). The link between the benefits and the contributions is represented b α, where α = 0 indicates that each individual will receive the same benefits and $\alpha = 1$ indicates that there is no redistribution of income. It is assumed that private insurance is costlier than public insurance. The rate of return on private insurance is constant while the rate of return on public insurance decreases with income. If α becomes large enough individuals with high income will also choose public insurance.

The level of α is determined at the constitutional stage in the decision making process. In the Casamatta et al. (1997) paper two different possible objectives are considered. First, with the Rawlsian objective the government maximises utility of the worst off individual with respect to α taking into account the direct impact of an increase in α as well as the indirect impact through the payroll tax. Second, with a utilitarian objective the constitutional problem consists in determining the α that maximises the sum of utility of all individuals. They show that if private insurance is inhibited, with a Rawlsian objective $\alpha = 0$ if the median income is below average, whereas $\alpha > 0$ if the median income is above average. With a utilitarian objective it may be optimal to set $\alpha > 0$, even if the median income is below the average income level.

For a given α the tax rate is chosen by majority voting, so we have to identify the median voter and determine his preferred tax rate. Casamatta et al. (1997) show that when private insurance is prohibited the preferred tax rate decreases or increases with α for individuals with above-average and below-average incomes respectively. Moreover, individuals with high incomes tend to prefer higher tax levels than individuals with lower income (this is because social insurance is the only source of income in the bad state of nature). In this case, the median voter is simply the individual with median income, i.e. individual 2, and depending on whether the w_2 is below or above average income the voted tax rate will be increasing or decreasing respectively.

When the individuals are allowed to purchase private insurance, different situations can be distinguished, depending on the value of α. Individuals with below average income always prefer social insurance to private insurance regardless of the value of α. For individuals with higher than average income we can determine a certain level of α for which they are indifferent between social and private insurance. If the actual value of α is below that

level, these individuals prefer private insurance and their preferred payroll tax is zero whereas for higher values of α a positive tax rate is preferred. Now there is a divergence between the distribution of income and the distribution of choice, i.e. the median voter is not necessaril individual 2. If w_2 is lower than the average income, the poor individual is the median voter for values of α for which the rich individual prefers a zero tax. Individual 2 has the decisive vote for values of α for which the rich individual prefers a positive tax rate. If w_2 is higher than the average income, both individuals 2 and 3 prefer a zero tax rate for low values of α. Consequently, for these low values of α the voting equilibrium is a zero tax since individual 2 is the median voter. For higher values of α the rich individual still prefers a zero tax rate, whereas the individuals 1 and 2 prefer a positive tax rate. For these values of α the poor individual has the decisive vote. If α is larger than the indifference level of the rich individual, all individuals prefer a positive tax rate and the median voter is individual 2.

The determination of α in the constitutional stage if private insurance is available again depends on the level of w_2 with respect to average income. With a Rawlsian objective, if w_2 is below average income, α is set zero, since then the poor individual is the median voter and nothing can be gained from setting $\alpha > 0$. If w_2 exceeds average income, it is always optimal to set a positive level of α, but if α becomes larger than the value for which individual 2 is indifferent between social and private insurance, the economy moves away from redistribution. Therefore, α is set at the indifference level of individual 2. With a utilitarian objective, it is not possible to determine the optimal value of α analytically.

From the above analysis, we can conclude that allowing for private insurance reduces the size of the social insurance program just on the base of political voting. On the other hand, the welfare of the poor individuals increases due to the availability of private insurance, although they do not purchase private insurance. Moreover, private insurance in itself tends to increase welfare since it gives individuals an additional option. This corresponds with the conclusion of Epple and Romano (1996) that a mixed regime dominates both exclusive regimes.

Voting for Social Security

In most European countries social security programs are organised as a pay-as-you-go (PAYG) system (i.e. the workers in one period pay for the benefits of the retirees in the same

period). The payroll tax is determined by the dependency rate (the ratio of the number of retirees to the number of workers) and the replacement rate (the ratio of the retirement benefits to the wage rate). The problem European countries are facing nowadays is that the dependency rate is increasing since people are living longer, so the length of retirement in good health increases, while the replacement rate is not modified. This means that the payroll tax has to be increased.

Under the PAYG system pension benefits to which a retiree is entitled are not directl related to his past contributions. Therefore, current taxpayers have an incentive to misrepresent their preferences by voting for a lower tax rate now and a higher tax rate upon their retirement, unless they are convinced that there will be no other voting opportunities within their lifespans or the current tax rate will prevail in all future voting processes (Hu, 1982).

Boadway and Wildasin (1989) analyse the political process behind social security. Using a model of overlapping generations, they study the determinants of the existence and level of social security programs and the dynamic evolution over time. The level of benefits to retirees (β) is the only policy choice variable in the model and it is determined by majority voting. It is assumed that the social choice of β will be the most-preferred level of the median voter (according to the median voter theorem, see also above), who maximises his remaining lifetime utility (or consumption) in the belief that, once chosen, the value of β will remain unchanged for the remainder of his lifetime. The age of the median voter is lower than but close to the age of retirement.

Boadway and Wildasin show that, if it is not possible to borrow against future social security benefits and if this constraint is binding (which is only the case if β is larger than the after tax wage), the ideal level of social security benefits for the median voter will not be the efficient level of β, since this level will only be chosen by an individual who is at the beginning of his active life.

Pestieau applied the model developed in Casamata et al. (1997) to the problem studied b Boadway and Wildasin (1989). He distinguishes three types of individuals with different levels of productivity, h_i, and income, w_i. (i = 1, 2, 3). The three groups are assumed to be of the same size and to grow at the same rate n. People start as workers and in the next period they retire. Two social security systems are analysed, the PAYG and the fully funded (FF) system. The average rate of return to the social security equals n with PAYG and r (interest rate) with FF. They assume $r \geq n$. Consumption by the young, c, equals after tax wage minus

private savings. Consumption by the old, d, equals private savings (including the proceeds) plus the social security benefits. Both the old and the young have to vote for the payroll tax level, where the old are only interested in d whereas the young are interested in both c (which is reduced by a higher tax level) and d (which increases with a higher tax level).

First, with a PAYG system, retirees of all three groups choose a payroll tax level $t = 1$. The working generation maximises its utility comparing the return on social security with that on private saving. For all values of α, the rich workers choose a zero tax level because of (1) the higher rate of return on private saving ($r > n$) and (2) the redistribution. For each group, we can again determine a level of α for which they are indifferent between a positive tax and saving. If w_2 is below average income, the workers 1 and 2 choose a positive tax and no saving for values of α below their indifference level of α and conversely for higher levels of α. The median voter theorem holds because of single peaked preferences. As in the previous section, the median voter is not necessarily the individual with median income. Depending on the value of α, the workers of type 1 or the workers of type 2 are the decisive voters. If α exceeds the indifference level for the worker of type 1, the equilibrium tax will be zero.

Now, we consider the funded system. In this case there is no intergenerational redistribution. The retirees are indifferent about the payroll tax level, so only the young are voting. Since $r = n$, for $\alpha = 1$ the workers are indifferent between private and public schemes. If $\alpha < 1$, the workers of type 1 and 2 prefer the collective scheme, and the individuals of type 3 prefer the private scheme.

If both systems are compared, assuming that $r = n$, with PAYG the tax rates are higher than with FF. Under the Rawlsian criterion FF is preferable to PAYG or conversely, depending on the degree of substitutability between consumption in the first and the second period. With a utilitarian criterion FF is consistently preferred to PAYG. Consequently, there is no ideal system.

Reforming Social Security

In many countries pensions are organised in a PAYG system. Because of rapid growth in population and productivity in the past decades, past and current retirees have received much more back from social security than they contributed, even if we allow for a reasonable rate of return (Belan and Pestieau, 1998). However, because of the ageing of the population several

countries are planning to shift to a FF or privatised system to avoid an non sustainable pressure on public expenditures. Such a shift will have considerable short-run costs. The transition generation has to be 'sacrificed' in the sense that they have to pay the payroll tax for the benefits of the current retirees as well as the contribution to the fund for their own retirement.

Belan et al. (1998) argue that to avoid the double burden on the transition generation the contributions paid when the PAYG system was introduced should have been kept and invested instead of transferring it as a to a generation of retirees who had not contributed to it. Some economists (e.g. Feldstein and Samwick, 1996) state that the transition from a PAYG to a fully privatised system of individual retirement accounts can be done without sacrificing the transition generation. They argue that, although the short-run costs are high, the welfare gains in the long-run are so huge that the temporary loss is bearable.

Belan and Pestieau (1998) however argue that gains are not possible with the transition from a PAYG to a fully funded system *per se, ceteris paribus.* Gains are only possible if other changes are also made, such as a change in the rate of redistribution. However, such a change does not justify a transition from PAYG to FF since these gains can also be made within the PAYG system. In academic discussions or political debates the comparison between FF and PAYG approaches often bears these other dimensions such as the rate of redistribution of those two alternatives in stead of the fundamental difference between PAYG and FF, the former not being funded and the latter being funded.

If the government does not want the present generation to bear a double burden, she has to borrow money to pay for the pensions of the retirees who did not yet (fully) contribute to their fund. This amount of money is just equal to the amount of money the transition generation would have to pay. The transition is just shifting from implicit to explicit debt and the debt is equivalent to the burden of the PAYG system.

Belan and Pestieau (1998) show that it is possible to get a Pareto-improving reform in the case of endogenous labour supply (in which case the key element of the reform is not so much the shift from an unfunded to a funded system but more the shift from a distortionary to a non- distortionary tax scheme), in the case of endogenous economic growth (where the benefits result from a subsidy on savings that could also have been introduced with a PAYG system).

Optimal Redistribution with Social Insurance

In many countries, governments try to achieve a redistribution of income. Governments redistribute not so much by taxation, but mostly by providing health services, education and social insurance. In a first-best world a purel redistributive tax and not social insurance should not be used for the objective of redistribution. In such a world, the only reason to introduce social insurance is because of the economies of scale. However, in a second best world it can be optimal to use the mechanism of social insurance to redistribute income over individuals.

Cremer and Pestieau (1996) study the role of social insurance in redistribution. The use a model with two individuals with different productivity levels. The individuals are also different with respect to their probability of incurring a loss, for example becoming disabled, unemployed, or sick. Part of the potential loss is covered by social insurance while the rest may be covered by a private insurance purchased at the insurance market. Risk averse agents will choose full insurance, in which case there is no uncertainty for the agent anymore.

The government only observes labour income, but not the wage, labour supply, and the probability of incurring a loss of each individual. The government chooses the optimal income taxation level and the proportion of social insurance that maximises welfare. Cremer and Pestieau (1996) show that the optimal tax rates and redistribution levels depend on the sign of the correlation between ability and risk.

Conclusions

On the basis of the discussion above here some main conclusions will be given. First, pure redistribution is not politically sustainable. Second, supplementary private schemes are most often desirable. Third, social security benefits chosen by majority tend to be excessive particularly with a pay-as-you-go system. Fourth, reforming social security from an unfunded to a fully funded system without sacrificing a generation and without changing the rate of redistribution is neutral. Finally, in a second-best world social insurance can be used for redistribution purposes even when optimal income taxation is available.

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