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Preface

Autumn is the busiest period for NAKE. When I am writing this, we are in the middle of the second block of Utrecht courses. Yet, we still have to round off the last affairs of the successful NAKE Day in October where more than 70 papers were presented. And, apart from completing this *NAKE Nieuws*, we are busy preparing the upcoming workshop in Maastricht. As you can see from the programme elsewhere in this issue, it is (again) going to be an interesting workshop. At this workshop the following students will receive their diploma:

Michèle Belot ..... KUB
Marrit van den Berg ..... WAU
Corjan Brink ..... WAU
Marurice Bun ..... UvA
Thomas Dohmen ..... UM
Alexei Goriaev ..... KUB
Thomas de Graaff ..... VU
Bas van Groezen ..... KUB
Ben Kriechel ..... UM
Philipp Maier ..... RUG
Sander Onderstal ..... KUB
Joulia Ossokina ..... EUR
Nico Polman ..... WAU
Linda Toolsema ..... RUG
Federica Teppa ..... KUB
Jeroen van de Ven ..... KUB
Lucio Vinhas de Souza ..... EUR

I would like to seize the opportunity to already congratulate them with this achievement.

At the annual meeting of members at the NAKE Day, three new members of the Board of Management were elected: Eric van Damme, Ben Heijdra, and Maarten Janssen supersede Theo van de Klundert, Simon Kuipers, and Philip Hans Franses, respectively, who all resigned for various reasons. I would like to thank the outgoing members of the board for everything they did for NAKE. The change in the composition of the board also led to some changes in the division of tasks. Joan Muysken is still chairman, while Gerard van der Laan is the new secretary and Ben Heijdra has taken over the portfolio of treasurer.

One of the first things the new Board of Management did was deciding to award **Arie Kapteyn** the title of *Honorary Fellow* of NAKE at the occasion of his move from Tilburg University to the USA. This way, the board wants to express its gratitude to Arie, who almost 15 years ago was the founding father and first chairman of the Network. It was Arie who convinced Roel in 't Veld, then Director of Universities at the Ministry of Education and Sciences, of the soundness of the network concept and obtained the first f 250.000 and a chair. This enabled the appointment of the first director and thus formed the starting point for the Network of Quantitative Economics (NKE), which in 1991 merged with the Network of General Economics to become the Netherlands Network of Economics (NAKE).

In this issue of *NAKE Nieuws* you find three reports on the lectures during the Groningen workshop in June. The first report is by **Jan-Tjeerd Boom** (University of Groningen), who writes on the lectures by Ernst Fehr titled Behavioural Microeconomics. Fehr illustrated that many experiments support the idea that besides the Homo Economicus there also exists a Homo Reciprocans. He argued that to model the behaviour of this 'cooperative man' the concept of rationality should not be given up. The standard assumption of selfishness should be replaced, however, by an assumption of inequity aversion.

Bas van Groezen (Tilburg University) wrote a very concise report on the lectures of Oded Galor who, among other things, presented a model describing economic growth and demographics since Adam and Eve. Hans-Werner Sinn argued in his lectures on systems competition that if governments stepped in where markets failed, reintroducing markets through the backdoor of systems competition will again result in market failure. **Ben Kriechel** (Maastricht University) nicely conveyed this message in his report on Sinn's lectures.

Finally, I wish you all a merry Christmas and a happy New Year!

Lex Meijdam

NAKE WORKSHOP

11 - 15 December 2000

Maastricht University

During the week from Monday 11 December to Friday 15 December 2000 the Netherlands Network of Economics (NAKE) will organize a PhD. workshop. Four distinguised

and public economics. Each course consists of five lectures spread out over five days.

Courses

Kaushik Basu, Cornell University, Ithaca, USA
'Rationality and Social Norms'

Guido Imbens, UCLA, Los Angeles, USA
'Causal Inference and Program Evaluation'

Gerard Roland, Université Libre de Bruxelles, Belgium
'Transition and Economics'

Hyun Song Shin, Nuffield College, Oxford, United Kingdom
'Financial Crises: Theories and Models'

For more information see: http://few.kub.nl/nake/workshop.htm

PROGRAMME NAKE WORKSHOP
MAASTRICHT, 11-15 DECEMBER 2000

Monday December 11	**Tuesday December 12**
10.00 – 11.00 registration/coffee 11.00 – 12.15 Roland 12.15 – 13.30 Lunch 13.30 – 14.45 Shin 15.00 – 16.15 Imbens 16.30 – 17.45 Basu 17.45 – 19.15 Welcome reception	09.00 – 10.45 Imbens 11.00 – 12.45 Shin 12.45 – 14.00 Lunch 14.00 – 15.45 Roland 16.00 – 17.45 Imbens
Wednesday December 13	**Thursday December 14**
09.00 – 10.30 Basu 10.45 – 12.15 Shin 12.15 – 13.30 Lunch 13.30 – 15.00 Imbens 15.15 – 16.45 Roland 16.45 – 18.15 Private consultations	09.00 – 10.45 Basu 11.00 – 12.45 Roland 12.45 – 14.00 Lunch 14.00 – 15.45 Shin 16.00 – 17.45 Basu 20.00 Workshop dinner
Friday December 15	
09.00 – 10.30 Shin 10.45 – 12.15 Roland 12.15 – 13.30 Lunch 13.30 – 15.00 Basu 15.15 – 16.45 Imbens 16.45 – ... Closing drinks	

Note: All lectures except those on Monday include a short (5-10 minutes) break.

Behavioral Microeconomics

Ernst Fehr

Report by Jan-Tjeerd Boom, University of Groningen

1. Introduction

Mainstream economics views human beings as being exclusively self-interested. Although many people, including economists, have not felt at ease with this assumption, it was used because it predicted human behavior reasonably. Only lately have economist begun to seriously analyze peoples real behavior in economic situations.

Much of the analysis is done through experiments in which subjects are faced with economic situations. A number of experiments have confirmed the theory of rational, self-interested human behavior. However, in many cases, different behavior was found. In general, people are much nicer and much more cooperative than predicted by the self-interested model. On the other hand are people nastier and even brutal in response to hostile actions than the theory predicts.

In effect, much of human behavior seems to be reciprocal. This means that people are nice to those that are nice to them, while they are willing to punish, even at their own expense, those who do not cooperate.

In his lecture, Fehr gave an overview of some experiments and there outcomes. He first discussed several game theoretic models on which some experiments are based. From this, he derived some basic determinants of human behavior in economic situations and developed a theory that could explain this behavior. Finally, in his last two lectures, he discussed the implications of the design of contracts on behavior of the subjects and tried to explain the evidence with his theory of inequity aversion.

In this report, first a short introduction to laboratory experiments is given. After this, in section 3, an overview of some experiments is given and the theory of inequity aversion is discussed. In section 4 contracts are discussed, and finally in section 5 some conclusions are given.

2. Laboratory Experiments

Fehr defines laboratory economic experiments as follows:

> In laboratory economic experiments, real subjects make decisions in a controlled environment. They are paid real money according to the implemented payoff functions and according to their decisions and – in an interactive situation – according to the decisions of the other subjects.

Doing such experiments has several advantages above observing economic behavior in 'the field'. First, the endogenous and exogenous variables of the economic model can often be measured unambiguously. One reason for this is that there are much fewer unobservable variables. Furthermore, there are no causality problems because 'ceteris paribus' changes can be implemented.
Second, the experimenter often knows the theoretical equilibrium exactly. Therefore, equilibrium and disequilibrium actions can be explicitly observed. This also means that the adjustment process can be explicitly observed and examined.
Third, the experimenter controls the information conditions and the exogenous stochastic processes. This factor is especially important for all models of asymmetric information.
Fourth, the experiment is replicable. Anyone who questions the evidence can replicate the experiment.
Experimental economics is however not without flaws. One criticism is that the setting of the experiment often is very different from the every day experience of the participants. They might therefore react very differently during the experiment than they would in a real economic situation.
A second problem can be that the participants try to react in a way preferred by the experimenter. Even if the experimenter does not explicitly give information on how he expects the results will, or should, be, participants can sometimes find out about this anyway.
Thirdly, the stakes in the experiments are often very low. Most experiments are conducted in industrialized countries where wages are high. The rewards of the experiments are often not more than $10 to $25. It is argued that other incentives than selfish ones may prevail at such low payoffs. Fehr has taken account of this

criticism in many of his experiments by conducting them both in industrialized countries and in developing countries with the same monetary reward. In developing countries, this often means that the stakes are the equivalent of one or more months' wages.

3. Fairness, Competition and Cooperation

The model tested is the standard rational actor model (SRAM), which assumes that economic actors have completely selfish preferences, an unbounded ability to find the best alternative and posses sequential rationality. As the name already says, this is the standard model used in many parts of economics and it can be found in many standard textbooks (see Varian (1992) and Mas-Colell et al. (1995)).
Fehr and Schmidt (1999) review a number of experiments. Some of the models tested confirm the SRAM, while others do not. To explain their empirical findings, they present a new theory on the behavior of economic actors (see also Rabin (1993)). Below I will discuss the different models shortly.

3.1 The Tested Models

Ultimatum Game. The ultimatum game is a two stage game with two players. In the game, one player gives a proposal about the division of a surplus of fixed size. The second player can either accept or reject the proposal. In stage 1, player 1 proposes a share $s \in [0,1]$ to player 2. In the second stage, player 2 either accepts or rejects player 1's offer. The monetary payoffs for both players are (0,0) in the case player 2 rejects the offer and (1-*s*,*s*) if player 2 accepts the offer. The SRAM predicts that player 2 always accepts any $s>0$.
Fehr and Schmidt (1999) find that virtually no offers were made above $s=0.5$ and that in 70% of the cases, offers lay between 0.4 and 0.5 and offers below $s=0.2$ were rarely observed. In stark contrast to the predictions of the SRAM, responders frequently rejected very uneven proposals and the probability of rejection decreases with s. Fehr and Schmidt also found that proposers adjust their proposal to the toughness of the responder, i.e., if the responder is perceived as tough, the proposer offers him a larger share of the surplus. Roth et al. (1991) also found this result.

Market Game with Proposer Competition. In this two stage game, there are *n* players, of which *n*-1 are proposers and 1 player is the responder. In stage 1 the *n*-1 proposers simultaneously propose a share $s_i \in [0,1]$. In stage two, the responder either accepts or rejects the highest s denoted by s^h. The payoffs in both cases are as follows. In the case of rejection by the responder, the payoff is zero for everybody. If the responder accepts s^h, the responder's payoff is s^h, the payoff of the highest proposer is $1-s^h$ and is zero for all the other responders. The equilibrium outcome according to the SRAM is that all proposals are at $s=1$.
In this model, the SRAM is supported. In general, responders accept all $s^h>0.5$ and after a few periods there are many proposals at $s=1$. Furthermore, convergence to the equilibrium is quick.

Market Game with Responder Competition. The market game with responder competition is a three stage game with n players, of which *n*-1 are responders and 1 player is the proposer. In the first stage, player 1 makes a proposal $s \in [0,1]$. In the second game, the *n*-1 responders all individually accept or reject the proposal. If more than one responder accepts the proposal, a third stage is needed, in which nature selects one of the accepting players at random. The monetary payoffs are zero if no responder accepts the proposal. If at least one responder accepts the offer, the payoff of the proposer is 1-*s* and *s* for the selected responder. All other responders receive zero. The SRAM predicts that responders accept any offer $s \geq 0$ and therefore, the proposer offers $s=0$.
Although the predictions of the SRAM are not exactly matched, Güth et al. (1997) find results that come close. Specifically, Güth et al. (1997) find that after four periods, the average acceptance threshold is well below 5% of the surplus. Furthermore, after four periods all offers are below 25% of the surplus and the average offer is about 15% of the available surplus. An interesting finding is that one selfish responder triggers the equilibrium as predicted by the SRAM.

Public Good Game. In the public good game, n players decide simultaneously about their contributions $g_i \in [0, y]$ to the public good, where y is the amount of money available to every player. The monetary payoffs are defined as $x_i = y - g_i + a\sum g_j$, where $a<1<an$. This game is like the classic Prisoners' Dilemma. It does not pay for the individual to contribute to the provision of the public good. However, the

collective payoff would be maximized if all players spend all their money on the public good. The SRAM predicts that all players will free-ride and not donate to the public good.
This is also the result Fehr and Schmidt (1999) arrive at. During the initial periods, average contribution is between 40% and 60%. In the final periods however, the vast majority of subjects free-rides completely.

Public Good Game with Punishment. This game is two stage game. The first stage is equal to the normal public good game. In the second stage, players decide simultaneously whether to punish other players after they observed the contributions $g=(g_1,\ldots,g_n)$ of all players to the public good. The punishment player i inflicts on player j is denoted by p_{ij}. The cost of punishment is $0<cp_{ij}<p_{ij}$. The monetary payoffs are $x_i(g,p)=y-g_i+a\sum g_j-\sum p_{ji}-c\sum p_{ij}$. Note that punishing other players is not individually rational in this game. Hence, the SRAM predicts that players will free-ride and no player will punish.
Fehr and Gächter (1997) find that punishment occurs frequently. In most cases, the contributors to the public good punish the free-riders and the less a player contributes to the public good, the more he is punished. A very surprising finding is that 75% of the subjects contributes the maximum contribution y in the final period.

Gift Exchange Game. The gift exchange game is a two player game with a principal and an agent. The principal offers the agent a certain wage after which the agent either accepts or rejects the offer. If the agent accepts the offer, he receives the wage and exerts a certain effort, e. The payoff of the principal is given by $p=ge-w$, where w is the wage. The payoff of the agent is given by $u=w-c(e)$, where $c(e)$ is the cost of the effort level chosen by the agent. The SRAM predicts that the agent will exert the minimum effort.
In his lecture, Fehr showed that in the gift exchange game, 30% of the subjects act purely selfishly. However, many of the subjects do not behave purely selfishly. In many cases, the effort level of the agents increased in the wage level offered by the principal. This is an example of positive reciprocity, which in general means that people react positively to a positive deed of their opponent.

3.2 Theoretic Considerations

The experiments mentioned above and many others conducted in the past ten years suggest that there exists something as a 'Homo Reciprocans', i.e., cooperative behavior exists. This is not only true when the subjects know each other, but also when the subjects are total strangers. Furthermore, it is also confirmed under experimenter-subject anonymity. This is important with regard to the criticism given above that subjects unconsciously try to live up to the experimenter's expectations. As already mentioned, it is also confirmed when the stakes are rather high and under one-shot repetitions. Still, 'Homo Economicus' also exists. Many experiments suggest that a large fraction of subjects behave purely selfishly.

The interaction between the two different types is of some interest. Positive reciprocity, as in the gift exchange game, induces selfish types to be nice. Negative reciprocity, e.g. punishment for unwanted behavior, deters selfish types to behave opportunistically. This is shown in the public good game with punishment where cooperative subjects through punishment could induce selfish types to contribute to the public good. Finally, selfish types induce homo reciprocans to behave selfishly. In the public good game, one selfish type can induce the cooperative players to defect too.

These findings raise several questions. First of all, do we have to give up the selfishness assumption or the rationality assumption or both? If we give up the selfishness assumption, which motivational forces do we take into account? Several forms of bounded rationality can replace rationality, but which of these do we choose? And last but not least, how do 'non-selfish' motivations interact with bounded rationality?

Fehr suggests the following approach. He is reluctant to give up the rationality assumption, because this seems to explain much behavior in the final period of relatively simple games. At the same time he suggest the idea of inequity, or inequality aversion. Loewenstein et al. (1989) show that at least a fraction of the subjects dislike inequity relative to relevant comparison persons. The aversion against disadvantageous inequity is thereby much stronger that that against advantageous inequity.

Often altruism is given as one explanation for cooperative behavior. According to Fehr, altruism is in the domain of advantageous inequality. On the other hand, relative deprivation, or envy, in the domain of disadvantageous inequality.

4. Contracts

Another conclusion Fehr draws from the experiments mentioned above is that the economic environment, e.g. institutions and contracts, are decisive for what behavior subjects show. In this section, the effect of different contracts on the behavior of subjects will be discussed.

Fehr et al. (1998) and Fehr and Falk (1999) conducted an experiment in which they mimicked a labor market. The labor market was characterized by a large excess supply of labor. In thia case, the SRAM predicts a competitive equilibrium with low wages. Fehr et al. (1998) and Fehr and Falk (1999) found that the outcome depends on the contract offered to the employees. In the presence of complete labor contracts, i.e. contracts in which the effort is exogenously enforced, wages come close to the competitive equilibrium. However, with incomplete labor contracts, i.e. workers can reciprocate, wages stabilize far above the competitive equilibrium. Furthermore, with incomplete labor contracts, competition has no impact on wage formation.

This experiment shows that even with large unemployment, wages do not fall. This is the often documented case of downward wage rigidity. According to Bewley (1995), the main causes of downward wage rigidity have to do with employers' beliefs that other motivators than financial incentives are necessary, which are best thought of as having to do with generosity. Bewley also finds that managers claim that workers have so many opportunities to take advantage of employers that it is not wise to depend on coercion and financial incentives alone as motivators.

The findings made by Bewley (1995) show that most labor relations are based on incomplete contracts. In these contracts, compensation cannot be completely conditioned on workers' efforts and workers have discretion with regard to their effort choice. The result is a motivation problem: workers have an incentive to provide the lowest possible effort level that is compatible with firms' enforcement technology. The main questions can now be raised. Firstly, to what extend does

reciprocity help in overcoming the incentive problem? Secondly, to what extent do explicit economic incentives solve the incentive problem?

These questions are dealt with by Fehr et al. (1996) and Fehr and Gächter (2000). In the experiments, there are two kinds of players; 'firms' and 'workers'. In the first stage, firms make a contract offer existing of w, the wage level and $\hat{e}$, the expected level of effort. In the second stage, workers either accept or reject the offer. Upon acceptance, the workers choose their actual effort e, which can differ from $\hat{e}$. Hence, the contract (w, $\hat{e}$) is incomplete because w is not conditioned on e. Therefore, this experiment is called the trust treatment (TT). The monetary payoffs for the firms and workers are respectively:

$$p = 100e - w \qquad (1)$$

$$u = w - c(e) \qquad (2)$$

where $w \in [0,100]$. The prediction is that selfish players will choose the minimum effort level available, which is $e=e^{min}=0.1$, the corresponding equilibrium wage is $w=1$. This is also what the SRAM predicts.

The result of the experiments by Fehr et al. (1996) and Fehr and Gächter (2000) however differed from this prediction. In general much higher wages were offered and workers responded to this by exerting higher effort levels than the absolute minimum. Moreover, the higher the wage offered, the higher the effort of the workers. Hence, firms appeal to workers' reciprocity and many workers respond to this.

Does this change when economic incentives are used instead of appealing to reciprocity? This question was dealt with in the same papers as mentioned above. Now firms could make a contract offer existing of w, $\hat{e}$ and f. Here f is a fine, constrained by $0 \leq f \leq f^{\max} = 13$, collected by the firm, that the worker has to pay in case of verifiable shirking ($e<\hat{e}$). The workers, upon acceptance of the offer, choose the actual effort level e, which can diverge from $\hat{e}$. In the experiment, a random mechanism determined with probability 1/3 whether $e<\hat{e}$ was verifiable. This incentive contract is more complete than the one discussed above because f is conditioned on e. Therefore, this experiment is called the incentive treatment (IT). The SRAM predicts that a (selfish) worker will perform $\hat{e}$ if $(1/3)f \geq c(\hat{e})$. The maximum fine, f^{max}, determines the maximum enforceable $\hat{e}$.

The question now is, how the reciprocity and the economic incentives interact. As mentioned above, even without incentive contracts, reciprocity gives rise to $e>e^{min}$. For the incentive contract, the SRAM predicts that the real effort level will be equal to the maximum enforceable effort level. There are now two hypotheses. The first one, which is the standard hypothesis, is that financial incentives and reciprocity-driven voluntary co-operation are additive. The second one is that financial incentives crowd out voluntary co-operation.

Fehr and Gächter (2000) give several reasons why incentive contracts might crowd out voluntary cooperation. First of all, reciprocity driven voluntary co-operation may be based on the trust expressed by the principal. The threat to fine the agent is then incompatible with trust. Secondly, the threat to fine the agent may cause a hostile atmosphere. The threat to fine may also destroy the appeal to workers' reciprocity. Finally, principals may now use the stick instead of the carrot, i.e. there are not given any generous offers.

The experiments with the incentive treatment (IT) and trust treatment (TT) gave some interesting results. In the IT, principals rely less on the 'carrot' and more on the 'stick'. On average, wages, rents and desired effort levels are higher in the TT. In the IT, average fines were almost maximal with 69% of all IT contracts having maximal fines. Furthermore, average desired effort levels in the IT are not incentive compatible. In 59% of all IT contracts the demanded effort level is not incentive compatible. A second result is that on average, effort levels in the IT are lower than in the TT. Even in the incentive compatible IT contracts, a large fraction of the agents shirked. Furthermore, voluntary excess effort vanishes completely in incentive compatible IT contracts and in the majority of non-incentive compatible IT contracts, the agents chose the minimum effort level, while in the majority of TT contracts, agents chose non-minimal effort levels. A third result is that IT contracts are less efficient than TT contracts, while principals' profits are highest under incentive compatible IT contracts. The fourth result is that on average, principals in the IT did not offer lower rents at given desired effort levels and in both the IT and TT, principals increased the offered rent if they demanded higher effort levels.

The overall results are that incentive contracts cause a substantial crowding out of voluntary cooperation. This induces firms to make less generous offers and to rely almost exclusively on the ex-ante threat of punishment. Finally, overall efficiency in

the trust treatment is higher, but firm profits are lower, i.e., the introduction of the incentive caused a redistribution in favor of firms and lowered efficiency.

In another paper, Fehr et al. (2000) add another possible contract form; the bunus contract. In the bonus contract, the principal makes a contract offer $(w, \hat{e}, b^*)$. Now there is no fine, but firms can announce to pay a bonus, b^*, in addition to the base wage w, after the firms have observed the actual effort. Note that the bonus announcement b^* is not binding.

So now we have the trust contract, the incentive contract and the bonus contract. What Fehr et al. (2000) wanted to analyze was whether reciprocity affects contractual choices and hence incentive provisions and whether reciprocity gives rise to contractual incompleteness. The experiment conducted consisted of a series of one-shot interactions between principals and agent. The ranking in terms of contractual completeness is as follows. The incentive contract is the most complete, followed by the trust contract, the least complete is the bonus contract. Since the trust contract and the incentive contract were already discussed above, we will concentrate on the bonus contract.

The predictions of the SRAM for the bonus contract are that the actual paid bonus is zero, the actual effort level is e^{min}, only minimal wages are offered by firms in an implicit contract and that the payoffs are the same as in the trust contract. Finally, it is expected that principals prefer the incentive contract over the bonus contract.

The results from the experiments do however show a quite different pattern. First, principals strongly prefer the bonus contract to the incentive contract and the incentive contract over the trust contract. Furthermore, effort is much higher under the bonus contract and somewhat higher under the incentive contract compared to the trust contract. Principals' profits are also much higher under the bonus contract than under the incentive contract. Many principals honour high performance by bonus payments that are in fact conditioned on the effort level. Hence, the opportunity to promise and pay bonuses has a strong incentive effect.

As mentioned above, Fehr together with others has developed a theory on inequity aversion. The question is, whether this theory can explain the major behavioral patterns. In their paper, Fehr et al. (2000) show that they can for the most part. I will not give the technical details of this analysis, but only the intuition behind the explanations.

Inequity averse principals can and do condition the bonus payment on the observed effort level of workers. This provides strong pecuniary incentives for the selfish agents to perform under the implicit contract. Inequity averse agents shirk, because they are afraid of being cheated by the selfish principals. Since the average effort is higher in the implicit contract, inequity averse principals prefer the implicit contract. Therefore, selfish principals also prefer the implicit contract, because they enjoy the benefits (high effort) without the costs (zero actual bonus).

The conclusions of this section are that experiments indicate a strong preference for the implicit, least complete, contract. Furthermore, the theory of fairness developed by Fehr and Schmidt (1999) is consistent with the major facts and offers the following explanations. Fair principals, because of their ability to keep 'non-binding' promises, use implicit contracts to provide strong incentives for selfish agents. Selfish principals prefer implicit contracts because the presence of fair principals allows them to cheat the agents. Finally, fair agents shirk because they dislike being cheated.

5. Conclusions

The analysis discussed above suggests that 'Homo Economicus', defined as a rational and selfish actor, exists. However, besides homo economicus, there also exists 'Homo Reciprocans'. Moreover, 'Homo Reciprocans' seems to be in the majority. The existence of 'cooperative man' is supported by many experiments. It is shown that subjects behave cooperatively even to total strangers, when the stakes are high and under one-shot repetitions. Furthermore, it is also confirmed under experimenter-subject anonymity. However, it depends on institutional factors, e.g. contract design, which behavior prevails.

To model such behavior, Fehr argues that the concept of rationality should not be given up. However, the selfishness assumption should be replaced, at least for a part of the population by a inequity aversion assumption. Inequity aversion means that people receive disutility from differences in well being between subjects.

In the part on contracts it was shown that incentive contracts crowd out voluntary cooperation. This induces firms to make less generous offers and to rely on the ex-ante threat of punishment. Furthermore, the incentive is less efficient, but results in a higher profit for the firms. Compared with both incentive and trust contracts, bonus

contracts perform best, even though they are the contractual completeness of this contract is lowest of all three. Principals strongly prefer the bonus contract to the incentive and trust contract. The reason is that inequity averse principals can through bonus contracts condition the bonus payment on the observed effort level of workers. This provides an incentive for workers to exert a high effort level. In turn, selfish principals also want to use bonus contracts because it gives them a high effort and they can defect on the payment of the bonus. Because inequity averse workers are afraid of this kind behavior, they shirk.

This also shows that the theory of inequity averseness can predict the behavior of a large part of the population. Although it does not predict behavior right in every instance, it is an important improvement on the traditional standard rational actor model.

Literature

Bewley, T. (1995), A Depressed Labor Market as Explained by Participants, *American Economic Review, Papers and Proceedings 85*, 250-254.

Fehr, E. and Falk, A. (1999), Wage Rigidity in a Competitive Incomplete Contract Market, *Journal of Political Economy 107-8*, 106-134.

Fehr, E. and Gächter, S. (2000), Do Incentive Contracts Crowd Out Voluntary Cooperation?, Working Paper 34, Institute for Empirical Economic Research, University of Zürich.

Fehr, E., Gächter, S. and Kirchsteiger, G. (1996), Reciprocity as Contract Enforcement Device, *Econometrica 4*, 833-868

Fehr, Ernst, Klein, Alexander and Schmidt, Klaus (2000), Endogenous Incomplete Contracts, mimeo, University of Munich.

Fehr, Ernst and Schmidt, Klaus (1999), A Theory of Fairness, Competition and Cooperation, *Quarterly Journal of Economics 114* (3), 817-868

Güth, W., Marchand, N. and Rulliere, J.-L. (1997), On the Reliability of Reciprocal Fairness – An Experimental Study, Working Paper, Humboldt University, Berlin.

Loewenstein, G. Thompson, L. and Bazerman, M. (1989), Social Utility and Decision Making in Intertemporal Contexts, *Journal of Personality and Social Psychology 3*, 426-441.

Mas-Colell, Andreu, Whinston, Micheal D. and Green, Jerry R. (1995), *Microeconomic Theory*, Oxford University Press, Oxford

Rabin, Matthew (1993), Incorporating Fairness into Game Theory and Economics, *American Economic Review 83* (5), 1281-1302.

Roth, A., Prasnikar, V., Okunu-Fujiwara, M. and Zamir, S. (1991), Bargaining and Market Behavior in Jerusalem, Ljubljana, Pittsburgh and Tokyo: An Experimental Study, *American Economic Review 81*, 1068-1095

Varian, Hal R. (1992), *Microeconomic Analysis*, Third Edition, W.W. Norton, New York.

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From Stagnation to Modern Growth: Population, Technology and Inequality in the Process of Development

Bas van Groezen*

At the recent NAKE-workshop in Groningen, professor Oded Galor gave ¯ve interesting lectures on the evolution of economic growth in di®erent contexts. This report summarizes his lectures. The ¯rst section deals with the explanation of the historical transition of economies from a Malthusian regime of stagnation to modern sustainable growth. After that, the U-shaped relationship between output per capita and the labour force participation of women is explained. Galor's fourth lecture, on ability biased technological transition, wage inequality and economic growth, is not in this report. The ¯nal section describes Galor's analysis on (the evolution of) income distribution in a macroeconomic context.

1 From Maltusian Stagnation to Sustainable Growth

Most economists nowadays believe in sustainable economic growth, and indeed this is what can be observed from the (recent) past. It may therefore sound surprising that up to some centuries ago, stagnation used to be the prevailing state of nature. Many economic studies either focus on the period up to the industrial revolution or on modern sustainable growth. But there are virtually no models that can explain the entire evolution from stagnation to sustainable economic growth. In his ¯rst lecture, Galor described a model that does explain the development of population growth, technological progress and output growth in the last several millennia. Three eras are distinguished that are characterised by di®erent regimes: the Malthusian regime, applicable for the period before 1500, the Post-Malthusian regime, which falls between 1500 and 1870, and the period

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after 1870, during which economies experienced a demographic transition and sustained economic growth. This section describes the model of Galor and Weil (2000), which explains the occurence of these regimes and the transition from one to another.

The Model

Consider an economy inhabited by individuals who live for two periods. In the first period of his life (childhood), the individual is raised by his parents and therefore requires some fraction of their time. This fraction increases with the quality of the child (e.g. the amount of education). In the second period of life (parenthood), the individual allocates his time between working and child rearing. Because he derives utility from both material consumption and the quality and quantity of his offspring, he not only chooses his consumption level and how many children to have, but also the quality of his progeny. However, someone only derives utility from consumption if it is above the minimum subsistence level.

Consumption goods are produced with a fixed factor (like land) and labour, according to a CRTS-production function. The effective amount of labour depends not only on the number of hours worked, but also on the amount of human capital per worker. The more time was spent on quality (i.e., education) one period before, the higher an individuals' level of human capital. Furthermore, the rate of technological progress has a negative impact on human capital. This reflects the fact that progress implies the introduction of new technologies which require skills that differ from the existing ones and therefore have to be acquired.[1] This does not mean, however, that technological progress is bad for production: it increases the effective number of efficiency units of labour per worker and thereby also has a positive impact on production per capita.

But what drives technological progress? Obviously, the higher the level of human capital, the faster technologies improve. Furthermore, the size of the population is an important determinant: if an economy is inhabited by many people, then, for instance, the supply of new ideas will be high, which has a positive impact on the number of innovations and hence on technological progress.

From the Malthusian Regime...

Suppose the economy starts off with a rather low level of technological progress. Because wages are low, people earn just enough to survive (consumption equals the subsistence

[1] A good example is the development of computers: more education is required to make sure that people can use them.

level). Investing in the quality of children is not worthwhile as the return to human capital, the future wage rate, is quite low. Instead, the quantity of children is what people mainly choose for, and hence they have as many children as possible, i.e., up to the point where consumption equals the subsistence level. This is exactly what Malthus (1798) described. If a household gets a higher income, it would be able to raise more children (and indeed do so), so that after a while, the capital labour-ratio declines and wages (and output per capita) fall. If, on the other hand, the household income is below its subsistence level, people would by de¯nition die due to malnutrition, disease and famine. This causes output per capita to increase to its equilibrium level. Hence, population growth equals the rate of economic growth (i.e., technological progress), so that output per capita is virtually stable. This is consistent with estimates of the (constant) standards of living until 1500 in e.g. Western Europe and the observed coexistence of both wide di®erences in technologies and small di®erences in standards of living across some countries prior to 1800.

...via the Post-Malthusian Regime...

In the Mathusian regime, technological progress is slow due to low spendings on child quality. However, population is growing steadily, which in itself has a positive (though moderate) impact on the rate of technological progress. Consequently, wages increase but cause population to increase as well, so wages decrease again. After some time, however, population growth is so high that the rate of technological progress reaches the level at which the wage rate is such that parents are induced to substitute child quality for quantity. Technological progress causes both an income e®ect (more resources available for raising children, so both quantity and quality increase), and a substitution e®ect (reallocation of resources from quantity to child quality). In the Post-Malthusian regime, the income e®ect is dominant[2], so both the size and the quality of the population increases. Furthermore, output per capita increases, which is the fundamental di®erence with previous times. At some moment it will even be so that households are able to spend more resources on children as their income grows above the minimum subsistence level.

Empirical analyses for the period 1500-1870 con¯rm these developments for this regime.

[2] As the number of children is high, it is quite costly to invest in the quality of each child.

...to Modern Times

In the Post-Malthusian Regime, population size and quality grow. Obviously, this has a tremendous and self-reinforcing e®ect on the level of human capital and thereby on the rate of technological progress: not only are there more people who can generate new ideas, but they are also better able to do so, due to higher spendings on education. This causes the wage rate (i.e., the return to human capital) to increase further. As a result, parents substitute more and more child quality for quantity. Besides, as the number of children decreases, it is less costly to educate each child. Subsequently, the above-mentioned substitution e®ect becomes dominant at some moment. This implies a declining rate of fertility and increasing output growth rates (also in per-capita terms). From around 1870, this is indeed what is observed. The economy gradually converges to a new steady state where output per capita grows at a positive rate and population growth is moderate.

2 The Gender Gap, Fertility and Growth

The analysis that was decribed above provides an explanation for the observed decline in the rate of fertility and a higher growth rate of (per capita) output. However, there are other empirical facts that have to do with endogenous fertility and the model does not take into account. One of them is the U-shaped relation between output per capita and the labour force participation of women. In his third lecture, Galor therefore paid attention to one of his models that explores the role of the gender gap in economic growth (see Galor and Weil (1996)).

The Model

The analysis is based on an overlapping-generations model. The single good is produced with three factors of production, viz. capital, physical and mental labour. All factors are complements, but capital complements mental labour more than physical labour.[3] Because the economy is closed, its capital stock equals aggregate savings of the previous period. Both men and women decide how much time they spend on raising children, and, as a result, how much labour to supply. Furthermore, it is assumed that women have a comparative advantage in mental labour, as men have a higher endowment of physical strength but an equal endowment of mental labour.[4] Hence, the wage rate of men is

[3] It may also be that capital and physical labour are substitutes.

[4] One could also assume that women are smarter.

higher than that of women.

Couples[5] derive utility from their number of children in the first period of their life and consumption when retired. They are restricted by a budget constraint that has two parts. If the total time spent on raising children is less than the time endowment per person, then only the woman will raise the children, and the marginal cost of an extra child is the woman's wage rate. But if raising the children takes more time, the man would also participate in bringing up the children. In that case, an extra child has a higher `price', viz. the man's wage rate.

The Evolution of Fertility and Women's Participation

The optimal number of children depends on the relative wage rate, and thereby indirectly on the capital-labour ratio. If all child rearing is done by women, then an increase in men's wage rates, due to technological progress, will cause a positive income effect on the number of children. Initially, this was the case. However, as the economy develops, its capital intensity increases (beacuse of the technological progress as a result of population growth, as was described above).[6] Since capital is more complementary to mental labour, in which women have a comparative advantage, this implies an increasing relative wage of women. Consequently, at some moment in time, women are induced to participate in the labour force and raise fewer children. The capital-labour ratio then increases through two channels. First, the household's income rises, which increases savings and thereby the capital stock in a closed economy. Second, the rate of fertility declines, so there is more capital per worker available. This leads to a positive feedback loop: women's wages rise even more, fertility declines further, and so on. Eventually, the economy reaches a new steady state equilibrium with a lower fertility rate and higher labour force participation of women.

Up to now, the model provides an explanation for a decreasing fertility rate and increasing income growth and women's participation on the labour market. However, empirical analyses show a U-shaped pattern of female labour force participation. The model above can be extended in several ways to also incorporate this fact.

First, suppose that households with low incomes actually want a higher number of children than they can afford. Obviously, in a growing economy, fertility will rise - and women's labour force participation declines - because this supply constraint becomes less binding, until the point is reached that women find it more worthwhile to join the labour

[5] Defined as a combination of a man and a woman.

[6] Without such progress, the economy would be trapped in this high-fertility, low-growth equilibrium.

force (as described above). Second, the existence of home-labour can explain the U-shaped pattern. If women work at home, which does not require capital, then raising a child does not imply high opportunity costs. As the economy grows, the positive income e®ect on fertility, caused by the higher male income, will ¯rst dominate the negative substitution e®ect of a higher relative wage of women that can be earned outdoors. Consequently, women's labour force participation decreases. But after a while, the latter e®ect will start to dominate the income e®ect, and the relation between female labour supply and fertility is reversed.

3 Income Distribution and Growth

The last of Galor's quintet of lectures dealt with the model of Galor and Zeira (1993) on income distribution and growth. From time series and cross section data it can be seen that there is a hump-shaped relationship between income inequality and the development stage (or GDP-level). In the neoclassical approach, the relation between income distribution is one-way, in the sense that growth has an impact on distribution. Hence, it is considered a passive variable. The approach of Galor and Zeira is di®erent. Their analysis shows that income distribution itself in°uences economic growth, which subsequently leads to changes in income distribution. This section will discuss that model.

The Model

Consider a small open economy with perfect capital mobilility, so the interest rate is equal to the (unchanging) world rate, and other factor prices are constant as well. The single good is produced either in the skilled sector, with capital and skilled labour, or in the unskilled sector, with unskilled labour only. Furthermore, the capital market is characterised by imperfections, which is re°ected in a higher rate of interest for borrowers than for lenders.

Individuals live for two periods. When young, they decide whether to invest in human capital or not. Investments in human capital are assumed to be indivisible (one of the fundamental assumptions of this model). In case people do not invest, they work as an unskilled employee. People who do invest in human capital will be a skilled worker in the second period of life, the others remain unskilled. Each individual is endowed with the same potential skills. However, people are assumed to be altruistic towards their progeny; hence, they leave bequests, and the only way agents initially di®er is therefore the capital inherited from their parents.

The assumption of capital market imperfections implies that individuals who borrow (for investing in human capital) face a higher rate of interest. To assure that not all individuals will choose to become skilled workers, it is assumed that investment in human capital is not bene¯cial for those who must ¯nance the entire cost of education via borrowing. On the other hand, investment in human capital must be bene¯cial for individuals who can ¯nance the entire cost of education without borrowing, if not all are to choose to stay unskilled. Whether one has to borrow or not depends on whether or not investments in human capital exceed the bequests received. Hence, occupational choice is fully determined by the inheritance: the higher it is, the more likely it is that someone will be skilled. The distribution of inheritances (i.e., wealth) therefore fully determines economic performance.

The Dynamics of Wealth Distribution

The crucial variable for investment in education is the bequest one gets. If it is rather low, the level of education may be zero or positive, but the bequest left to o®spring will not be very high. Eventually, bequest levels will decrease and descendants will become unskilled. Descendants of individuals who initially inherit quite much will likewise become skilled. So in the long run, two groups can be distinguished: skilled and unskilled workers, giving rise to a certain (unequal) income distribution. Thus, the amount and the distribution of initial wealth determine whether an economy ends up rich or poor. As Galor and Zeira put it, a country has better growth prospects if it has a reltively larger middle class.

But how does (in)equality a®ect economic growth, and more speci¯cally, is inequality good or bad? Suppose we have a `rich' economy, i.e., initial bequests are high on average. If this economy is characterised by an equal income distribution, the variation in bequests will not be high and in the long run, all people will be skilled and leave substantial bequests. But if the initial income distribution is unequal, say skewed to the left, then poor individuals cannot leave enough bequests for their children to become skilled, so eventually, the economy is characterised by two groups of people, skilled and unskilled, and consequently, an unequal income distribution and lower overall welfare result. Hence, according to this model, equality turns out to be good for a rich economy. On the other hand, if the economy is poor, in the sense that initially average bequests are low, then a rather equal wealth distribution implies that in the long run, all individuals will be unskilled and the economy is in an equilibrium of low output growth. But an income distribution that at ¯rst is skewed to the right, leads to a steady state in which there are two groups of people, skilled and unskilled, and a higher level of output. Redistribution

from the rich (skilled) to the poor (unskilled) may decrease the inequality and lead to a higher welfare. Hence, for a poor economy, some inequality is good, as it ultimately allows individuals to invest more in human capital.

Modern Growth and Policy Implications

In a recent paper, Galor examines the issue of income (in)equality for modern societies, where the enigine of growth shifts from physical to human capital. Because physical capital can be held in one hand only, the accumulation of such capital does not speci¯cally require an equal distribution of wealth. However, an economy can only accumulate human capital if there is a spread of ownership, simply because human capital is indivisible. Therefore, more equality is and will be desired in modern economies. The question is whether a government should intervene. One of the crucial assumptions in the model above is the spread between the rate of interest of borrowers and lenders. This makes investing in education a costly matter, if one inherits a small amount and thus has to borrow. The government could therefore subsidize education, and ¯nance these costs by a tax on skilled workers in the next period. It is shown that this not only increases investment in education in the short run, but also in the long run and can even lead to a Pareto-improvement because the goverment does not have to monitor every individual borrower as it can give a subsidy to all students and tax all high incomes. Furthermore, goverment policy could try to reduce the imperfections on the capital market and thereby reduce the gap between both interest rates, which is one of the main causes of inequality.

References

[1] Galor, O. and D.N. Weil (1996) \The Gender Gap, Fertility, and Growth" American Economic Review 86: 374-87.

[2] Galor, O. and D.N. Weil (2000) \Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond" American Economic Review (forthcoming).

[3] Galor, O. and J. Zeira (1993) \Income Distribution and Macroeconomics" Review of Economic Studies 60: 35-52.

[4] Malthus, T.R. (1798) An Essay on the Principle of Population.

Systems Competition

Ben Kriechel[¤]

Abstract

This paper reviews the ideas of `Systems Competition' which were the topic of the NAKE-Lectures by Hans-Werner Sinn.[1]. An analysis of the competition between countries over factors of production in a framework of mobile factors is derived and applied to questions with relevance for current policy. Using the `selection principle' Sinn is able to provide deeper insights in the questions of social dumping, the provision of infrastructure and product standards.

1 Introduction

The `New Systems Competition' lends its intellectual roots from its ancestor: the `systems competition' between economic ideologies that captured economists ever since the Russian Revolution. During the time of the cold war, the question which economic system | capitalist or communist | is superior was at the center of the debate. After the cold war and the `defeat of communism' systems competition can move on to another level. It is no longer the question which economic system prevails, but which form of capitalism will be able to attract the necessary factors of production in order to °ourish for the years to come.

Increasing globalization and progress in transportation and communication allows for higher and higher mobility of factors. Capital moves by now quite freely between most western countries, and increasingly so between western countries and the rest of the world. Labor mobility is also greatly increasing | especially, but not only, within the European countries | but also through immigration into western countries.

As factors of production become more mobile they react more rapidly to di®erence in elements of the national systems: taxes, regulations, infrastructure, services et cetera. The idea of new systems competition is to evaluate the competition between nation states

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through their choices of systems-elements geared to attract those factors of production that allow them to prevail.

1.1 The Case of Europe

It can be expected that the systems competition will be especially important for the European countries. Through the European Union the mobility of production factors is not only facilitated but guaranteed in the famous treaty of Maastricht[2]. Through the introduction of the Euro, the °ows of capital have been eased, and the burden of exchange-rate uncertainties no longer play a role in the decision on capital investments across the Euro-countries. This abolition of exchange rate risks can be most easily observed in the tremendous narrowing of the interest rates paid on bonds in the di®erent Euro currencies. While they di®ered several percentage points two years before the introduction of the Euro, just after the introduction the di®erences were a mere twenty to thirty basis-points, less than one tenth of the former di®erences. This allowed for improved allocation of capital over the entire Euro region without the exchange rate burden.
The free movement of goods have allowed ¯rm to choose optimally the country to produce in, irrespective of the national markets they want to serve. To a smaller extent has the right to settle freely in any European country allowed for labor mobility. The barriers due to di®erences in cultures and language still impede a `competitive' outcome of movement: that workers move to the countries which pay the highest wages. However, in this context does the enlargement of the European Union and the recent immigration of Eastern European workers into the European countries predict interesting outcomes. The large wage di®erentials between the Eastern countries, and especially the northern part of the European Union suggest bigger than so far observed movements from East to West, allowing for higher productivity of the labor in the western countries, i.e. generating higher marginal products than at the countries of their origin.

The question of systems competition remains and becomes more prominent the more the di®erences between the countries in terms of factor rewards become equalized. It is the ¯nal di®erences between the systems that will be channeling the allocation of production factors between the countries. In this context the fear of social dumping, of a race to the

[2] This right of free movement of capital, services, goods, and settlement was included in the treaty of Maastricht. But only lately with several years of delay can we see the implementation of all its implications into national law. This can be expected to lead to increasing labor mobility at least at some levels of the labor market.

bottom appears. Will it be possible to save the Western European welfare state in such a world of systems competition? Or will it lead to a relocation of industries through °ows of capital and workers towards countries which have lower standards, and lower costs of the welfare state? Can stringent environmental regulation be kept in a competition between nations for the investment of ¯rms?

1.2 Selection Principle

> \It has often been argued that systems competition is comparable to competition in private markets.[...] Governments are seen as ¯rms which compete with one another by o®ering attractive packages of services and tax prices and, although they are driven by national goals, competition makes them behave in a way compatible with an international welfare optimum." (Sinn, 1997, p. 248)

In order to evaluate the question whether the governments do compete like ¯rms for the factors of production, or for the maximization of rents, we have to be careful in using analogies between ¯rms and governments. We should be critical of any direct comparison, and evaluate its credibility. Sinn (1997, p.248) does not agree with the simple analogies, since

> \[...] governments undertake a variety of economic activities which cannot be handled satisfactorily by competitive markets. Since governments have stepped in where markets have failed, it can hardly be expected that a reintroduction of a market through the backdoor of systems competition will work. It is likely to bring about the same kind of market failure that justi¯ed government intervention in the ¯rst place"

This is in essence the selection principle. Rooted in the German public ¯nance literature which explains the existence of public production through market failures, it postulates the existence of national public production in an international context. In other words, if the reason for the establishment of rules and elements of the di®erent systems are market failures, it is unlikely that they will be abolished through the competition between nation states. However, in the spirit of Hayek we could ask ourselves whether many of the public goods provided are really necessary, and whether they will survive the international competition for factors of production. This will be evaluated with the the aid of the selection principle.

2 Provision of Public Goods and Systems Competition

The ¯rst example to illustrate the usage of the selection principle given is the ¯scal competition for the provision of public goods. In the framework of two factors of production, labor and capital, the question of taxing the mobile factor capital is evaluated. This analyzes the question whether countries can tax ¯rms to provide infrastructure or necessary public goods. Consider the case of ¯gure 1 in which the downward sloping line gives the marginal value product of labor, r¤ is the world rate of return for capital which cannot be a®ected by the countries[3]. The capital level `employed' at the world rate of return would be K¤, where the workers are considered to receive the residual rents depicted in the triangle AEG. If public goods have to be provided | say infrastructure | the government might consider taxing the capital at tax rate t. This would, however, not be welfare enhancing since capital would °ow out of the country, until it reaches the level K_t, which equalizes the return, net of taxes with the world rate of return. However, the total wealth of the country, considered to be labor income and tax is now diminished by the triangle CDE, the welfare loss of the tax.

If we now consider the case of a necessary investment in infrastructure on a one-to-one basis with the investment in capital. This infrastructure can be paid for by a tax on labor income or the return on capital. Let:

$$f(K;L) \tag{1}$$

be the production function producing a homogeneous product. The ¯rm works under pro¯t maximization, such that

$$f_K = r + c(K;W) + ¿ \tag{2}$$

Where r is the world rate of return on investment, c(K,W) is the congestion function describing the public good, and ¿ is a percentage tax levied on capital income. The congestion function can be most easily understood if we consider it to describe the case of a street. Using the street has a cost c(K;¢) depending on the capital intensity | say trucks | using it, while W gives the width of the infrastructure, say width of a street, and the wider it is the more trucks can drive on it congestion free. So $c_K \cdot 0$ and $c_W > 0$.

[3]Countries are considered to be small open economies, hence cannot a®ect the world interest rate

[1]These lectures are based on the forthcoming book by Sinn

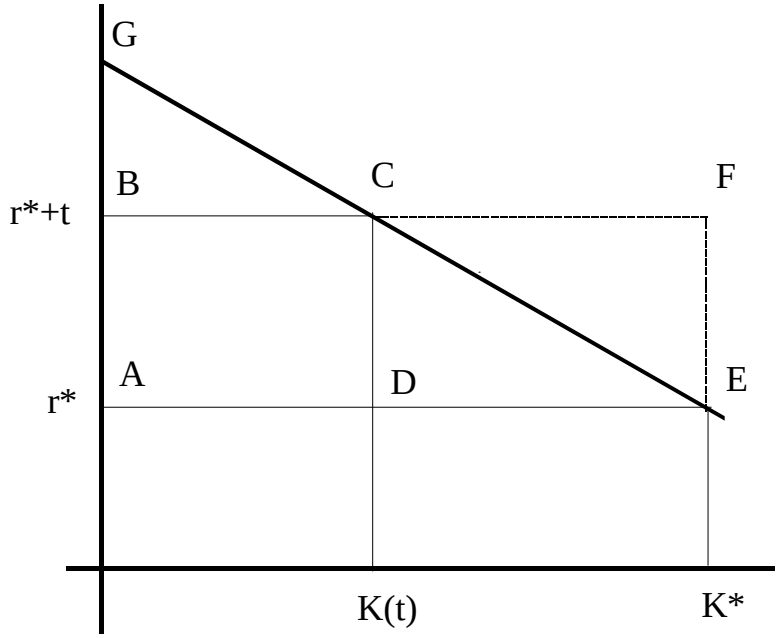

Figure 1: Erosion of source tax

The government's budget constraint is given by

$$¾L = ½W ¡ ¿K \tag{3}$$

where ¾ is the proportional tax rate on labor, and ½ gives the price of `one unit of the public good'. Rent maximization of the government can be evaluated as

$$\max_{¿;W} f ¡ f_K K + r\bar{K} ¡ ¾L \tag{4}$$

Using the equation (4) we can rewrite it to be:

$$, \max_{W;K} f(K;L) ¡ r(K ¡ \bar{K}) ¡ c(K;W) ¡ ½W \tag{5}$$

We get two ¯rst order condition from the maximization problem of the government:

1. $f_K = r + c + c_K K$
2. $¡ c_W K = ½$ `Samuelson Condition'

From this we can derive the optimal bene¯t tax to be

$$¿ = c_K K \tag{6}$$

So the tax is exactly at the marginal congestion level of capital. Given the return on capital and the labor income government chooses ¿ and K such that it maximizes the sum of labor income and capital tax revenue. This is the case when the tax rates equals the marginal congestion of capital $c_K K$ as has been shown above.
However, we did not check yet whether the revenue generated by this source tax level is su±cient to cover for the necessary infrastructural outlays. For the case of a pure public good, it is straightforward that it is not the case. $c_K = 0$, hence the optimal capital tax ¿ = 0. So the full cost of the infrastructure has to be shouldered by a tax on the immobile factor, labor. However, if the goods are not of the pure public good type, we can derive from Euler's theorem, stating that:

$$c_K K + c_w W = ¸c \tag{7}$$

Where ¸ is the degree of homogeneity of the user cost function. Inserting the Samuelson condition and equation (6) into equation (7) yields:

$$¿K = ½W + ¸cK \tag{8}$$

This result shows that the optimal congestion charge will only cover the cost of providing the public good if ¸ · 0. In other words if the congestion cost function is of degree zero or higher. If the cost function is of negative homogeneity, at least part of the cost have to be covered by a tax on the ¯xed factor.

2.1 Club goods

The interesting question in the context of systems competition is whether the government should provide the infrastructure for capital and who should pay for it. We have seen above mathematically that there are conditions under which the government will provide the public good, and sometimes it is (partly) ¯nanced by the immobile factor rather than the mobile factor which actually bene¯ts most from the public good. In order to sign the degree of homogeneity, the ¸ as we denoted it above, we can examine whether the infrastructure is a public good, or a club good. A club good means that the provision could be organized privately since exclusion is feasible and the club members pay for the infrastructure. The di®erence between club and public provision is that among clubs we can imagine competition, whereas the public provision imply at least a `local'[2] public monopoly type of provision.

[2] The term local is chosen rather than national since we can imagine that the provision of public goods can also be done on a state, regional or city level

Given that we have many clubs o®ering di®erent bundles of infrastructure for di®ering prices we can postulate the following market outcome:

$$P \acute{} \; ¿_i + c(K_i; W_i) = ¿_j + c(K_j; W_j) \qquad 8_{i;j} = 1; :::; n: \tag{9}$$

The price plus the price of congestion is the same. In other words better infrastructure (higher W) comes along with lower prices for a given level of usage. If in this context ¸ < 0, private clubs will not be able to provide the infrastructure, the competition would imply a race to the bottom. So the selection principle suggest that governments concentrate on public goods with a ¸ < 0, in other words with goods which involve scale economies.

2.2 Underprovision of the public good?

It is natural to ask what happens if no subsidy on the mobile factor, capital, can be given. That is the case in which ¾ = 0. Fully di®erentiating we get:

$$' \acute{} \; \frac{dK}{d¿}\Big|_{¾=0} = \frac{1 + c_W \frac{K}{½}}{f_{KK} ¡ c_K ¡ c_W \frac{¿}{½}} \tag{10}$$

This implies the following ¯rst order condition for revenue maximization of the domestic population:

$$\frac{dR}{d¿} = ¡ ' ¢ f_{KK} ¢ K = 0 \tag{11}$$

The two equations above imply that ' has to be equal to zero. This can only be the case when ½ = ¡ c_W ¢ K, which is the Samuelson condition for optimal provision of a public good. In essence there is a balancing between the infrastructure provided, attracting investment, and the deterrence that higher tax rates will yield. We can thus derive the optimal tax rate under the self-¯nancing constraint to be:

$$¿ = c_K ¢ K ¡ ¸c \tag{12}$$

According to the selection principle only the case of ¸ < 0 is relevant, in which case the tax rate is higher than the marginal externality c_K ¢ K. This implies that less capital than in the ¯rst best case will be invested, but given the self-¯nancing constraint, the amount is optimal.

Returning to our example of the European Union, we have to lift one crucial assumption of our model. The second factor of production, labor, is in principle also mobile. This implies that no infrastructure equilibrium exists, since the workforce will not be willing to subsidize the infrastructure of capital.

2.3 Tax Harmonisation

One solution suggested to alleviate the above problem is tax harmonisation. Tax harmonisation can be shown to lead to a competition in terms of infrastructure at the cost of the non-mobile factors of production that have to finance it. This can be seen by differentiating the total rents:

$$\frac{dR}{dW} = (f_k \cdot r - c_K \cdot K - c)\left.\frac{dK}{dW}\right|_{\bar{c}} - c_w \cdot K - \frac{1}{2} \tag{13}$$

$$\left.\frac{dK}{dW}\right|_{\bar{c}} = \frac{c_W}{f_K K - c_K} > 0 \tag{14}$$

From equation (14) we can see that an improvement in infrastructure at a given tax rate always attracts more capital into the country when the cost are shouldered by the fixed factor.

Both equations together imply that:

$$\frac{dR}{dW} = (\bar{c} - c_K \cdot K)\frac{c_W}{f_K K - c_K} - \frac{1}{2} \tag{15}$$

$$-c_W \cdot K = \frac{1}{2} - (\bar{c} - c_K \cdot K)\frac{c_W}{f_K K - c_K} \tag{16}$$

there is an oversupply of infrastructure compared to the first best case. Equation (16) defines the new optimum in the infrastructure competition.

A solution for this problem could be to adhere to the above derived result: tax revenues of capital should only be used to finance infrastructure for this factor. This would allow competition in the bundles of tax-rate and infrastructure while avoiding the over-supply through infrastructure competition. Again this result only holds if we assume labor to be immobile.

Other possible ways to avoid both the race to the bottom and the infrastructure competition is to introduce the residence principle for capital incomes, i.e. domestic capital owners' earnings are taxed in their home-country even if the revenue is generated abroad. Alternatively, and a more radical change would be to change the tax system to a cash-flow taxation (cf. Sinn, 1985).

3 Erosion of the Welfare State

Gains from trade are one of the generally accepted concepts in the economic profession. Countries trade those goods in which they have a (relative) advantage for goods in which

their trading partner has specialized. Both countries are usually better of, given normal assumptions. However, one of the main fears of the free trade opponents is that the welfare state cannot be upheld. Given that free trade is | in essence | a trade in factors used in the production, it is clear that the free movement of factors will lead to similar problems and possible gains than free trade does. In this section the problem of ¯nancing the welfare state under trade and factor movements will be examined. The selection principle allows us to analyze this problem.

Sinn (1997, forthcoming) analyzes the welfare state by choosing a framework in which the social insurance covers uninsurable risks. He characterizes the welfare state as the provision of the government of these insurances which a private insurance could not bring forward. As an example Sinn gives that parents would like to insure that the future of their children will be (¯nancially) secured. However, at the date of birth | when they are still ignorant about the possibility whether their children will need some transfer payment they cannot insure this risk privately, since they would have to take an insurance in the name of their child for the remaining (working-) live of their kid. This is legally impossible. At a latter stage, when the child becomes an adult and can legally decide for itself, part of the risk will probably already be observable, hence uninsurable.

The welfare state provides for this problem by redistributing wealth from those inhabitants which are productive, and those who are not productive enough to support themselves. The question in the context of free movement and free trade is however, whether we can ¯nance such a redistribution, or whether the system would break down since the productive persons are not willing to provide for the needy, hence emigrate away from the high-welfare state.

3.1 Basic model

Assume an initially closed economy, producing a homogeneous product using capital and labor[3] as its inputs in its production function: $f(K;L)$. The factor rewards re°ect the marginal products, i.e. $f_L = w$ and $f_K = r$. Assume the total amount of capital and labor to be ¯xed on the national level.

At the micro level, workers are `endowed' with e±ciency units depending on two random processes, which is modeled as follows:

$$X \acute{} \mu_1 \Cent \mu_2 \tag{17}$$

[3] Labor can also be thought to be measured in e±ciency units.

Where $E(X) = E(\mu_1) = E(\mu_2) = 1$. It is presumed that μ_1 describes the genetically determined characteristics which are known when a child grows up. μ_2 describes career risks such as promotions, health, accidents, et cetera. Both variables are i.i.d. over time and across workers. Since workers are risk averse, they would like to take a wage insurance. Private insurances would in principle only be willing to insure the risk of the second type, since the ¯rst type is already revealed at the age that a person is able to take an insurance. Let us de¯ne the income of a single individual by:

$$Y = \mu_1\mu_2 l - E(C) + rK^1 \tag{18}$$

In which K^1 are the assets owned by an individual, and C is some stochastically independent risk, in addition to the wage risk. We assume perfect insurance markets, thus, since the workers are risk averse the will fully cover the risk of C and the insurance premium will be the expectation of the risk. The insurance markets open after μ_1 is realized, and before μ_2 and C is known. If risk aversion is small enough, adverse selection implies that both μ_1 and μ_2 are not insurable since μ_2 also depends on μ_1 .

One can show that there is a welfare increase through redistibutive taxation. Let

$$T = \tau l \tag{19}$$

be the governments budget constraint. While the post-redistribution income is:

$$Y = \mu_1\mu_2 \tau l (1 - \tau) + T - E[C] + rK^1 \tag{20}$$

Where the mean and standard deviation (sd) of the income is:

$$E[Y] = l(1 - \tau) - E[C] + rK^1 \tag{21}$$

$$sd[Y] = (1 - \tau) l \tau sd(\mu_1\mu_2) \tag{22}$$

Since the mean | or expected income | is exactly the same as before the redistribution, the only di®erence lies in the standard deviation. The standard deviation in the welfare state is lower, hence there is an improvement of social welfare if we assume the agents to be risk averse.

3.2 Redistribution under Systems Competition

Will the opening of the borders for free capital movement and also for free movement of labor lead to a breakdown of the welfare state? This is the question we want to

answer in this section. We will assume an open capital market, with a world interest rate: $r_i = r_j = r^{\alpha}$. In the labor market we will also assume factor price equalization:

$$l_i[\mu_1\mu_2 \; ¡ \; ¾_i(\mu_1\mu_2 \; ¡ \; 1)] = l_j[\mu_1\mu_2 \; ¡ \; ¾_j(\mu_1\mu_2 \; ¡ \; 1)] \tag{23}$$

Now it can be shown that having a welfare state imposes positive externalities on the other countries. Taxation of rich, productive, workers leads to lower (gross) wages in the other countries, since productive workers will be willing to immigrate to the low-tax countries, and work there for a lower gross wage, but higher net wages. Net payers of taxes would emigrate from high-tax countries while net receivers would immigrate. this is of course not a sustainable equilibrium.

4 Conclusion

Sinn has shown how the `Selection Principle' can be used to address many policy relevant issues. Only two main subjects were treated here, but in Sinn(forthcoming) the additional issues of environmental policy, product standards, and the competition of competition laws are evaluated. With the use of simple but powerful models Sinn has been able to show the problem of the free factor movement for the established economic system. This has been done especially for the European case, which shows the actual character and the policy relevance of this research. The concept of systems competition has been elaborated extensively on the future of the welfare state and the provision of infrastructure.

References

[1] Hans-Werner Sinn. Kapitaleinkommensbesteuerung. Eine Analyse der intertemporalen, internationalen und intersektoralen Allokationswirkungen. J.C.B. Mohr, 1985.

[2] Hans-Werner Sinn. The selection principle and market failure in systems competition. Journal of Public Economics, pages 247{274, 1997.

[3] Hans-Werner Sinn. Systems Competition. Blackwell-Basil, forthcoming.