The Mutual Gains from Trade Moderate the Parent-Offspring Conflict

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Abstract

This essay asserts that the mutual gains accruing from the exchange of goods between siblings can moderate the famous parent-offspring conflict, an issue of interest in evolutionary biology. The rationale combines basic concepts of economics and behavioral genetics, and fills in the gaps of standard economic theory by justifying why trade, ultimately a cooperative endeavor, is possible from egoistic utility maximizers.

Keywords: Parent-offspring conflict, Gains from trade, Economic methodology, Philosophical foundations of economics

1. Introduction

Nobody doubts there are conflicts of interest in social and economic life. However, many are unaware, or do not accept, that there are deep biological reasons for such conflicts based on genetic differences. Robert Trivers (1974) introduced the notion of a parent-offspring conflict to signify the evolutionary conflict arising from differences in optimal parental investment to an offspring from the standpoints of the parent and the offspring. Any investment by the parent in an individual offspring decreases the parent's ability to invest in other offspring, while the selected offspring's chance of surviving increases. The parent-offspring conflict arises not only in humans, but also in other mammals, birds, and plants. All sexually reproducing species are subject to the parent-offspring genetic conflict.

One grim implication of this conflict is that, in Trivers's words, "under certain conditions parents are expected to attempt to mold an offspring, against its better interests, into a permanent nonreproductive" being. However, Trivers also recognizes that, "when circumstances change, altering the benefits and costs associated with some offspring behavior, both the parent and the offspring are selected to alter the offspring's behavior appropriately." This essay shows how in modern humans one such a circumstantial change had in fact occurred on a permanent basis. The circumstance is the possibility of trade and the gains accruing from it, which reduce the costs of optimal parental investment. The gains from trade ultimately moderate the parent-offspring conflict.

Here, down-to-earth arguments are used to make this point, through basic concepts of behavioral genetics and economics. Using a simple style fills in the gaps of standard economic theory by justifying why trade is possible from egoistic utility maximizers. Standard economic theory ignores that utility-maximizing individuals cannot automatically engage in trade. In the face of critical scarce resources, they find themselves in a Hobbesian trap, which is a ubiquitous cause of violent conflict (Schelling, 1960; Daly and Wilson, 1988; Glover, 1999). Each individual seeks to remove the obstacle represented by its competitor, and he or she recognizes that the other also wants to do the same. Mutually distrustful individuals have an incentive to inflict a preemptive strike to avoid being invaded for a competitor's gains. As a result, violence thrives and cooperation cannot flourish. Life ends up, in the words of Thomas Hobbes, "nasty, brutish and short." Standard economic theory further ignores that trade is ultimately a cooperative endeavor. Utility maximizers engage in trade only after the emergence of cooperation. This essay demonstrates how this can be justified.

The next section explores the parent-offspring conflict in greater detail. It is followed by a section explaining the main developments of behavioral genetics. Section 4 discusses the relationship between genes and the individual. Section 5 is about the emergence of cooperation. Section 6 asserts that parents are essentially "the state." Section 7 discusses the role of crime. Section 8 highlights the role of trade in the parent-offspring conflict. Section 9 concludes the essay.

2. The Genetic Economics of the Parent-Offspring Conflict

Because an individual shares genes with his or her offspring, gene counting explains that parental investment is equally split among one's children. This is because they are related to each offspring by an equal factor: 50 percent. However, each child is related to himself or herself by a factor of 100 percent. In a family with two children and one pie, for example, parents are willing to split the pie 50-50 in favor of each child. But each child is willing to split the pie in a ratio of two-thirds to one-third, as shown in Table 1. After all, a child shares half his genes with a sibling, but shares all of his genes with himself (Hamilton, 1964; Trivers, 1974, 1985). Thus, there is a genetic basis for a perennial conflict between parents and offspring. Of note, genetically unrelated individuals are thought to deserve no piece of the pie.

Table 1: The Genetic Parent-Offspring Conflict

	First Child	Second Child
Father	$\frac{1}{2}$	$\frac{1}{2}$
Mother	$\frac{1}{2}$	$\frac{1}{2}$
First Child	$\frac{2}{3}$	$\frac{1}{3}$
Second Child	$\frac{1}{3}$	$\frac{2}{3}$

3. Behavioral Genetics

Why does the conflict in Table 1 deeply underly the conflicts of interest that are pervasive in social and economic life? To understand the role genetics plays, it is worth presenting here some key developments in the science of behavioral genetics and, in particular, those associated with the nature-nurture debate.

The nature-nurture debate can be appreciated by putting the field of behavioral genetics into historical context. Behavioral genetics is a branch of psychology, not biology. Starting with the observation that individuals are different, one can see such differences are not random, rather, they aggregate in families. This suggests differences are inherited. Inheritance was originally demonstrated through animal breeding, which included behavioral differences. Francis Galton founded the field of behavioral genetics by establishing psychology as a Darwinian discipline. In his studies of "eminent" men, he found that eminence ran in families, not only because of "nurture" (the environment) but also because of "nature" (genetics). He favored the genetic explanation when analyzing examples such as Michael Faraday, a genius who grew up in poverty. Galton (1876) concluded that, "there is no escaping from the conclusion that nature prevails enormously over nurture when the differences of nurture do not exceed what is commonly to be found among persons of the same rank in society." However, although Galton recognized the role of the environment, his disciples engaged in an agenda of genetic determinism, and this led to the eugenics movement.

The eugenics movement negatively influenced psychology and the newly born discipline of behavioral genetics. The popularity of the eugenic movement can be related to two consequences of the Industrial Revolution: 1) the demographic transition, because people crowded in cities and this resulted in social pathologies, and 2) the affluence of the richer members of society accompanied by their declining fertility. When it was recognized that the eugenics movement inspired early Nazi policies, the movement became unpopular almost overnight. Furthermore, behavioral geneticists were identified as pariahs, and the number of psychologists interested in inheritance declined rapidly. The widespread discredit in behavioral genetics created a void that was filled by theories of "blank slate" (Pinker, 2002), which deny any genetic influence over behavior.

One such a theory was gender neutrality. John Money, one of its proponents, asserted that sexual behavior and orientation as male or female does not have an innate basis. Sexuality was believed to be undifferentiated at birth and to become differentiated as masculine or feminine during the course of various experiences of adolescence. Money found a natural experiment to prove his theory of nurture over nature: In Winnipeg, Canada, a pair of monozygotic twins were born male, but one of them had his penis burned away by an unsuccessful, unorthodox surgery to cure urinary infection. His parents opted for another surgery to change the unfortunate boy's sex, and the male-born child was then raised as a girl. As the child was growing up, "she" was extremely unhappy and became suicidal. The parents then decided to tell their "daughter" the truth when "she" was 15. Feeling relief, "she" immediately turned back into a boy.

He then married a woman who already had a child and became a good father. Sadly, at the age of 38, he committed suicide. This is known as the John/Joan case, and represented the apex of blank slate thinking within psychology. After this blank slate theory's massive failure, the same twin studies provoked a rebound of interest in behavioral genetics in the late '60s.

Most studies did not seek the association of individual genes to a given behavioral trait. However, some statistical correlations emerged after crunching numbers from the meta-analysis of controlled studies of twins and adoptees. By the end of the '90s, behavioral genetics had reached a consensus on three basic "laws" of behavior (Turkheimer, 2000):

1. Genes are involved in all human behavior.
2. The effect of the family environment on individual behavior is negligible.
3. The unique environment of an individual (possibly his or her peer group (Harris, 1998)) explains the behavior not accounted for by the direct effects of genes or families.

The percentage of the behavior that can be directly attributed to genes is 40 to 50 percent; the shared environment in the family is only 0 to 10 percent; and, the unique environment is responsible for the remaining percentage (Pinker, 2002).

4. Individuals and Genes

Additional discussion is necessary regarding the genetics economics of identical twins (same genome), who share the same prenatal environment in the womb. A fetal conflict should be regarded as evidence for the existence of a utility function for the individual, not for the genome.

A vanishing fetus is a relatively frequent event that occurs in up to one out of eight multi-fetus pregnancies (Landy and Keith, 1998). Here, the possibility of fratricide exists, which cannot be explained by a mere counting of genes. After all, why kill a sibling with whom one shares 100 percent of his genes? Each fetus, like any living individual, is a survival machine blindly set by natural selection to preserve one's own genes (Dawkins, 1976). A fetus is selfish and struggles for survival, sometimes at the expense of the other competitor, even one with whom the fetus shares the genome.

The notion of a utility function applies to situations where one has to choose between the possible actions that could lead to different outcomes (Von Neumann and Morgenstern, 1944). Individuals will choose the action that leads to the most desirable outcome, the one with the highest utility. Of note, this does not require the individual to have free will. From a neurological standpoint, free will is an illusion (Harris, 2012). And, from a neurological perspective, a utility function can be revealed from the workings of an individual's sensorimotor system, which has been shaped by natural selection to make choices between different actions (Kording et al., 2004). Once the goals of a utility function are specified, the decision problem becomes one of solving an optimal control problem, thereby finding the actions that maximize utility.

Both the twins, or in fact, their sensorimotor systems, maximize utility in the womb environment. However, as resources are limited in the womb, the environment is one of a two-person, zero-sum game. Obviously, a "theory of mind" is absent from the sensorimotor system, therefore, the best that nature can accomplish through adaptation is to endow each fetus with strategies that randomize their choices over all possible actions. Notwithstanding this fact, the minimax theorem guarantees that even in such a constrained situation an optimal mixed strategy for each player exists (Von Neumann, 1928). And one such possible optimal strategy may be for one fetus to kill the other in some situations.

If it is the individual, not the genome, who maximizes utility, which utility does he or she maximize? Evolutionary biology, not economics, has the answer (Da Silva, 2014). A benefit to a living creature ultimately refers to the individual's inclusive fitness: The number of its surviving offspring, plus positive and negative effects on the reproductive success of relatives, each devalued by its relatedness to them. This is how biology explains utility. Biology has a well-developed theory of exactly what utility is based on Darwin's concept of reproductive success (Trivers, 2011). Broadly viewed in these terms, one can argue that microeconomics focuses exclusively on the survival part of the utility function whenever an individual maximizes the consumption of goods. The reproduction aspect is largely neglected (Da Silva, 2014). Richard Dawkins (2012) noted that fitness became that which is maximized in natural selection when biology deployed mathematics to bridge Darwinism with Mendelian genetics.

However, while inclusive fitness is the quantity which an individual appears to maximize, gene survival is actually being maximized. Thus, a proper new approach continues to consider consumption maximization as an argument of the utility function, but also includes an inclusive fitness term (Da Silva, 2014).

Individuals are subject to genes, but sometimes they may be in conflict, too. In other words, although individuals are their genes' agents, typical agency problems in economics may arise. Evidence of this fundamental biological conflict is provided by the literature of "two selves" in cognitive psychology.

The human mind is subject to predictable biases and heuristics (Kahneman, 2011). One such cognitive bias, perhaps the most fundamental one, is the conflict of two selves – the experiencing self and the remembering self, which do not have the same interests. The remembering self prevails. There is neglect of the duration of a bad experience and useless concentration on a peak-end rule, due to the workings of the automatic, fast brain. For instance, you may give the good and the bad part of your experience equal weight, although the good part lasted 10 times longer than the other. This is how things work, and this sounds like self-deception. The biological roots of the two selves can be accommodated within an evolutionary adaptive theory of self-deception, such as the one suggested by Trivers (2011). Why is there a contradiction at the core of our mental lives? As soon as information hits our brains, it often becomes biased and distorted, usually without conscious effort. In short, why does self-deception succeed? Trivers argues that in order to deceive others, we often deceive ourselves first. We selectively recall information and bias our arguments.

5. Emergence of Cooperation

The third law of genetic behavior mentioned earlier can be justified by the fact that an individual who has a utility function and meets peers outside the family environment will struggle to find a niche. This niche is where it is most likely for the individual to reach a higher status. Utility-function endowed individuals do not necessarily kill parents or siblings in the presence of the parent-offspring conflict mentioned above, due to the counting of genes. However, genetically unrelated peers outside the family are considered subhuman. As such, one has to first explain why peers are not murdered in the first encounter. Before peers are engaged in the quest for status, a certain degree of cooperation must have already evolved between them.

In the face of the Hobbesian trap mentioned earlier, a credible defense that can be announced to potential adversaries is: "I will not attack first, but if I am attacked and survive, then I will strike back" (Pinker, 2002). The Hobbesian trap can be removed by the *lex talionis*: "an eye for an eye, a tooth for a tooth" (Daly and Wilson, 1988). Interestingly enough, this is the Hammurabi's code, one of the first written codes of law in recorded history, which serves as a basis for all the laws of classical antiquity, including those of the Roman Empire. This is also the golden rule of Confucius: "Do unto others as you would have them do unto you." Thus, the *lex talionis* is the basis of modern law. A computationally distilled version of the *lex talionis* is the celebrated "tit for tat" strategy of game theory (Axelrod, 1984).

6. Parents as "the State"

The next step: For individuals to vest authority in a sovereign third person or assembly (Hobbes's Leviathan). The most effective general violence-reduction technique invented is adjudication by an armed authority (Pinker, 2002). As the state evolves, its monopoly of violence is justified to remove the Hobbesian trap by enforcing the *lex talionis*. Arguably, a similar arrangement is likely to have evolved even in prehistoric times. This is because trade (which, as argued here, is made possible only after cooperation has taken place) may explain the *Homo sapiens*' success accompanied by the displacement of the Neanderthals (Horan et al., 2005).

However, the state must also justify its existence by being credible. This can be illustrated by an ultimatum game. In the face of the conflict between the two siblings shown in Table 1, where each demands two-thirds of the pie, if the parents (essentially, "the state") assign the property right of the pie to the first child, this child will offer one-third for the second. If the second child rejects the offer, both will get nothing. The dominant strategy for the second child is to accept any piece that is greater than zero. However, though this arrangement is rational for both, what is at stake is more profound. The state is founded under the premise of removing the Hobbesian trap by enforcing the *lex talionis*. The parents's role is similar to that of the state on such a matter. (But hopefully not on the monopoly of violence in the household.) This can be grasped by the ubiquitous advice that parents give to their offspring: "Do unto others as you would have them do unto you."

Because the parents want to offer half of the pie to each child, which is considered unfair by both, the "state" morality here does not match the genetic preferences of each child. The credibility of the state is then undermined; the rational offer is rejected; and conflict is ignited. Of note, behavioral economics evidence from the ultimatum game favors the rejection of such a rational offer.

7. Crime

Because of the lack of credibility in the third party, which monopolizes morality, crime may become an option for the children. Here, a prisoner's dilemma of game theory can arise. In one such instance, the children are partners in a crime and are questioned in separate rooms. Each has a choice of confessing to the crime, and thereby implicating the other, or denying the crime. If only one prisoner confesses to the crime he will go free and the other will spend six months in jail. If both deny, they will be held for one month. However, if both confess, they will be held for three months. The negative utilities are depicted in Table 2.

Table 2: The Prisoner's Dilemma for the Siblings

		Second Child	
		Confess	Deny
First Child	Confess	-3, -3	0, -6
	Deny	-6, 0	-1, -1

The two rational individuals might not cooperate, even if it appears that it is in their best interests to do so. Indeed, the equilibrium is the confess-confess strategy, which is not Pareto-efficient because the deny-deny strategy is better for both players. If each child could trust the other, they could coordinate their actions and decide that both would deny. However, such cooperation is not a Nash equilibrium of this one-shot game. The dominant strategy is for both to confess.

Because distrust cannot be completely eliminated by the state, crime will be perennial. Thus, the two children are likely to repeatedly find themselves in the same situation of the prisoner's dilemma. Outside the family environment, the dilemma would also be the norm among the children and their peers. However, given the fact that the game is repeated with an unknown end date, cooperation can emerge out of genetically selfish acts (Axelrod, 1984). Interestingly, the solution comes again from the *lex talionis*. Using tit for tat, the deny-deny strategy, which means cooperation, can become attainable for both children and even for the children playing against their peers.

The values chosen in Table 2 for the prisoner's dilemma faced by the siblings are arbitrary. In the given example, $0 > -1 > -3 > -6$. Table 3 generalizes this. Realizing that $T = 0 > R = -1 > P = -3 > S = -6$, the game will continue to be a prisoner's dilemma for any values as long as $T > R > P > S$. Such a condition will ensure the payoffs lead to individual self-interest, which is an evolutionary stable strategy in the sense that players who deviate from the strategy can never make inroads against a population of defectors (Maynard Smith, 1982). A second condition, $R > (T+S)/2$ (in the particular case of Table 2, $-1 > -3$), is also implied. For instance, if both players get locked into an alternation of cooperation and defection, the second condition will guarantee that each will do worse than if they had cooperated with each other on every play from the beginning.

Table 3: The Generalized Prisoner's Dilemma for the Siblings

		Second Child	
		Confess (Defect)	Deny (Cooperate)
First Child	Confess (Defect)	P, P	T, S
	Deny (Cooperate)	S, T	R, R

Tit for tat is an evolutionary stable strategy if, and only if, a probability w of the two players meeting in the future is sufficiently large, such that w is strictly greater than the larger of the quantities, either $(T-R)/(T-P)$ or $(T-R)/(R-S)$ (Axelrod, 1984). The quantity $(T-R)/(T-P)$ represents the relative payoff for being nasty and getting away with it, as opposed to being nasty and getting caught.

And $(T-R)/(R-S)$ is the incremental difference in what one receives for being nasty and getting away with it, when compared with the incremental amount one receives for being nice without being duped (Casti, 1996). As discussed earlier, although the genome and its agent (the individual) may have distinct interests, the Hamilton's inclusive fitness perspective suggests that the gene ultimately will rule over the individual. Thus, computing the quantities above for two players who are genetically related is more likely to foster cooperation than the computation done by selfish peers. Kin selection (helping one's relatives) is good for cooperation to emerge. When the genome is in charge, the siblings will recalculate the payoff matrix depicted in Table 3 in terms of inclusive fitness, which results in reversing one or both of the inequalities $T > R$ and $P > S$. Situations can improve as clustering reinforces cooperation. A cluster of tit-for-tat individuals can become viable even when the majority of players is being nasty by defecting at every encounter. Furthermore, clustering may be associated with kinship. Thus, genetic relatedness is key for cooperation to prevail at large. Of note, not defecting is a kind of altruism because an altruistic individual foregoes gains that might have been made. The gene perspective entails cooperation between otherwise non-cooperative individuals.

Also noteworthy, the essence of the insight above is to combine two prisoner's dilemmas into one set of "interconnected games," an idea already suggested by Folmer *et al.* (1993) in the context of international environmental agreements. Similar to the theme "repetition enables cooperation" for repeated games, interconnection may be an extra source of cooperation.

8. Trade

The emergence of cooperation helps to expand the "moral circle" (Singer, 1981) in that the killing of relatives is no longer the only alternative; the killing of peers is no longer the only alternative; the killing of foreigners is no longer the only alternative; and so on. Under cooperation, trade can also flourish. By relying on the gains potentially made possible from trade, parental investment abates. Parents may then be willing to increase their parental investment, and this will moderate the parent-offspring conflict.

The siblings will dictate somewhat the now more-affluent resource allocation in the household for two reasons: 1) the family environment effect on an individual child behavior is negligible, and 2) parents will consider their inclusive fitness. So the children will be offered not only pie, but also pizza. As a result, their preferences will become defined toward both goods. Because the siblings can now cooperate, they may try exchanging the goods to reach a utility that is now higher than the utility that could accrue from killing one another. If the outcome of the exchange turns out to be mutually beneficial, trade can evolve, which further reinforces cooperation.

At first, both siblings are likely to show an "endowment effect," because merely possessing a good increases its value to its owner. The endowment effect shows respect for one's private property in the absence of a legal institution, ensuring third-party contract enforcement (Gintis, 2007). However, as the state has already evolved, trade can now ensue. Parents may be reassured that their offspring will exchange pieces of pie and pizza. The set is one of pure exchange, with no production and just endowments of the two goods: pie and pizza for each child. Then, they will maximize a utility function with two arguments: the consumption of the two goods along with the inclusive fitness term. Both survival (through the consumption of resources) and reproduction (through decisions based on inclusive fitness) will eventually be considered (Da Silva, 2014).

In standard economics, the preferences over the quantity of the two goods (a consumption bundle) can be represented by indifference curves. These consist of all bundles that leave one consumer indifferent to a given bundle because the joint utility accruing from each bundle is the same. Bundles located above the indifference curve bring higher utility. Thus, such bundles are preferred. Two consumers and two goods can be depicted in an Edgeworth box that shows their endowments and utility functions. An Edgeworth box for the two siblings considering convex monotonic indifference curves is shown in Figure 1.

As for the pie, the parents can initially endow their first child to fulfill his will: two-thirds to him, and one-third to his sibling. At the same time, to balance their decision the parents fulfill the will of the second child and offer two-thirds of pizza to him, and one-third to the first child. By exploiting the gains from trade, the two children may end up at the 50-50 allocation genetically preferred by both parents. This outcome is also efficient.

Indeed, at the point of endowment in the Edgeworth box, both siblings can be better off if they exchange pieces of pie and pizza. These points are above both indifference curves.

Thus, trade can increase the utility of both children. All the gains from trade are exhausted when the two indifference curves become tangent. This is the Pareto-efficient allocation where there is no way to make a child better off without making the other worse off.

Cooperation is implied as both siblings trade in the Edgeworth box. This is because at the Pareto-efficient allocation, each child is on his highest possible indifference curve given the indifference curve of the other. Of course, the fact that a Pareto-efficient allocation exactly matches the allocation genetically preferred by the parents (50-50 of both goods) depends on certain technicalities, such as the particular shape of the well-behaved indifference curves considered; a similar bargaining power of the siblings; the absence of strategic behavior of both parties on this particular matter; and so on. Nevertheless, the example illustrates that at least one Pareto-efficient allocation resulting from trade is possible: The one that can remove the parent-offspring conflict.

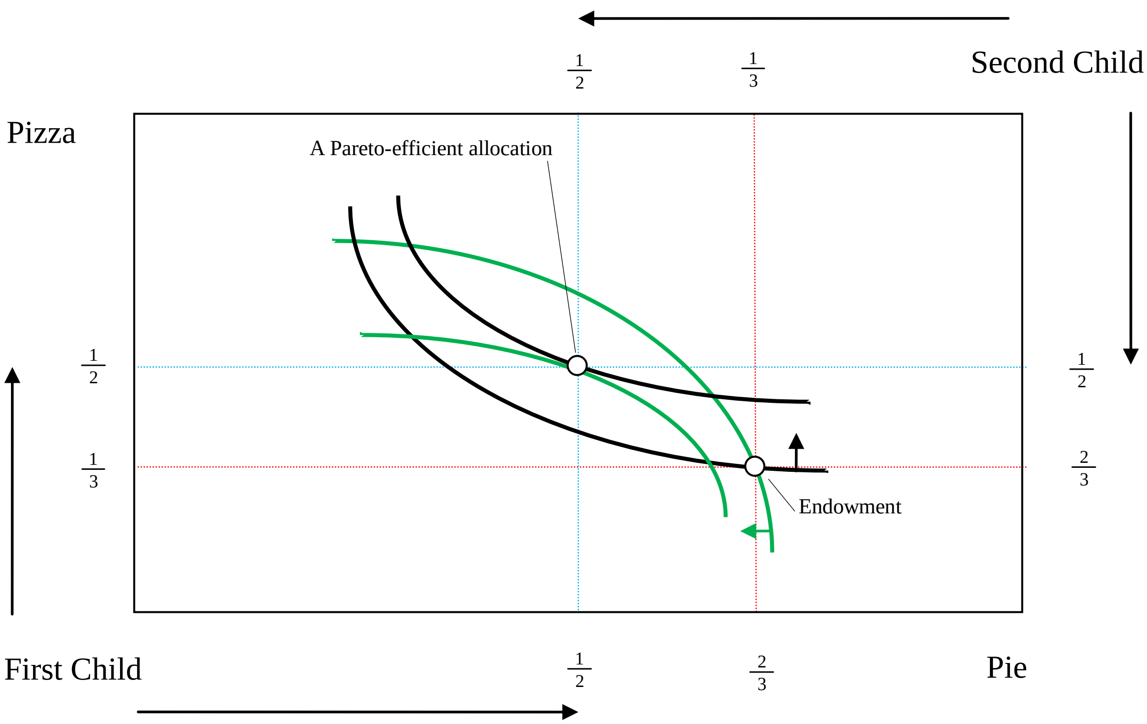

Figure 1: Edgeworth Box for the Two Siblings; Pie and Pizza

9. Conclusion

As scarcity abates in the family environment with regards to the boost in parental investment, the gains from trade moderate the parent-offspring conflict. Furthermore, it becomes possible to have an allocation that is both Pareto-efficient and matches the genetic preferences of the parents.

Trade is made possible after the emergence of cooperation and does not follow from egoistic utility maximizers. When they met, utility maximizers are in a Hobessian trap, which is a ubiquitous cause for violence. Standard economics ignores such subtleties. One contribution of this essay is to fill in the gaps of microeconomic theory with a full-fledged rationale for this omission.

However, the main contribution of the essay is to remove one grim implication of the parent-offspring conflict: Parents will attempt to mold an offspring against his best interests. It is pointed out that in modern humans, the possibility of trade and the gains accruing from it make it possible to reduce the costs of optimal parental investment. Such gains from trade will ultimately moderate the parent-offspring conflict.

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