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Professor Zak's empirical studies on trust and oxytocin

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ABSTRACT

In supporting his thesis that "market behavior is morality embodied", Professor Zak describes empirical studies on trust and oxytocin, with emphasis on his own work. I will discuss this work, suggesting that some conclusions are too enthusiastic.

1. Introduction

From our first economics course, we learn great respect for the ability of markets to organize economic activity with limited central direction. We also learn about market shortcomings regarding inequality, environmental damage, slavery, war, and other social problems. In his Introduction, Professor Zak emphasizes admiration of markets and deemphasizes criticism. His central thesis is that "market behavior is morality embodied."

To me, the market admiration is advanced with too little challenge. Among other arguments, we read (Section 1) that "uncoerced market exchange requires gains for both parties," that "sharing the gains . . . is the norm" because "excessive greed results in an absence of exchange", and that "virtue is rewarded and vice is vigorously punished". Such claims seem too enthusiastic. Exchange may be uncoerced, but the more knowledgable, dishonest, or powerful trader may gain an unfair share of the surplus. Excessive greed may prevent exchange, but well calibrated greed may earn a lavish, dishonest living. In many circumstances, vice is rewarded and virtue punished. A surprise, given the paper's title, is the heavy emphasis on two-person exchange. Many-person exchange through markets is little discussed.

Professor Zak gives two reasons why people reject his thesis that market behavior is morality embodied. First, "This essay's thesis is controversial primarily because of the Confucian/Vedic/Marxian residue that invades our daily thought and language as well as the practice of neoclassical economics." Second, "The belief in the selfishness of merchants . . . persists because it makes compelling story-telling. . . It is more interesting to tell a tale of the selfish, cheating merchant than the quotidian normalcy of purchase and delivery." On the other hand, perhaps we have better sense than that. Perhaps our concerns about economic problems result from their importance in everyday life.

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Supporting Professor Zak's philosophical inquiry is a broad discussion of scientific findings, with substantial emphasis on his own work, particularly concerning trust and the hormone oxytocin. I will discuss several of Professor Zak's scientific projects, following citations back to the original papers and to other writings.

2. Trust games and oxytocin blood level

In three closely related papers, summarized in the target paper, Zak et al. (2004, 2005) and Zak (2005) investigated the relationship between subjects' behavior in an experimental trust game and the level of the hormone oxytocin in their blood. Animal studies had suggested that oxytocin promotes prosocial behavior.

The Trust Game involved two subjects and a $10 endowment. At the outset, both players were told that they have $10 in their accounts. Player 1 was asked to choose an amount to be transferred to Player 2's account. As explained to both players, the transfer amount was tripled on the way to Player 2's account. Then Player 2 was asked to choose an amount to back-transfer to Player 1's account. The back-transfer was not tripled. That ended the game; the amounts in the two accounts were paid.

A simpler Random Draw Game served as a comparison. In it, the Player 1 transfer was selected by drawing a numbered ball from an urn, where the numbers were selected to make the average transfer approximately the same as in the Trust Game. In the Random Draw Game, Player 2 was fully informed that the transfer was decided by an urn, not by Player 1.

Members of a subject pool were randomly assigned to pairs to play the games. Anonymity was preserved by having all players receive information and enter decisions from partitioned computer stations. Immediately after a subject finished, he or she went to an anteroom to give a blood sample, from which oxytocin and several other hormone levels were measured. Prior to the game, subjects filled out a questionnaire on personality traits and life events. The main results from the experiment were three:

(A) The average back-transfer from Player 2 to Player 1 was larger in the Trust Game than in the Random Draw Game, suggesting that Player 2 subjects recognized and rewarded Player 1 subjects for their trust. The difference was statistically significant, but only at $p = 0.030$ (two-tailed).
(B) The average Player 2 oxytocin level was higher in the Trust Game than in the Random Draw game, suggesting that oxytocin was stimulated by another person's prosocial behavior, but was not stimulated by an impersonal urn. The difference was statistically significant, but only at $p = 0.049$ (one-tailed).
(C) The back-transfer from Player 2 subjects to Player 1 subjects in the Trust Game had an unclear relation to the oxytocin level of Player 2 subjects. The authors ultimately concluded that the relation was positive, suggesting that oxytocin stimulates prosocial behavior.

Significance was borderline for results A and B ($p = 0.030$ and $p = 0.049$). However, result C seems the most important since it involves an effect of oxytocin on prosocial behavior. For result C, significance is more complicated. One of the three papers presented a scatter diagram between (i) the amount back-transferred by Player 2 to Player 1 and (ii) the oxytocin level of Player 2 (Zak, 2005, Fig. 1). Let these two variables be called "BackTransfer" and "OT". The scatter between BackTransfer and OT was the only presentation of raw data in the three papers. I requested copies of the survey questionnaires, experimental instructions to players, and information on data and statistics. I received the survey questionnaire, but was told that the game instructions and data had been discarded within old computers. Thus, I will try to squeeze what I can out of the scatter.

The scatter was said to "show a positive relationship" (Zak, 2005, p. 369), but that is doubtful, either from inspection or from regression analysis. The visual impression of the scatter is a ∩ shape. Here are two regressions based on data measured from the scatter.

$$\text{BackTransfer} = \underset{(1.71)}{5.66} + \underset{(0.00497)}{0.00338}\,\text{OT} \qquad (R^2 = 0.0095,\ N = 50) \tag{1}$$

$$\text{BackTransfer} = \underset{(2.83)}{-0.972} + \underset{(0.0154)}{0.0451}\,\text{OT} - \underset{(0.0000164)}{0.0000465}\,\text{OT}^2 \qquad (R^2 = 0.1545,\ N = 50) \tag{2}$$

The numbers in parentheses under regression coefficients are their estimated standard deviations. The authors (Zak et al., 2005) viewed the direction of causality between back-transfer and oxytocin level as unclear. However, they used back-transfer as the dependent variable in various regressions. Accepting this premise, we can interpret the regressions.

The coefficient of OT in regression (1) is not significant, suggesting the absence of a positive relationship. The coefficients of OT and OT^2 in regression (2) are significantly positive and negative, respectively, at better than a $p = 0.007$ level (t-test, two-tailed), suggesting a ∩ shape. As OT increases from zero in Eq. (2), BackTransfer rises from near the origin to a peak about halfway along the observed OT range, and then falls back to zero. Neither regression explains a substantial fraction of the variability in BackTransfer. The authors reported that they had computed regressions roughly of form (2), but did not describe the ∩ shape of the fitted function or give the regression coefficient values or standard deviations (only coefficient signs). Some of their regressions included the initial forward-transfer as an additional independent variable, or as a normalization of the dependent variable (redefining the dependent variable as the ratio of the back-transfer to the initial forward-transfer).

These seem better specifications, but again only fragments of regression results were presented. The fragmentary reporting plus the loss of the original data mean that we are stuck with the BackTransfer and OT data as a basis for further investigation of results.

The analysis might well have stopped with a comment that the data did not allow a definite conclusion about result C. The study would still be interesting. However, the authors pursued a positive result by challenging some of the observations. There were five observations in the lower right of their scatter of points. These five subjects showed high values of OT, but low values of BackTransfer, contradicting the authors' hypothesis and anchoring the right side of the ∩. Without the five, the scatter would indicate a positive relationship, as claimed. (The simple correlation between BackTransfer and OT would have risen from an insignificant $r = 0.097$ to a significant $r = 0.51$.) A case for excluding the five observations began in Zak (2005, p. 369). He commented:

> "We investigated traits that differentiated these five 'unusual' participants from the others and found that they exhibited labile affect on four self-report measures, were usually sexually active, said that they thought others were trustworthy, and evaluated themselves as very trustworthy. They also stated that accumulating wealth while others lived in poverty was acceptable. Though these results are based on a small sample and should be taken with caution, they suggest that a lack of trustworthiness after receiving a signal of trust is associated with identifiable personality traits."

This quotation refers to subjects' answers to the survey questionnaire. The challenge is more sharply stated in the current target paper (Section 4.4):

> "My lab also showed that DM2s in the trust game who are unconditional nonreciprocators (that is, who play the sub-game perfect Nash strategy) have a dysregulation of the OT system (Zak, 2005). In psychological surveys, these Machiavellian players have characteristics similar to sociopaths (they are manipulative, feel entitled to certain things as 'their right', have a lack of remorse, shame or guilt, shallow emotions, a lack of empathy, and are sexually promiscuous; see Diagonostic and Statistical Manual IV TR, American Psychiatric Association, 2000). Social phobics have a similar OT dysregulation (Hoge, Simon, Kaufman, Zak & Pollack, 2007), and autistics may as well (Hollander et al., 2003)."

The phrase "in psychological surveys" refers to subjects' answers to the Zak et al. questionnaire. The words "they are manipulative, . . ., sexually promiscuous" refer, not to subjects' answers, but to the definition of "sociopath" in the American Psychiatric Association source. Since the reference to Zak (2005) refers to the first quotation, I think the "unconditional nonreciprocators" are the same five observations. However, the reference to Nash equilibrium might mean that only three of the five (those with exactly zero BackTransfer) are under consideration. Whatever the exact meaning, the quotation is remarkable. Subjects who contradict the authors' hypothesis are disparaged as "Machiavellian players . . . similar to sociopaths", based only on their location on a scatter and their self-descriptions as trustworthy, emotionally labile, sexually active, and willing to accumulate wealth while others live in poverty. Most surprising is the willingness to diagnose a medical ailment – a "dysregulation of the OT system" – from such information. The comparison of the subjects to social phobics and autistics is also puzzling. In one paper cited in support, Hoge et al. (2008) found that, for 24 socially phobic patients, oxcytocin level was positively associated with symptom severity ($p = 0.04$, two-tailed). In the other paper cited in support, Hollander et al. (2003) found that repetitive behaviors of 15 adult autistics were on average reduced following synthetic oxytocin infusion ($p = 0.027$, two-tailed). The "similarity" of social phobia or autism to the behavior of the five subjects or to sociopathology is completely unclear.

There is no iron law against challenging subjects who contradict a preferred hypothesis, but the burden of proof should be heavily on the challengers. To me, the burden against the five observations was not carried.

Moving on, there is confusion about sample size in the three papers by Zak and coauthors. The sample for the scatter between BackTransfer and OT (in Zak, 2005), on which the main conclusion was based, was $N = 50$. This sample was reported as $N = 77$ in the text of the same paper, and as $N = 48$ in the related Zak et al. (2005) paper. Referring to this experiment, the target paper says (Section 4.4), "Because any physiologic measurements are inherently noisy, we ran a very large sample ($N = 156$) to demonstrate that the findings were robust." In Zak (2008, pp. 267–268), the reported sample is up to $N = 212$:

> "I studied 212 subjects. . . Approximately 98 percent. . .had proportional behavioral responses: the higher their oxytocin levels, the more they shared money with the person who initially demonstrated trust in them. But the other 2 percent of subjects, though their brains produced a surge of oxytocin, were untrustworthy, keeping all or nearly all the pot of money they controlled (Zak, 2005). Two percent is roughly the proportion of sociopaths in the population, and these subjects' psychological profiles had elements of sociopathy."

Part of the confusion about sample size is that each of the $N = 50$ observations on the authors' scatter diagram between BackTransfer and OT involves two subjects (a Player 1 and a Player 2). Nonetheless, $156/2 = 78$ and $212/2 = 106$, which are not close to each other or to 50. Part of the confusion might be that the experiment was not done all at once, but in cumulating waves, with some late subjects not included in early papers. However, the preceding quotation implies that all 212 were involved in Zak (2005), which is the source of the scatter.

Also note the "2 percent of subjects" in the preceding quotation. These seem again to be the five challenged observations (the calculation is apparently 5/212 = 2.36% ≈ 2%). The purpose of the comment is to support the "dysregulation" finding by claiming a match between the frequency of the five in the sample and the frequency of sociopaths in the population. However, the proper measure of the five's frequency in the sample is five out of the 50 Player 2 subjects on the scatter under discussion; and 5/50 = 10%, not 2%.

In Section 4.4 of the target paper, Professor Zak comments, "The behavioral effects of OT in humans were unstudied prior to the discovery by my lab of its effects mediating trusting behavior between strangers (Zak et al., 2004, 2005)." However, several prior studies of behavioral effects of OT on humans are briefly reviewed in Hollander et al. (2003), an article cited in the target paper.

3. Trust games and externally administered oxytocin

The three papers just discussed related trust games to oxytocin naturally generated within subjects, as measured from blood samples. A paper by Kosfeld et al. (2005) related trust games to oxytocin externally administered by nasal inhaler. Half the subjects inhaled oxytocin, and half inhaled a placebo, under double-blind conditions. The external administration and randomization clarified the direction of effect; subjects' game behavior was the dependent variable and oxytocin the independent variable. The game instructions and questions were readily available. They provided a helpful sense of how the experiment might appear from a subject's viewpoint. The authors found that the average transfer from Player 1 to Player 2 was 17% higher for the oxytocin group than for the placebo group (significant at $p = 0.029$, one-tailed), but that the back-transfer from Player 2 to Player 1 was not significantly different between the two groups ($p > 0.243$ over several tests, two-tailed).

4. Ultimatum games, dictator games, and externally administered oxytocin

In a similar experiment, Zak et al. (2007) administered oxytocin to half the subjects by nasal inhaler, with the other half receiving a placebo, under double-blind conditions. Again experimental games were studied, but this time ultimatum and dictator games rather than a trust game.

The ultimatum game involved two people, a proposer and a responder, and an amount of money, in this case \$10. The proposer was asked to propose a split of the \$10 into P for the responder and \$10–P for himself (all subjects were male to avoid the risk that oxytocin might cause miscarriage). The responder could accept the proposal, in which case payments were made, ending the game. Or the responder could reject the proposal, in which case the proposer and responder were paid nothing, ending the game. In the dictator game, the first person, the dictator, was asked to announce a split of \$10 into D for the other person and \$10–D for himself. That ended the game; the second person had no decision to make.

In the experiment, each of 68 subjects was asked (i) what value of P he would choose if assigned the role of proposer in the ultimatum game, (ii) what rejection value R he would choose if assigned the role of responder in the ultimatum game, and (iii) what value of D he would choose if assigned the role of dictator in the dictator game. The oxytocin, or placebo, was administered an hour before subjects were asked for their choices. At the experiment's end, the authors had observations on three variables (P, R, D) for each of 68 subjects, half of whom had inhaled oxytocin. Random pairings were drawn, and the payoffs resulting from those pairings were made.

A subject who chose a larger P, or a smaller R, or a larger D would in each case be helpful to the other player. That is, each of (P, R, D) is an indicator of prosocial behavior (negatively for R), though other motives are involved. The purpose of the experiment was to investigate the impact of oxytocin on the three variables (P, R, D). The authors presented the oxytocin-vs-placebo contrast for each:

$$\bar{P}_{\mathrm{OT}} = \$4.86, \quad \bar{P}_{\mathrm{PL}} = \$4.03, \quad p = 0.005, \quad 20.6\% \text{ prosocial difference.} \tag{3}$$

$$\bar{R}_{\mathrm{OT}} = \$3.03, \quad \bar{R}_{\mathrm{PL}} = \$2.91, \quad p = 0.78, \quad -4.1\% \text{ prosocial difference.} \tag{4}$$

$$\bar{D}_{\mathrm{OT}} = \$3.77, \quad \bar{D}_{\mathrm{PL}} = \$3.58, \quad p = 0.51, \quad 5.3\% \text{ prosocial difference.} \tag{5}$$

Here bars over variables indicate group means, with the subscripts OT and PL indicating the oxytocin and placebo groups. The p-values are for two-tailed Mann–Whitney tests. Only the P contrast of line (3) is statistically significant. The per cent "prosocial differences" are intuitive summary measures, computed relative to the placebo benchmark. The percent in line (4) is given a negative sign since R is an anti-sociality measure. A fair summary might be that oxytocin had a significant prosocial effect for only one of the three measures, namely P, with an estimated effect of 21% for that measure.

However, the target paper (Section 4.5) states that subjects in the oxytocin group were "80% more generous" than subjects in the placebo group. The "80% more generous" conclusion was featured in the original paper's abstract; it is featured on Professor Zak's website; it has been repeated in numerous media interviews given by Professor Zak (available on his website); and it is typically presented as if the primary outcome from the study. Yet there is no 80% apparent from lines (3)–(5). Further, in a review of the effect of hormones on trust and altruism, Fehr (2008, pp. 51–52) comments that Zak et al. (2007)

"confirmed that OT has no effect on generosity." Fehr's "no effect" comment is easy to understand. He takes D as a measure of "unconditional generosity", and the D-contrast of line (5) is far from statistical significance. But where did Zak et al. get the "80% more generous"?

They did so by giving "generosity" a special definition. A subject's generosity was defined to be P–\$2.97, where \$2.97 is the grand average of R over all subjects (from line (4)). P–\$2.97 was called "generosity" because it is how much more a subject would be offering than was necessary to avoid rejection by an average responder. From line (3), the per cent difference between the averages of P–\$2.97 for the oxytocin and placebo groups is

$$\frac{(\bar{P}_{\mathrm{OT}} - \$2.97) - (\bar{P}_{\mathrm{PL}} - \$2.97)}{\bar{P}_{\mathrm{PL}} - \$2.97} = \frac{4.86 - 4.03}{4.03 - 2.97} \approx 80\% \tag{6}$$

The algebraic cleverness of Eq. (6) is that normalizing P as an excess over \$2.97 has no effect on the numerator, but shrinks the denominator. Without the \$2.97, the per cent difference would be 21%, as given in (3). With the \$2.97, the per cent jumps to 80%. To me, and apparently to Fehr, P–\$2.97 seems a doubtful measure of generosity. A subject does not know that the average of R is \$2.97; a subject would have no assurance that a proposal P only slightly greater than the average R would be large enough to prevent rejection by his particular partner; and, in any case, D seems a cleaner measure of generosity.

Overall, use of "80% more generous" as a punchline seems to be misleading, detracting from the careful scientific effort put into the experiment. Since interpretation of subjects' responses is at the heart of issues here, the exact phrasing of the instructions and questions, and perhaps the table of (P, R, D) data-points for the 68 subjects, would be helpful to readers. However, Professor Zak informed me that this information had been discarded within old computers and thus was not available.

5. Cross-country evidence on the relation of trust to other variables

To confirm the role and importance of trust, the target paper looks to cross-country data on trust as related to cross-country data on oxytocin, economic growth, happiness, and stock returns. The trust variable is from the continuing World Values Survey (see their website). In repeated surveys of many countries, respondents are asked, "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" A country's trust is then defined as the fraction of its respondents who answer "can be trusted" as opposed to "can't be too careful".

5.1. Trust and oxytocin

Zak and Fakhar (2006, p. 414) "hypothesize that human beings living in environments associated with higher levels of oxytocin and/or estrogen are more likely to report that others in their society are trustworthy." Since the authors had no cross-country data on oxytocin or estrogen, they constructed proxies using three principal components from a list of 31 variables claimed to be "oxytocin-correlates" or "estrogen-correlates". Examples of the 31 variables are breast feeding, telephones, religion, biodiversity, pesticides, and the phytoestrogen content of foods. No evidence is presented that national levels of these variables actually are correlated with national levels of oxytocin or estrogens. For example, it is known that breast feeding induces oxytocin surges; but, since breast feeding occupies only a tiny fraction of a society's time, and since oxytocin surges are short-lived, it is not known whether there is a measurable effect at the national level.

The trust variable was regressed on per capita income and on the first three principal components of the hypothesized oxytocin and estrogen "correlates". The regression shows very strong significance for per capita income, and borderline significance for two of the three principal components ($p = 0.031$ and $p = 0.038$, two-tailed). The R^2 was 0.702. The authors interpreted the regression as confirming their hypothesis, and they offered the thought (p. 420) that the "presumed causal mechanism is either that oxytocin directly raises trust, or does so indirectly by stimulating social interactions which build trust." Since the project involved no data on oxytocin, heavy skepticism seems appropriate.

5.2. Trust and growth

Building on work of Knack and Keefer (1997), La Porta et al. (1997), Whitely (2000), and others, Zak and Knack (2001) related trust to economic growth. Using 41 cross-country observations, they regressed the growth rate of GDP per capita on the World Values Survey trust measure and other explanatory variables. Based on this study, the target paper (Section 6) reports that trust is "strongly associated with subsequent per capita income growth". The *Moral Markets* book (Zak, 2008, p. 273) comments that: ". . . trust is among the strongest predictors that economists have ever found of whether a country would have increasing or decreasing living standards. Low-trust countries have stagnating or declining per capita incomes, whereas high-trust countries enjoy steady income growth."

The Zak and Knack paper has been influential in prompting follow-up studies, notably Beugelsdijk et al. (2004), Berggren et al. (2008), and Roth (2009). These studies enlarged the data-set and introduced extensive tests of robustness. Beugelsdijk et al. concluded that robustness was "rather limited". Berggren et al. titled their paper "Trust and growth: a shaky relationship." Roth, using the most recent data, provided the most striking conclusion. He constructed a panel data-set for five time periods (each five years long) for each of 41 countries (OECD and further European countries). Since trust varied

substantially over periods for a number of the countries, the panel set-up was potentially important. The primary result was that, when trust is allowed to influence growth quadratically, the effect of trust on growth is positive for smaller values of trust but negative for larger values. When trust was forced to influence growth linearly, the effect of trust on growth was *negative* under fixed effects panel estimation (the random effects model failed the Hausman test). The cross-country analysis of Dearmon and Grier (2009) is related. Also using panel data, they conclude (p. 210) that "...trust is a significant factor in development". However, they relate the level, rather than the growth rate, of GDP per capita to trust; there is no direct contradiction between Roth (2009) and Dearmon and Grier (2009). Overall, despite comments in the target paper and *Moral Markets* book, strong caution about a positive trust-growth relation is in order.

5.3. Trust and happiness

In Section 6.2, the target paper comments on cross-country correlations among trust, happiness, and income per capita:

> "... among 85 variables examined, Zak and Fakhar (2006) report that happiness had the highest correlation with trust... These results continue to maintain significance when income is controlled."

The comment refers to the Zak and Fakhar (2006) paper discussed in Subsection 5a above. The sample was 27 countries (see Zak and Fakhar, Fig. 5). Since the quotation is surprising, I tried to check, focusing only on the three variables mentioned.

The trust data were easily found on the World Values Survey website; and the income per capita data were easily found in Summers and Heston (1991). The happiness data were a puzzle. Zak and Fakhar (p. 426) said they used survey data involving the question "how many days in the last week did you feel happy?" However, the vague reference led me only to website dead ends. I gave up and improvised a happiness index from a World Values Survey question (1989–1993 wave). The question asked whether a respondent was "very happy", "quite happy", "not very happy", or "not at all happy". I assigned values 4, 3, 2, 1 to the four possible answers and averaged over respondents for each country. To my great surprise, the improvised index exactly reproduced the happiness values in Zak and Fakhar (on their Fig. 5). Apparently I stumbled on the actual Zak–Fakhar source by blind luck.

Returning to the quotation two paragraphs above, I found the first sentence to be wrong in the sense that another of the Zak and Fakhar variables, namely income per capita, had a higher correlation with trust ($r = 0.71$) than did happiness ($r = 0.58$). Regarding the second sentence of the quotation, the partial correlation of trust with happiness, given per capita income, was 0.30, which is not significantly different from zero ($p = 0.15$, Fisher z-test, two-tailed). Thus, if happiness had the highest partial correlation with trust, it would follow that none of the other variables had significant partial correlations, in which case it is not clear what useful meaning the second sentence might have.

5.4. Trust and stock returns

As referenced in the target paper, Zak (2003) presented a scatter diagram for 16 OECD countries involving (i) average annual inflation-adjusted stock market return for 1990–2000 and (ii) the World Values Survey measure of trust. The identities of the 16 countries, the reason for including only 16, and the sources and definitions of returns were not given. The target paper (Section 6.2) comments, "... stock market returns in the OECD from 1990 to 2000 are strongly predicted by survey measures of trustworthiness." In fact, the scatter was not predictive at all. In a regression of return on trust, based on data measured from the scatter, the trust coefficient is not close to significant, much less strong prediction ($t = 0.89$, two-tailed $p = 0.39$, $R^2 = 0.054$). There is one extreme outlier country with negative return. If it is excluded, the trust coefficient is still not significant ($t = 1.74$, two-tailed $p = 0.11$, $R^2 = 0.188$).

6. Conclusion

Among other views, Professor Zak advances these: There is much more to economic behavior than narrowly self-interested optimization. Humans are social animals whose evolved inclinations to trust and cooperate are important to economic behavior. It makes sense for economists to study morals scientifically in the context of how they relate to economic decisions and institutions. Other fields, including evolution and neuroscience, are involved. I agree with these views and thank Professor Zak for advancing them.

However, there is a persistent problem. Professor Zak's conclusions from his empirical studies seem to go well beyond the data.

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