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Abstract

Self-control theory is one of the best studied criminological paradigms. Since Gottfredson and Hirschi published their General Theory in 1990 the theory has been tested on more than a million subjects. This meta-study systematizes the evidence, reporting 717 results from 102 different publications that cover 966,364 original data points. The paper develops a methodology that makes it possible to standardize findings although the original papers have used widely varying statistical procedures, and have generated findings of very different precision. Overall, the theory is overwhelmingly supported, but the effect is relatively small, and is sensitive to adding a host of moderating variables.

JEL: C13, D03, K14, K42

Keywords: Keywords: self-control, general theory of crime, meta-study

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I. Control Theory

Few criminological theories have had such an impact as the "General Theory of Crime" by Gottfredson and Hirschi (Gottfredson and Hirschi 1990). The theory is not only pervasively cited,[1] and has triggered a lively theoretical debate. It has also been tested empirically hundreds of times.[2] This meta-study organizes the empirical evidence. While a predecessor study 10 years ago had covered 19 papers (Pratt and Cullen 2000), this paper covers 102 publications. It develops a new methodology to make the effect of low self-control on crime and deviant behavior comparable across studies, including the competing operationalizations of self-control. It uses the resulting dataset to test the effect of multiple explanatory variables on the sensitivity of deviance to a lack in self-control.

The general theory has become a classic of criminological theory. Suffice it in this introduction to recall its key components and claims. The theory sets out to explain the stability of crime over the lifecourse of the individual (Gottfredson and Hirschi 1990**:** 107 and passim), and the versatility of crime, i.e. a lack of specialization in committing certain types of crimes (Gottfredson and Hirschi 1990**:** 91-94 and passim). The theory posits the following explanation: Resulting from deficiencies in child rearing (Gottfredson and Hirschi 1990**:** 97-107), the inability to resist the drive for immediate gratification is likely to stay with this person for the rest of her life. And a person having a hard time controlling her urge to commit one crime is likely to do no better if the opportunity to commit another crime presents itself (Gottfredson and Hirschi 1990**:** chapter 5).

Bold claims provoke critique (for summary accounts see Brannigan 1997**;** Schulz 2006**:** chapter 6). Critics have wondered whether low self-control and the propensity to commit crime collapse, which would make the theory tautological (Akers 1991**;** Marcus 2004), and whether self-control is not better analyzed as a feature of the situation, not as a personality trait (Wikström and Treiber 2007). They have pointed to the fact that, at least in the original version of the theory (but see Hirschi 2004**:** 543; Piquero and Bouffard 2007), criminal opportunity got short shrift (Barlow 1991). They have wondered whether it is justified to even extend the self-control explanation to white collar crime (Tittle 1991**;** Reed and Yeager 1996**;** Herbert, Green et al. 1998), whether it is legitimate to explain the well-known decline of crime with age by a distinction between a stable trait ("criminality") and its time-variant expression ("crime") (Tittle 1991**;** Geis 2000**;** Geis 2008), and whether social norms (Taylor 2001) and culture are not a more important determinant of the crime rate than the General Theory admits (Komiya 1999). From the opposite angle, it has been said that the key role of parental management is inconsistent with a purely individualistic explanation of crime (Kissner 2008). Critics have also missed an explicit treatment of the link between crime and power, in particular to the detriment of women (Miller and Burack 1993), they have argued that disruptions of parental attachment in early childhood should be acknowledged as an additional cause of crime (Hayslett-McCall and Bernard 2002), and that the theory should account for the fact that most antisocial children do not turn into adult criminals

[1] Google Scholar lists 4696 citations, as of Feb 19, 2012.
[2] For detail, see section 0 below.

(Cohen and Vila 1996). In a series of articles, Gottfredson and Hirschi have responded to their critics, have further explicated and slightly modified their theory (Hirschi and Gottfredson 1987**;** Hirschi and Gottfredson 1989**;** Hirschi and Gottfredson 1993**;** Hirschi and Gottfredson 1995**;** Hirschi and Gottfredson 2000**;** Hirschi and Gottfredson 2001**;** Gottfredson and Hirschi 2003**;** Hirschi 2004**;** Gottfredson 2008**;** Hirschi and Gottfredson 2008**;** Gottfredson 2011).

II. Present Research Focus

The General Theory has thus triggered a lively theoretical debate. Yet in comparison the reaction of empirical criminologists has been just overwhelming. Since the book has come out in 1990, hundreds of empirical tests have been performed (see next section for details). It is the purpose of this meta-study to make this huge body of evidence accessible, to make individual contributions comparable, and to derive insights for the relationship between self-control and crime that do only follow from all these studies jointly, not from individual contributions in isolation. Of course, not all of these studies have defined deviance the same way, nor have they operationalized and measured self-control by the same construct. To make results comparable, I therefore construct an index that is relative to the dependent and the independent variable used by the respective study. Conditional on the specifics of the study, the index measures by how many percent antisocial behavior increases if self-control drops by 10 percent. I register the specifics of each study in multiple dimensions, and use these indicators as control variables.

Overall, the General Theory has performed very well empirically. In all these empirical tests, low self-control and crime, or deviant behavior more generally, have hardly ever been negatively correlated. Insignificant findings are also rare. In most studies, low self-control has the expected positive effect on the frequency or the severity of crime. Yet contextual factors matter to a remarkable degree. To preview only a few findings: self-control is much more important for actual delinquency than for "analogous behavior". It is even more important for actual convicts. It is most important for adolescents, but only if analogous behavior is at issue. If one does not control for race, one overestimates the effect of low self-control. If one does not control for family support and for opportunity, one underestimates the effect.

Methodological issues do also become visible: Attitudinal measures, like the popular scale by Grasmick, Tittle et al. (1993), heavily underestimate the effect of low self-control. Several explanatory variables significantly interact with the average level of deviance in the sample. If researchers have used a non-linear statistical model, they estimate a much smaller effect. The later the study, in historical time, the bigger the estimated effect.

There is one major predecessor study, by Pratt and Cullen (2000). It covered 19 papers, while my meta-study covers 109 (102), with 826 (717) separate observations (see Figure 1). I also develop a new dependent variable, which is better suited to organize this evidence. I explain the methodological differences between both meta-studies in section 0 below. Other summary reports and meta-studies are less close. Riddle and Roberts (1977) is a meta-study of psychological research

on a measure of delayed gratification on delinquency. Hinshaw (1987) summarizes findings about the correlation between attentional deficits and aggression in children. Lipsey and Derzon (1998) cover predictors of adult delinquency from observing them as children or adolescents in general. Hoyle, Fejfar et al. (2000) is a meta-study of the relationship between personality measures and sexual offending. Baumeister (2002) surveys empirical findings about the effect of low self-control on consumer behavior. Smith (2004) reviews those papers on self-control theory that specifically look at the moderating effect of criminal opportunity. Cullen, Unnever et al. (2008) do the same for those papers specifically looking at moderation by parenting. Finally Piquero, Jennings et al. (2010) have a different dependent variable. Their meta-study analyses the degree to which self-control is open to purposeful intervention.

III. Methods

1. Data Set

In an attempt to be exhaustive, I have started with the keyword "Gottfredson Hirschi" in the National Criminal Justice Reference Service database. This led to 162 hits. Removing duplicates and papers unrelated to self-control theory, I have kept 95 entries. In the next step, I have checked the lists of references of these publications, and the lists of references of all papers found this way. This led to another 283 entries. In the final step, I have checked the 2010, 2011 and advance access files[3] of the following major journals: British Journal of Criminology, Canadian Journal of Criminology and Criminal Justice, Crime and Delinquency, Criminal Justice and Behavior, Criminology, Deviant Behavior, European Journal of Criminology, Journal of Crime and Justice, Journal of Quantitative Criminology, Journal of Research in Crime and Delinquency, Justice Quarterly. This led to a final 14 entries, and to a total of 392 papers that constitute my gross sample.

Unfortunately, I can only cover 109 of these papers in my meta-analysis. Table 1 lists the reasons why I had to exclude papers. Since there is frequently more than one reason, the table takes the form of a correlation matrix. For instance read the entry in the "wr_dv" / "wr_iv" cell as saying that there is one paper that not only has the wrong dependent, but also the wrong independent variable. 48 papers have no data, be it that the author is only interested in self-control theory (43 papers) or in empirical methodology (5 papers). Most of the former papers have already been covered in the introduction. 43 papers have the wrong dependent variable, for instance because they are interested in explaining levels of self-control, not levels of deviant behavior. Another 37 papers have the wrong independent variable, for instance since they explain deviance with the level of parental control.

A considerable number of papers do not report a piece of information that would be necessary for calculating the index. 14 papers do not establish a nexus between low self-control and devi-

[3] Deadline August 20, 2011.

ance in the first place. 57 papers do not report the range of the dependent variable. I then cannot say by how many percent the dependent variable changes if self-control is reduced by 10%. 66 papers do not report the range of the independent variable. I then cannot say which is the effect of a 10% reduction in self-control. That is, without knowing both ranges, I cannot normalize the findings across studies. I explain this is more detail in sections 0 and 0 below. If the respective paper has used a linear statistical model, I do not necessarily need the mean of the dependent variable. In a linear model, the marginal effect of a one unit change of an independent variable on the dependent variable is the same whichever the level of the dependent variable. This is different with non-linear models, like logit or a negative binomial regression. In order to exclude as little papers as possible, I then calculate the marginal effect at the mean of the dependent variable. I must exclude 43 papers since they use a non-linear model, but do not report the mean of the dependent variable. If the range of the dependent or the independent variable is not reported, but if I know their means and standard deviations, I construct the range, assuming that either variable is normally distributed. In 49 papers, I cannot use this proxy either since the mean of the independent variable is not reported either. In further 38 papers, information about the standard deviation is missing. Two papers estimate an ordered logit model, but do not report the estimated cut off points. That makes it impossible to calculate the marginal effect of a change in self-control at the mean of the dependent variable. 54 papers do not provide any measure of effect size. One paper suffers from an obvious mistake which I cannot correct. One works with simulation. Three papers only report qualitative findings. Three more papers report the same data as an earlier paper published in a different journal.

	th	meth	wr_dv	wr_iv	no_n	m_ra_dv	m_ra_iv	m_me_dv	m_me_iv	m_sd	m_cut	m_eff	mist	sim	no_q	rep
th	43															
meth		5														
wr_dv			43	1		1	1		1			1				
wr_iv				37	3		1					1				
no_n					14	1	1					1			1	1
m_ra_dv						57	53	35	36	26		2				
m_ra_iv							66	35	42	32		2				
m_me_dv								43	41	30		1				
me_me_iv									49	35		1				
me_sd										38		1				
m_cut											2					
m_eff												54				
mist													1			
sim														1		
no_q															3	1
rep																3

Table 1
Reasons for Excluding Papers from Meta-Analysis

th: theory only; meth: empirical methodology only; wr_dv: wrong dependent variable; wr_iv: wrong independent variable; no_n: paper establishes no nexus between low self-control and deviance; m_ra_dv: range of dependent variable not reported; m_ra_iv: range of independent variable not reported; m_me_dv: mean of dependent variable not reported; m_sd: standard deviation of dependent variable not reported; m_cut: coefficients of cut-offs not reported (for ordinary logit); m_eff: no measure of effect size; mist: mistake in data; sim: simulation; no_q: no quantitative information; rep: repeats earlier publication

The remaining dataset covers 1,074,895 observations.

The left panel of Figure 1 shows that interest in self-control theory has peaked after the turn of the century, and has somewhat been on the decline in recent years. This might imply that the

empirical body of evidence is maturing, which would make this a particularly suitable point in time for taking stock with a meta-study. The right panel demonstrates that journals have covered self-control theory unequally, with Criminology standing out.

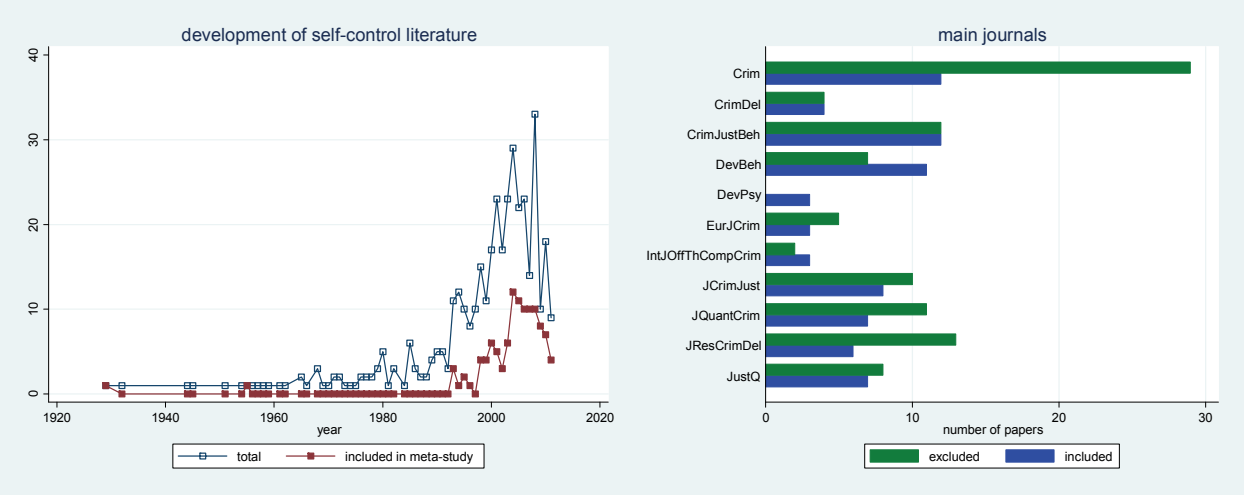

Figure 1
Features of the Data-Set

2. Dependent Variable

The dependent variable of the meta-study is a composite construct. In the original papers, some measure of deviance is explained by some measure of self-control. Yet for the purposes of the meta-study, this approach would not be meaningful. The measure of interest is not unconditional deviance, but deviance conditional on varying degrees of self-control. If self-control theory has it right, the lower self-control of an individual, or of a defined population for that matter, the higher the predicted level of deviance. Put differently, the explanatory power of self-control theory is the higher, the more the level of deviance is sensitive to changes in self-control. The dependent variable of the meta-study is precisely this. Separately for each paper, and if the paper had covered several populations, measurements, dependent or independent variables, then separately for each of those, it indicates how strongly predicted deviance increases if self-control goes down by 10%. Economists would call this an elasticity. From a policy perspective, the higher this dependent variable, the more important self-control is for crime control.

This procedure deviates from the research strategy of the major predecessor paper. Pratt and Cullen (2000) also estimate effect sizes, but they use a standardized correlation coefficient for the purpose. I take an alternative approach because otherwise I would have lost many more observations. In recent years, beta-coefficients have been reported less and less frequently. I can only reconstruct them from the unstandardized regression coefficients if the standard deviations of both the dependent and the independent variables are reported. This is often not the case.

More importantly even, 47 of the 109 papers covered by the meta-study use a non-linear statistical model. For such models, there is no meaningful way of calculating standardized correlations.

The dependent variable of the original papers is some measure of deviant behavior. I record the concrete type of behavior as one of the independent variables. That way I for instance can measure whether a lack of self-control is more important for delinquency than for analogous behavior. To make the degree of deviance comparable across studies, I work with the theoretical range. I express the mean of the dependent variable by a percentage of this range. Thus if deviance is, for instance, measured on a scale from 1 to 5, I translate a finding of 2 into (2-1)/(5-1) = .25. The same way I normalize the standard deviation.

Sometimes the dependent variable had been reversely coded, with higher values meaning less deviance. In that case I subtract the reported mean from the upper, not from the lower bound of the theoretical range. Other papers have transformed the dependent variable, for instance taking the natural log to guard against a skewed distribution. I then retransform the range and the mean before normalizing the finding. If the study has worked with a binary dependent variable, it is automatically bounded between zero and one. In that case, the mean dependent variable is the predicted probability.

If the theoretical range of the dependent variable has not been reported, I use the empirical range as a proxy. If neither of these measures is available, but the paper has reported the mean and standard deviation, I construct the lower bound by mean minus 3 standard deviations, and the upper bound by the mean plus 3 standard deviations. Since a negative amount of deviance could not be interpreted, I, however, truncate the range at zero.

The independent variable of the original papers is some measure of self-control. Different papers have used very different concepts and empirical strategies to generate this measure. These different approaches constitute another important explanatory variable for the meta-study. For normalizing the independent variable, I use the same approach as for the dependent variable. This not only makes it possible to express the observed mean and standard deviation by a percentage of the theoretical range. More importantly, standardizing both the dependent and the independent variables also provides me with a standardized measure of effect size. It is given by the percentage change of the dependent variable, conditional on a 10% change of the independent variable. Using both transformations, I thus generate a standardized regression coefficient.

This approach has a natural correlate for non-linear statistical models, like logit, ordered logit, probit, Tobit, Poisson or negative binomial regression. All of these have been used in self-control studies. In non-linear models, the marginal effect of a one-unit change in an independent variable depends on the remaining explanatory variables. It cannot directly be read off the regression coefficient. I then calculate the marginal effect of a 10% reduction in self-control *at the mean* of the dependent variable in the respective study. Finally if the study uses a structural equation model, I only use the direct effect of low self-control on deviance.

3. Analytic Strategy

For the ease of reading, independent variables are introduced together with the findings from the meta-study. At this point I have to discuss my analytic strategy. My dependent variable is continuous and uncensored. It is somewhat skewed. Yet if I repeat the analysis with a log transform or with a square root transform, coefficients are of course different, but results look qualitatively very similar. Significance levels are usually not affected. Since coefficients can then be interpreted directly, I prefer (untransformed) ordinary least squares.

I have, however, two complications. First from many papers I have more than one data point. Authors have compared different populations. Longitudinal studies have measured the same population repeatedly. Other authors have used multiple dependent or independent variables. Finally many authors have estimated several statistical models, usually in the interest of adding moderating or mediating factors. In all but the first case, observations are even dependent on observables. And if the same author has tested different populations on the same design, I cannot exclude that these observations depend on unobservables. With such a data generating process, a random effects model would be most efficient. Yet since most of my explanatory variables differ within, not between papers, these explanations would get lost if the Hausman test forced me to use a fixed effects model. More importantly, if I use a random effects model, I cannot weight the data. This, however, is mandatory in a meta-study. Although this involves a slight less in statistical power, I therefore revert to clustering standard errors for publications. To guard against heteroskedasticity, I also estimate robust standard errors.

The second complication is the mainstay of meta-study. While each statistical model in a paper covered by the meta-study generates but one data point, from the statistical tests performed by the authors of the original papers I have information about the reliability of these findings. Metastudy does not just aggregate this information (e.g. by calculating means). It measures what the entire community of researchers undertaking self-control studies has found, through weighing the contribution of each individual study by its precision. Since I must simultaneously solve the dependence problem, I cannot use ready-made tools like the *metareg* command of Stata (Harbord and Higgins 2008) for this purpose, though. Yet my solution keeps the essence of meta-regression. I weigh each data point by the inverse of the square of the standard error, and then cluster for publications.[4] Recall that my dependent variable is the sensitivity of deviance to a decrease in self-control. Consequently the standard error in question is the standard error of the regression coefficient for self-control in the original paper. Unfortunately some papers neither report standard errors nor p-values, from which standard errors could be reconstructed. Although I otherwise have full data, I have to exclude another 112 data points since I cannot weigh them. This leaves me with a final sample of 717 data points. The final sample still covers 966,364 original data points.[5]

[4] The Stata code is reg dv ivs [aw=se^(-2)], robust cluster(study_id).

[5] For the unconditional effect of low self-control, I also report unweighted results that use all data, see below 0.

IV. Analysis

1. Descriptives and Unconditional Effect

Figure 2 summarizes the distribution of the dependent variable. One directly sees that it is very rare for the effect of the decrease in self-control on the level of deviance to be negative. This is only observed in 42 of 826, or in 5.08% of all cases. Most frequently, the effect is positive, but small. The median is at .02268. If a person has 10% less self-control than another, this person is 2.27% more likely to behave antisocially, or to deviate that much more from social expectations. Yet quite a few studies have found stronger effects, occasionally even above .1. Such a study predicts that a person with 10% less self-control than another is even more than 10% more likely to behave antisocially. Yet such an extreme effect of self-control is only observed in 11 of 826, or in 1.33% of all cases.

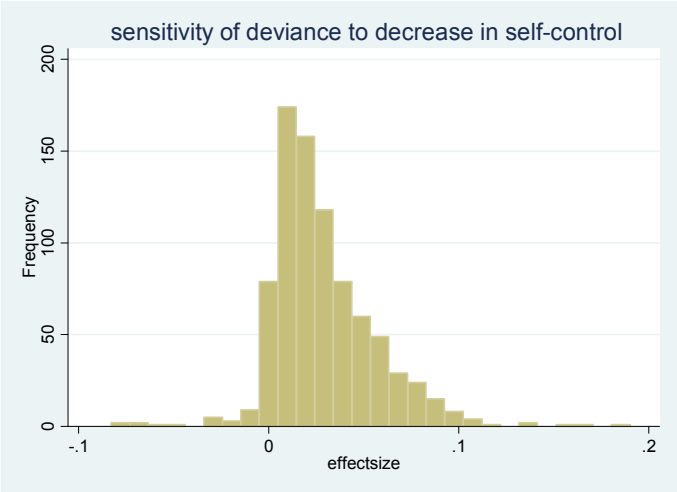

Figure 2
Distribution of Dependent Variable

In 633 of 717 studies, i.e. in 88.28 % of all studies that report significance, the degree of self-control significantly explains the frequency or intensity of deviance. Table 2 presents two regressions with just a constant, as statistical tests for the grand mean. Both have a positive, significant result. Overall, low self-control undoubtedly increases crime. Yet if I weigh observations by the inverse of the standard error, and thereby also exclude observations where the standard error had not been reported, the size of the effect goes down dramatically, and the standard error goes up substantially. The standard error in model 2 is about twice as large, and the effect is only some 13% of the effect measured with the raw data. In absolute terms, the effect is very small. The model only predicts an increase in crime by less than half a percent if self-control reduces by 10%. This of course is only the unconditional effect. If I condition the effect on appropriate control variables, it becomes bigger. This first finding should therefore not be misread. It does not show that the overall effect of self-control on deviance is negligible. It only shows that the unconditional effect is not the best object of observation.

	unweighted	weighted
cons	.02859*** (.002953)	.003711** (.001321)
N	826	717

Table 2
Constant-Only Model

OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01

2. Between Study Variation

I have data on two sources of variation: between and within the studies covered by this meta-study. On some independent variables, I have both sources of variation in my dataset. An example is gender. A few studies only tested males or females. Comparing these studies, I have an estimate for the sensitivity of deviance with respect to self-control, conditional on subjects being male or female. Yet most papers had both sexes in their samples. They usually control for gender in their statistical analysis. I could then calculate the degree of deviance, conditional on a participant having either sex.[6] This is however not the measure of interest. I would learn something about the sensitivity of deviance with respect to gender. What I want to know is the sensitivity of my dependent variable with respect to gender. I want to know whether the sensitivity of deviance with respect to self-control differs by gender. My dependent variable is itself a measure for sensitivity (of deviance with respect to self-control, that is), so that I am interested in the sensitivity of a sensitivity measure to control variables. In terms of regression analysis, for that I would need the interaction effect between self-control and gender. The studies covered by the meta-analysis have only very rarely estimated such interaction effects. I therefore only record within study variation by a set of dummy variables. These dummies are 1 if the respective study has controlled for the explanatory variable in question. This exercise gives me an estimate for the degree by which one under- or overestimates the effect of low self-control on deviance if one does not control for the respective explanatory variable. I report these estimates in the next section. This section is devoted to the effect of between study variation. I have data on between study variation in three dimensions: the type of deviant behavior (a), population characteristics (b), and the empirical methodology used by the study in question (c).

a) Type of Deviant Behavior

The first observed explanatory variable is the type of deviant behavior. The General Theory posits that low self-control is the prime cause of crime. Consequently, for the theory crime is an epiphenomenon. People low in self-control should not only be more likely to commit crime. They should also more frequently exhibit other forms of antisocial behavior that are not criminalized, and "analogous behavior" which may simply not be in their own best interest (Gottfredson and

[6] Technically, I would calculate cons + coef_gender, and standardize the result, using the procedure for the standardization of the dependent variable of the original study.

Hirschi 1990**:** 91-94 and passim). This claim has attracted considerable interest among empiricists. Studies widely vary with respect to the operationalization of deviance. If I separately analyze those studies that have measured delinquency, I find a significant effect of low self-control (N = 424, cons .00836**), as well as when I confine the analysis to studies with some form of non-criminalized analogous behavior (N = 217, cons .00167*). Model 1 of

Table 3 instead uses the type of deviant behavior as a control variable. One may read this result in two ways. The fact that the constant remains positive and significant if one controls for those studies that have measured delinquency shows that low self-control also predicts analogous behavior (which implicitly becomes the reference category). This supports the General Theory. Yet the coefficient for delinquency is more than twice as large as the constant. If one wants the model prediction for the effect on delinquency, one must add up the constant and the coefficient of the regressor. One then sees that the effect of low self-control on delinquency is about three times as strong as on analogous behavior.

The General Theory has also been influential with coining two broad categories for crime: "force or fraud" (Gottfredson and Hirschi 1990**:** 16). Some later contributions have explicitly used these categories. Other studies I have classified analogously, using "force" for all acts directed against the physical integrity of another person, and "fraud" for all acts directed against other individual's property or fortune. As model 4 shows, "fraud" (for which I have 94 observations) has a direct and strong effect. The likelihood to commit "fraud" is even more strongly affected by the individual level of self-control than the general willingness to engage in delinquent acts. By contrast, as models 2 and 3 show, with "force" (for which I have 170 observations), the story is more complicated. If one only controls for this class of deviant behavior, one finds no significant difference from the grand mean. Yet if one controls for delinquency and the interaction term, the main effect of delinquency jumps up, but it is reversed by the interaction term. This implies that low self-control (only) matters disproportionately for delinquent acts that do not involve physical attacks.

	model 1	model 2	model 3	model 4
delinquency	.00592* (.00268)		.00955*** (.00145)	
force		.00222 (.00303)	.00474 (.00462)	
delinquency*force			-.0117* (.00551)	
fraud				.00809** (.00248)
cons	.00244* (.00101)	.00330* (.00133)	.00189** (.00068)	.00349** (.00125)
p model	.0296	.4652	<.001	.0015
R^2	.1105	.0139	.1926	.0323

Table 3
Various Definitions of Delinquency

N= 717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

Using the same statistical model, one finds that the propensity to commit specific types of crime is very differently sensitive to more specific types of crime. Naturally, the number of observations on each of these classes of crime is relatively small. This explains why these regressors explain little variance, even if they turn out significant. To save space, I only report the number of observations falling into the respective class, and the coefficient in a regression explaining sensitivity to low self-control with this one dummy. That way I find a strong differential effect of low self-control on dishonest behavior (.01619***, 30 cases), on sexual offences (.02451***, 21 cases) and on traffic violations (.01870*, 18 cases), and a smaller but still sizeable effect on technical violations, for instance by parolees (.00708**, 17 cases). For the propensity to commit all these crimes, the effect of low self-control is particularly pronounced. The opposite is true for gang-related crime (-.00277^{+}, 22 cases).

Table 4 further investigates the effect of low self-control on analogous behavior (for which I have 217 observations). As one should have expected from Model 1 of Table 3, the effect is significant and negative. For analogous behavior, low self-control is less important than for actual delinquency. Yet this negative main effect disappears once one controls for substance abuse (model 2 of Table 4, 143 cases). This shows that the difference between criminal and non-criminal behavior is not a general one, but is specific to one form of analogous behavior, the abusive consumption of drugs, alcohol and tobacco. Model 3 further differentiates between substances more generally (like, in particular, alcohol) and shows that the effect of low self-control is more similar to delinquency if the consumed substance are drugs (68 cases).

	model 1	model 2	model 3
analogous	-.00566** (.00194)	.00336 (.00285)	.00336 (.00286)
substance		-.00932*** (.00222)	-.01105*** (.00217)
drug			.00516* (.00242)
alcohol			.00207** (.00066)
cons	.00733*** (.00190)	.00733*** (.00190)	.00733*** (.00190)
p model	.0044	<.001	<.001
R^2	.1379	.1701	.1922

Table 4
Analogous Behavior

N= 717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

b) Population Characteristics

If the General Theory has it right, those who have actually been convicted for committing a crime should exhibit particularly pronounced self-control problems. This explains why quite a number of studies have been conducted with convicted criminals. If one confines the sample to these 49 cases, one finds a strong significant effect of low self-control in the expected direction (cons .01633***). Model 1 of Table 5 is even more revealing. It uses the fact that the sample

consists of convicts as a control variable. The regression shows that convicts are almost 5 times as sensitive to levels of self-control as non-convicts. Of course, all convicts are delinquent, but not all delinquents are convicted. Model 2 shows that using delinquency as the measure of deviance, and the status of being a convict both independently, positively and significantly increase sensitivity for self-control problems.

	model 1	model 2
convict	.01278*** (.00249)	.00897** (.00321)
delinquency		.00546* (.00267)
cons	.00355** (.00127)	.00242* (.00100)
p model	<.001	<.001
R^2	.0375	.1283

Table 5
Convicts

N= 717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

It is a well-established fact that crime declines with age. Gottfredson and Hirschi acknowledge this fact, but do not claim that their General Theory explains it. Rather they introduce the distinction between crime and criminality. Criminality is a time invariant personality trait, namely self-control. There is an additional, unexplained source of variation, which one may call maturation, that is responsible for the relationship between actual crime and age. All the General Theory claims is that those low in self-control exhibit more deviance than individuals of the same age and high in self-control (Gottfredson and Hirschi 1990**:** 122-144). In my dataset, I have three cognizable age brackets: adolescents (N = 338, cons .00638**), students (N = 180, cons .00282^{+}) and subjects of higher age (N = 199, cons .00313). The sensitivity to self-control is most pronounced for adolescents, and least pronounced for students. It is insignificant if I analyse participants of higher age in isolation, and it is only weakly significant if I do the same for students. If I use all data and control for age, neither age bracket significantly explains the sensitivity to self-control.

Yet my normalization neutralizes differences across studies with respect to the theoretical, not to the empirical range of the deviance variable. One should therefore have expected that higher age has a negative effect on the normalized sensitivity of deviance to self-control. A negative coefficient would implicitly control for the fact that the level of crime decreases with age. Actually coefficients in model 1 of Table 6 are negative, but insignificant. The picture clears in model 2. In this model I explicitly control for the level of deviance. The coefficient has the expected positive sign, and is significant. The higher the level of deviance, the higher the percentage effect of a change in self-control. The more there is room for improvement, given the typical level of deviance in the population in question, the more visible the effect of low self-control. More importantly, conditional on the level of deviance to be expected in the respective age bracket, self-control matters less the higher the age of the population. Note that the two significant interaction

effects indeed show an independent effect of age on the sensitivity to self-control which is not explained by the age specific level of deviance. Adolescents are not only much more likely to exhibit crime and analogous behavior. Their level of deviance is also more sensitive to the degree of self-control than in elder individuals.

	model 1	model 2
student age	-.00356 (.00249)	.00681^{+} (.00373)
adult	-.00324 (.00291)	.00597 (.00594)
mean deviance		.02732* (.01041)
student*mean deviance		-.03769** (.01177)
adult*mean deviance		-.05013** (.01780)
cons	.00638** (.00196)	.00374^{+} (.00203)
p model	.3327	.0013
N	717	694
R^2	.0371	.1317

Table 6
Age

OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

In principle, the General Theory treats the well documented gender effect on crime the same way as the age effect. It does not aim at explaining the effect. But it claims that, taken the gender difference into account, there should be a differential effect of low self-control (Gottfredson and Hirschi 1990**:** 144-149). I have 201 observations with gender-homogenous populations, 98 of them with males. In the male only studies, the effect of a 10% reduction in self-control on deviance is even more pronounced, and has a lower p-value (cons .016628***). But in the female only studies, it is significant as well (cons .01274*). The evidence thus supports the main claim of the General Theory. Actually if I only control for gender, I do not even find a significant gender effect (model 1 of Table 7). This changes if I also control for age brackets and their interaction with gender (model 2). I then find that male subjects are much more sensitive to the level of self-control than females. Yet the main effect of gender and the two interaction effects essentially cancel out. This implies that the gender effect is confined to adolescents, who are the reference category.

Gottfredson and Hirschi are open to the possibility of an additional difference between males and females in criminality, i.e. in their level of self-control (Gottfredson and Hirschi 1990**:** 147). If I try to explain the mean level of self-control in each study by the gender of participants, I do not find a significant result. If I add this level as a control variable (Table 7 model 3), and interact it with gender, the interaction effect is also insignificant. All I find is a significant three-way interaction. Male students are the more sensitive to self-control the higher the level of self-control in the sample.

	model 1	model 2	model 3
male	.00445 (.00365)	.01241** (.00390)	.05138^{+} (.02923)
student		.03291*** (.00303)	.08570*** (.01068)
adult		.00977** (.00335)	.04817** (01291)
male*student		-.01246* (.00554)	-.17002*** (.03747)
male*adult		-.01431** (.00459)	-.05720^{+} (.03019)
mean self-control			.07966* (.02965)
male*mean self-control			-.10526 (.06491)
student*mean self-control			-.11724** (.02972)
adult*mean self-control			-.10013* (.03522)
male*student*mean self-control			.26966** (.07180)
male*adult*mean self-control			.11265 (.06731)
cons	.01217** (.00374)	.00631** (.00217)	-.02219^{+} (.01059)
p model	.2369	<.001	<.001
N	201	201	200
R^2	.0307	.2140	.2758

Table 7
Gender

OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

The General Theory treats race much the same way as it treats gender. Taking the well-documented race differences in criminality into account, it nonetheless expects a differential effect of low self-control. Yet the theory is also open to the possibility that racial background induces differences in criminality, i.e. in self-control (Gottfredson and Hirschi 1990**:** 149-153, 179). I have 48 one-race studies in my dataset, of which 21 test African-Americans. I do find a significant sensitivity to self-control in African-Americans (N = 21, cons = .04050***), but I do not find it for Caucasians (N = 27, cons = .01756, p = .125). The deviance of African-Americans is significantly more sensitive to self-control (N = 48, coef = .02294*).

"From our theoretical perspective, there is little reason to expect employment to be related to crime independent of the character of the offender" (Gottfredson and Hirschi 1990**:** 164). Admittedly this statement was made with respect to the unemployment-crime relationship. I have no data on participants selected for being unemployed. But I do know whether most or all of a sample consisted of participants who hold an employment position. This holds for 185 of 717 data points. As Gottfredson and Hirschi expect, this variable does not significantly explain sensitivity to self-control. If I analyze those whom I know to be employed in isolation, I do not find a significant effect of low self-control on deviance (cons .00299, p = .173).

It is one of the main purposes of the General Theory to get beyond "cultural" explanations. But the authors explicitly call for cross national research, hoping that it will help uncover the causes and consequences of low self-control. For "self-control is presumably a product of socialization"

(Gottfredson and Hirschi 1990**:** 179). Empirical researchers have taken up the challenge. While the majority of all studies have been undertaken in the US (436), there is a long list of other locations, including Canada (77), Russia (46), Thailand (36), Japan (18), and the Netherlands (14). As Table 8 demonstrates, country effects are pronounced. Sensitivity of deviance to self-control is much smaller in the United States, in Canada, in Japan and in the Netherlands, whereas it is much bigger in Russia.

United States	-.01380*** (.00277)
Canada	-.01272*** (.00345)
Russia	.01519* (.00730)
Thailand	.00190 (.00258)
Japan	-.01149*** (.00256)
Netherlands	-.00828** (.00263)
cons	.01658*** (.00258)
p model	<.001
R^2	.2063

Table 8
Country

N = 717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

d) Empirical Methodology

The General Theory has explicit implications for empirical methodology. (Gottfredson and Hirschi 1990**:** chapter 11). Since it expects criminality to play itself out in a multitude of ways, including analogous behavior not prohibited by criminal law, it expresses a preference for "behavioral" over "attitudinal" measures (Hirschi and Gottfredson 1993). A classic example is a study explaining driving under influence with the fact that drivers do not use a seatbelt (Keane, Maxim et al. 1993). The predecessor study to this meta-study did however not find a significant difference between the use of behavioral and attitudinal measures of low self-control, and it did also not find a significant difference between using the popular attitudinal scale developed by Grasmick, Tittle et al. (1993) and alternative scales (Pratt and Cullen 2000**:** 947). Many later studies have used these non-findings as a justification. For sure, a non-finding is only that: given the evidence the null hypothesis that both subsets of observations are taken from the same distribution cannot be rejected. A non-finding does not exclude that there actually is a difference, and that this difference can be shown with better data. The regressions in Table 9 provide this evidence.

Of the 102 papers for which I have full data, including standard errors, 11 have measured self-control with actual behavior, e.g. police records of earlier misdemeanor. Two papers are experiments. 13 work with vignettes. The remaining 77 papers use survey data. As model 1 shows,

survey evidence strongly underestimates the sensitivity of deviance to self-control problems. Model 2 demonstrates that asking for attitudes, not behavior, further reduces the estimated sensitivity of deviance to self-control. Finally model 3 shows yet another dampening effect of using the Grasmick Tittle scale. These findings suggest that the skepticism of Gottfredson and Hirschi with respect to just asking subjects for their self-control attitudes is well founded.

	model 1	model 2	model 3
survey	-.00838*** (.00177)	-.00678*** (.00174)	-.00539** (.00187)
attitudinal		-.00968** (.00313)	-.00580^{+} (.00339)
Grasmick Tittle scale			-.00489* (.00196)
cons	.01168*** (.00128)	.01940*** (.00308)	.01831*** (.00306)
p model	<.001	<.001	<.001
R^2	.0610	.1341	.1692

Table 9
Empirical Methodology

N = 717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

In the General Theory, self-control is conceptualized as a complex construct (Gottfredson and Hirschi 1990**:** 89 f.). Most empirical researchers have used the labels Grasmick, Tittle et al. (1993) have given to the elements: impulsivity, simple task, risk seeking, physical activities, self-centered, temper. Those using attitudinal questionnaires have aimed at first measuring these dimensions independently. But, again following Grasmick, Tittle et al. (1993), in the second step, using factor analysis, most authors have shown that, in their sample, these sub-constructs are highly correlated, and have constructed a single self-control score. Yet some studies separately use single aspects of self-control as explanatory variables. 59 do so for risk seeking, 49 for impulsivity, 15 for temper, 9 for self-centeredness, 7 for physicality and 3 for simple tasks. Further studies have measured related constructs: a lack of premeditation (21), present orientation (14) and frustration tolerance (5). Happily if I add a dummy variable that is 1 if the original study has used only a single aspect of self-control as the explanatory variable, it never is significant. This makes it possible to also use these data points; otherwise my sample would reduce by 189 observations.

I had already used the mean deviance in the respective sample to explain the differential effect of age (Table 6). Model 1 of Table 10 does not find a significant effect of this explanatory variable when not simultaneously controlling for other explanatory variables. By contrast, if one controls for the standard deviation of deviance, one predicts less sensitivity to self-control (models 2 and 3). Yet these two explanatory variables are most interesting in their interaction with other explanatory variables. The higher the level of deviance in a population, the more sensitively it reacts to changes in self-control provided criminal acts are at stake (two-way interaction between delinquency and mean deviance). Yet sensitivity drops strongly if, on top, deviance varies great-

ly (three-way interaction with the standard deviation). There is the opposite picture for participants of student age. Being in this age bracket dampens sensitivity of deviance to self-control the more the higher level of deviance. Yet the dampening effect is weakened the more the more deviance varies.

	model 1	model 2	model 3	model 4
mean_dv	-.00580 (.00855)		.01109 (.02013)	.03057 (.02117)
sd_dv		-.01666* (.00650)	-.02264** (.00810)	.01151 (.02475)
mean_dv*sd_dv			-.00316 (.04357)	-.08470 (.05931)
delinquency				-.00273 (.00301)
delinquency*mean_dv				.14808*** (.03491)
delinquency*sd_dv				-.02120 (.02541)
delinquency*mean_dv*sd_dv				-.22352** (.07556)
student				.00239 (.00622)
student*mean_dv				-.09100** (.03397)
student*sd_dv				.02187 (.02469)
student*mean_dv*sd_dv				.24555* (.10985)
adult				.02407*** (.00582)
adult*mean_dv				-.02352 (.02859)
adult*sd_dv				-.09008** (.03048)
adult*mean_dv*sd_dv				.13520^{+} (.07707)
cons	.00609** (.00196)	.00961*** (.00248)	.00923** (.00278)	.00309 (.00243)
N	694	597	597	597
p model	.4991	.0121	.0203	<.001
R^2	.0091	.0969	.1127	.4494

Table 10
Mean and Standard Deviation of Deviance

OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

I had already used the mean of self-control in the respective population to explain gender effects (Table 7). Controlling for this explanatory variable, or interactions with it, does not yield other interesting insights. Yet there is a significant positive main effect. The more pronounced self-control problems are in a population the more deviance of this population is sensitive to self-control (coef .02204*, cons -.00493, N = 644).

In the methodology section I have reported that many of the papers covered by the meta-study have estimated a non-linear model: a logit or probit model since the dependent variable was binary (120 cases); a Tobit model since the dependent variable was censored (108 cases); a Poisson or a negative binomial regression since the dependent variable consisted of counts (42 cas-

es). Happily, if I explain sensitivity of deviance to self-control with the fact that the study in question has used one of these non-linear estimators, I only find a weakly significant effect (coef -.00328^{+}, cons .00640***, N = 717). This effect might of course result from the fact that I have calculated marginal effects at the mean of deviance, in the respective study. Ideally one would want to compare these estimates with average marginal effects. Yet to calculate them, from each study I would need the complete design matrix, which I do not have.

Another methodological control variable is clearly insignificant. In their majority, authors have estimated statistical models without a constant. Yet a dummy that is one if the statistical model has a constant has no explanatory power. Likewise sensitivity of deviance to self-control is not significantly explained by the size of the sample. There was high variance in this respect, with samples as small as 44 observations, and as large as 85,301 observations. By contrast, I do find a significant effect of the year in which the study has been published (coef .000417** [year after 1992], cons .000371). Maybe the literature is more experienced in designing studies such that the effect is found.

3. Within Study Variation

As explained above, for the purposes of this meta-study I can only account for the fact that an original study has controlled for additional explanatory variables when estimating the effect of a change in self-control on deviance. Specifically I can see whether one overestimates or underestimates the sensitivity of deviance to self-control if one does not control for one of these variables. To that end I have dummy coded the control variables used by the original papers. If the coefficient of one of these dummies is significant and negative, if one does not control for the variable in question one overestimates the sensitivity of the deviance to self-control. If the coefficient is significant and positive, one underestimates the sensitivity of deviance to self-control if one does not control for this variable. Through controlling for the control variables used in the original papers, I indirectly capture the effect of variance within (not between) the original studies.

Most studies have either been confined to one of the sexes, or they have added gender as a control variable to their regressions. But 92 of 717 have not. If I try to explain sensitivity of deviance to self-control with just this dummy variable, I do not find a significant result. As Table 11 shows, this changes if I interact this control variable with key explanatory variables. I then find a fairly large and significant main effect for this control variable. It indicates that one underestimates sensitivity of deviance to self-control if one does not control for gender. I also find a significant positive interaction with participants taken from the student age bracket. By the same token, this finding implies that one underestimates the effect of participants being in this age bracket if one does not control for their sex. Actually the net effect (student + student*c_sex) is positive. With adding the control for gender, the sign of the main effect for the age bracket is reversed. Students are not less, but more sensitive to self-control than adolescents. Interacting the fact that the study has been run in the United States with having controlled for gender also leads

to a reversal in sign, but now in the opposite direction. While the main effect of the country dummy for the US is positive, the net effect is negative. When controlling for gender, US populations are less sensitive to self-control.

delinquency	.00442^{+} (.00233)
c_sex	.00677* (.00337)
delinquency*c_sex	.00137 (.00285)
student	-.00804*** (.00210)
student*c_sex	.01012** (.00324)
adult	-.00426 (.00760)
adult*c_sex	.00668 (.00790)
us	.00965*** (.00194)
us*c_sex	-.01832*** (.00378)
cons	.00159^{+} (.00087)
p model	<.001
R^2	.2263

Table 11
Controlling for Gender

N=717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

While gender obviously matters all over the world, whether race is an issue differs from nation to nation. This is the main reason why only 359 of 717 studies either were confined to one race, or added race as a control variable. If one does, the estimated sensitivity of deviance to self-control is substantially and significantly reduced (coef -.00604**, cons .00829***). Omitting this control variable thus leads to an exaggerated estimate.

As reported, all studies had participants from only one of the three age brackets. In principle, age is therefore always taken into account. Yet 549 of 717 studies additionally controlled for the precise age of the individual participant. If I try to explain sensitivity of deviance to self-control with just a dummy for the fact that the study has controlled for precise age, I do not find a significant result. As Table 12 shows, I still do not find a significant main effect for this control variable if I interact it with the age brackets. This implies: for adolescents, who are the reference group, one does not make a mistake if one does not control for the precise age. This is different, though, for the other two age brackets. For students, adding precise age is most important. If one does not, one heavily underestimates their sensitivity to self-control. By contrast, if one omits this control variable, one overestimates the sensitivity of participants above student age to self-control. Note that, for both age brackets, if one calculates the net effect, even the sign of the effect reverses.

student	-.00483* (.00214)
c_age	.00015 (.00337)
student*c_age	.01427*** (.00373)
adult	.00550* (.00289)
adult*c_age	-.00939* (.00400)
cons	.00627** (.00209)
p model	<.001
R^2	.2097

Table 12
Controlling for Age

N=717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

The General Theory is opposed to the idea that individuals are socialized by their peers into being criminals. The theory does not believe in social control, but in self-control. Yet it does not deny the possibility of peer-group effects. The theory only reverses causality: individuals low in self-control self-select into groups prone to committing crimes (Gottfredson and Hirschi 1990**:** 154-159). 181 of 717 studies have controlled for peer group effects. The regression of Table 13 suggests that omitting this control variable does not generally bias results; there is no significant main effect for this control variable. Not controlling for peers does also not seem to affect the estimated effect of delinquency, compared with other forms of deviance. Yet one is likely to overestimate the sensitivity of deviance in the form of force to self-control if one does not guard against peer group effects. Recall, however, that there was anyhow no significant difference in sensitivity if the deviant act can be classified as force (Table 3).

delinquency	.00804*** (.00201)
c_peers	-.00122 (.00134)
delinquency*c_peers	.00305 (.00322)
force	.00380 (.00384)
force*c_peers	-.01480** (.00463)
cons	.00247^{+} (.00130)
p model	<.001
R^2	.2438

Table 13
Controlling for Peers

N=717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

The General Theory sees a lack in self-control as the main cause of crime, and insufficient child rearing as the main cause of low self-control. Crime is unlikely if parents are attached to their

children, if they supervise them properly, if they recognize their deviant behavior and punish it. By contrast self-control suffers and therefore crime becomes more likely later in life if parents are criminals themselves, if the family is too large, if the marriage is split or has never existed, and if the mother works outside the home and does not manage to have her child guarded while she is away (Gottfredson and Hirschi 1990**:** 97-102). 278 of 717 studies have in some way controlled for family conditions. Yet this fact in and of itself does not significantly explain sensitivity of deviance to self-control. In line with theory, it is more informative to split control for family background up in the degree of familial support for the development of self-control on the one hand, and in elements of family background on the other hand that make it difficult for the child to mature into a properly controlled personality. If I dummy code those 76 studies that control for such family problems, I significantly explain sensitivity to self-control (coef .00720*, cons .00357**). I do not find a significant main effect of controlling for those 250 studies that have controlled for family support. Yet if I interact this variable with age brackets, both the estimated effect of student age and of higher age substantially and significantly increases (Table 14). One underestimates the moderating effect of age on the sensitivity of deviance with respect to self-control if one does not control for family support.

c_family support	-.00115 (.00354)
student	-.00433^{+} (.00247)
student*c_family support	.01840*** (.00489)
adult	-.00407 (.00287)
adult*c_family support	.01170** (.00427)
cons	.00703** (.00199)
p model	<.001
R^2	.0671

Table 14
Controlling for Parental Support

N=717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

The General Theory is squarely opposed to the claim of strain theory that class segregation causes crime (Gottfredson and Hirschi 1990**:** 78 f.). It expects self-control problems to be ubiquitous (Gottfredson and Hirschi 1990**:** 112f.) and in particularly not to be caused by unemployment (Gottfredson and Hirschi 1990**:** 163-165), and does not see any categorical difference between white-collar and blue-collar crime (Gottfredson and Hirschi 1990**:** chapter 9). Against this backdrop it is remarkable that a dummy for those 238 of 717 studies that have explicitly controlled for socio-economic status significantly explains sensitivity of deviance to self-control (coef .01802***, cons .00261**). If one does not control for SES, one strongly underestimates sensitivity to self-control.

In the carefully crafted index of Gottfredson and Hirschi (1990), the terms "morality", "normativity", "religion" or "attitude" are not listed. Criminal acts are described as immediately gratifying (Gottfredson and Hirschi 1990**:** 89 and passim). They are not committed because the criminal lacks insight into their social undesirability, but because she subdues to her impulses (Gottfredson and Hirschi 1990**:** 89-91). Controlling for participants' attitudes should therefore not change the estimated sensitivity of deviance to a lack in self-control. 93 of 717 studies have done this nonetheless. If one only uses a dummy for this control variable, one indeed does not significantly explain sensitivity. Yet the regression in Table 15 shows a significant interaction between this control variable and the fact that the dependent variable of the original study is actual crime. While sensitivity to self-control is considerably more pronounced with actual crime, the effect becomes much smaller if one controls for attitude. Actually a subsequent Wald test shows that the net effect is even insignificant. The picture further clears if one also takes into account whether the respective study has (also) controlled for religiosity; 99 of 717 studies have. Adding this control variable strongly increases the estimated sensitivity of deviance to self-control, as the large and significant main effect shows. Yet if that same study additionally controls for attitude, neither control variable affects the estimate. It however is resurrected through the three-way interaction if the dependent variable of the original study is actual crime. Apparently religion and self-control do interact in complex ways.

	model 1	model 2
c_attitude	-.00242 (.00194)	.00098 (.00140)
delinquency	.00828** (.00242)	.00909*** (.00192)
c_attitude*delinquency	-.00625* (.00312)	-.00783** (.00277)
c_religiosity		.01590*** (.00127)
c_attitude*c_religiosity		-.01645*** (.00141)
c_religiosity*delinquency		-.00270 (.00306)
c_attitude*c_religiosity*delinquency		.00733^{+} (.00422)
cons	.00344^{+} (.00194)	.00250* (.00126)
p model	<.001	<.001
R^2	.2031	.3298

Table 15
Controlling for Attitude and Religion

N=717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

For the General Theory, opportunity is not a sufficient cause of crime (Gottfredson and Hirschi 1990**:** 190, 198). The theory also is not particularly interested in opportunity as a contributory cause of crime. But the theory does not deny that opportunity is a necessary condition for criminal acts to occur (Gottfredson and Hirschi 1990**:** 22f.). 149 of 717 studies have explicitly controlled for opportunity. This is advisable. A dummy for studies with this control variable in and

of itself explains 7% of the variance and is highly significant (coef .01208***, cons .00336**). If one does not control for opportunity, one strongly underestimates the sensitivity of deviance to self-control.

Intelligence is not in the focus of the General Theory. The theory acknowledges the relationship between low intelligence and crime (Gottfredson and Hirschi 1990**:** 69, 96), but it insists that intelligence alone is a poor predictor of future crime (Gottfredson and Hirschi 1990**:** 232). 47 of 717 studies have controlled for intellectual ability. A dummy for these studies has a weakly significant negative effect on the estimated sensitivity of deviance to self-control (-.00355^{+}, cons .00479*). Yet where one should expect intelligence to be most important, it actually is: if one interacts the dummy for those studies that have controlled for intelligence with employment status, one finds a strongly significant negative main effect and a very strong positive interaction effect. In general, one overestimates the sensitivity of deviance to self-control if one does not control for intelligence. But one underestimates the effect of being employed. Conditional on intelligence, those employed are more sensitive to self-control (net effect .02166*).

c_intellect	-.00574** (.00185)
employed	-.00399 (.00288)
c_intellect*employed	.02565** (.00888)
cons	.00695*** (.00182)
p model	.0010
R^2	.1055

Table 16
Controlling for Intelligence

N=717, OLS, robust standard errors, clustered at the level of publications
standard errors in parenthesis, *** p < .001, ** p < .01, * p < .05, $^{+}$ p < .1

V. Conclusion

Overall, the General Theory is overwhelmingly supported by the data. In 88% of all empirical studies, the degree of self-control significantly explains the frequency or the intensity of deviance. Only in 4 of 717 cases, the effect is significant and negative. Otherwise, whenever the effect is significant, it is in the direction expected by the General Theory: the lower self-control, the more deviance. The effect exists separately for crime and analogous behavior, and for males and females.

Yet if one analyses age brackets in isolation, one only finds the effect for adolescents. If one splits the data by race, one only finds the effect for African Americans. And if one confines the analysis to data from subjects who are in an employment relationship, there is no significant effect.

The sensitivity of deviance with respect to self-control is moderated by the type of deviant behavior. Actual crime is more sensitive to self-control than analogous behavior. Also convicts exhibit higher sensitivity. Conditional on the level of deviance in the respective population, adolescents are more sensitive to self-control than elder participants. For students and participants of higher age, sensitivity to self-control depends on gender. Male students are less sensitive than female students. For participants of higher age, the combined effect of age and gender even points into opposite directions. While female adults are more sensitive to self-control than average adolescents, male adults are less so. African Americans are more sensitive to self-control, as are participants from Russia, whereas participants from the United States, Canada, Japan and Thailand show less than average sensitivity.

The estimated sensitivity of deviance to self-control is affected by the empirical methods used to generate the estimate. Most importantly, estimates are smaller in surveys, with attitudinal measures, and with the popular Grasmick Tittle scale. Each of these three features dampens estimated sensitivity, even if one controls for the remaining two features. One also estimates less sensitivity if the standard deviation of the dependent variable is large, and one estimates higher sensitivity if the mean level of self-control in the tested population is low. Also the more a study is recent, the higher the estimate.

Finally, the moderating effect of many explanatory variables on the sensitivity of deviance to self-control depends on whether one controls for further observables. Delinquency, age and country effects interact with gender. The effect of the three large age brackets changes if one controls for precise age or for parental support. One estimates a different sensitivity of physical attack to a lack in self-control if one controls for peer group effects. The moderating effect of actual crime changes if one controls for attitude and religion. The effect of being employed changes if one controls for intellectual ability.

This meta-study is a concise way of organizing a rich literature. It makes qualitative and even more so quantitative effects visible that could not be seen when studying the original papers. It offers a procedure for standardizing findings from self-control studies which may also prove useful for future publications. Original results are weighed by their precision. All estimates are of course checked for significance. Alternative statistical models with more control variables are reported whenever this is meaningful. Yet despite all the attempts to be controlled and precise, one should keep in mind that meta-study is best understood as quantitative lit review (Stanley 2001). It is much more objective, and usually also more informative, than narrative review. It exploits the fact that there is a whole body of studies that are sufficiently similar to make their joint analysis meaningful. Nonetheless, different studies have related, but different research questions. They may be differently well executed. Non-results are difficult to publish, which may lead to publication bias. Heterogeneity between studies can be pronounced, which may be due to unobserved explanatory factors (all of this had already been discussed by Druckman 1994). I have done as much as I could to mitigate these concerns. Still results from meta-analysis should be read with caution. If a researcher remains skeptical about a finding from meta-

analysis, she should design a new study that is specifically targeted to precisely this research question.

Three limitations affect this meta-study in particular. I had to exclude a large number of published papers since they did not report their data such that I could use my standardization procedure, or my procedure for weighing data by its precision. I could only record that an original paper had controlled for some moderating variable. I therefore only know that this dimension of the problem was taken into account, not how pronounced it was in the study in question, and how intensely it affected the sensitivity of deviance to self-control. Finally all my analysis is partial in the sense that I repeatedly explain the same (meta-)data by alternative sets of explanatory variables. Ideally one would wish to see the complete picture, with all control variables added simultaneously, maybe even interacted with each other. Yet for such an exercise, I do not have enough data. Also, too many explanatory variables are significantly correlated with each other. If one adds too many of them in one statistical model, multiple groups of them are jointly significant, but very few are significant individually.

Given the multitude and the variability of published studies, the empirical test of self-control theory is a mature literature. The fact that the number of pertinent publications has been on the decline for a couple of years suggests that the field is perceived to be saturated. Obvious moderating variables have been tested, most of them multiple times. The number of studies that have simultaneously controlled for multiple moderators is of course smaller. There are even less studies that have interacted moderator variables with self-control, or among each other. But one can push this exercise only so far. One quickly runs into combinatorial explosion.

Another concern seems more critical. Strictly speaking, most of the studies covered by this meta-study are correlational, not causal. In the typical design, researchers simultaneously elicit a measure for deviance (say with a survey, asking participants how often they have committed certain acts over a certain time span) and a measure for self-control (say with the Grasmick Tittle scale). In a regression, they then explain the incidence or the intensity of deviance with the degree of self-control. Let's assume that the effect is significant and positive. Such a finding will usually be presented as proof that self-control theory got it right. Yet for two well-known reasons this conclusion may not be drawn. It could be that it is not low self-control that engenders deviance, but deviance that engenders low self-control. Actually given the theoretical claims of the General Theory, reverse causality is not unlikely. The theory claims that actual crime and analogous behavior have the same source (Gottfredson and Hirschi 1990**:** 91-94), and that both originate in childhood (Gottfredson and Hirschi 1990**:** 94-97). The theory further claims that the inclination to fall for immediate gratification is a human universal (Gottfredson and Hirschi 1990**:** 89), which can only be tamed by proper child rearing (Gottfredson and Hirschi 1990**:** 97-108). This suggests that analogous behavior and imperfect self-control might mutually reinforce each other. Moreover, both a lack in self-control and deviance might actually be caused by omitted variables. Given the make-up of the General Theory, family variables would be obvious candidates. Admittedly some of the studies reported in this meta-study explicitly control for family

background. But by far not all do, and even if this is the case, this does not exclude other omitted variables.

The General Theory has a feature that invites a research strategy which still does not prove causation in the strict sense, but at least mitigates the concerns. The General Theory posits that the level of self-control is fixed relatively early in life, and does not change much thereafter (Gottfredson and Hirschi 1990**:** 96 f.). For sure the authors are themselves skeptical about the value of longitudinal research (Gottfredson and Hirschi 1990**:** chapter 11). But if one generates a reliable measure for self-control in children or young adolescents, and if those scoring low commit disproportionately many unwise acts while young, and criminal acts when elder, this makes it more likely that their deviant behavior is indeed caused by a lack in self-control (for a recent example see Moffitt, Arseneault et al. 2011).

Strictly speaking, proof of causation would, however, require exogenous variation. It would ethically be obviously inacceptable, and probably simply impractical, to randomly expose one fraction of otherwise identical groups of children to intervention that fosters the development of self-control, while the control group would be untreated. But the very fact that the General Theory specifies the hypothesized mechanism by which self-control is brought about suggests a way how causation could indeed be established. One would have to exploit natural variation in child-rearing practices. To that end, empirical research could benefit from exogenous disruptions of the relationship between parents and their young children. Sadly such disruptions are far from infrequent. One could test children from the same family, or at least from the same population, who have been brought up before a war or natural catastrophe, and those who had to live their early years in dire circumstances. If the theory has it right, the latter stand a much poorer chance to have their natural urge for immediate gratification tamed. This should translate into a lower level of self-control which, in turn, should be responsible for more deviance. Since this approach exploits natural variation, it would be important to control for other differences between the group nature has "treated", and the "control" which had the good fortune not to go through this experience. As with any natural experiment, there will be debate whether all plausible control has been implemented. But if successful, such a study would be a very strong proof of the General Theory.

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