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The Economics of Crime:
Investigating the Drugs-Crime Channel.
Empirical Evidence from Panel Data of the German States

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Investigating the Drugs–Crime Channel in Economics of Crime Models

Empirical Evidence from Panel Data of the German States

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Abstract

The rising trends both in drug addiction and crime rates are of major public concern in Germany. Surprisingly, the economic theory of crime seems to ignore the drugs–crime nexus, whereas the criminological literature considers illicit drug use a main reason of criminal activities. This paper provides an econometric assessment of the drugs–crime channel within a Becker–Ehrlich model of crime supply. Estimation with panel data from the German states allows us to take into account further factors that might influence both drug abuse and crime. The results indicate that drug offences have a significant impact, in particular on property crimes. We attribute this to a strong economic–related channel of drug abuse on crime.

1 Introduction

The rising trends both in drug addiction and crime rates are of major public concern in Germany. In particular, in East Germany the use of narcotics

was not widespread prior to unification, but a rapid catch up process has to be observed in this area.[1] Public concern about narcotics and crime covers both moral and economic aspects. The analysis mainly concentrates on the costs of drug addiction and related crimes which include expenditures of the public health system for drug addicts, negative productivity effects of drug use, tax evasion of black market activities, costs of prosecution among others. Furthermore, drug abuse may contribute to an increase in overall crime rates.

In fact, the evidence of a strong connection between illicid drug use and a wide range of criminal activities seems to be overwhelming. For instance, Beck et al. (1993) report that 49% of U.S. State Prison Inmates committed their offence under the influence of drugs or alcohol, and 17% indicated committing their offence to get money to buy drugs. Harrison and Gfroerer (1992) found that 26.1% of persons booked for any violent crime, and 24.7% of persons booked for any property crime used alcohol, cannabis and cocaine. A recent research study of the British Home Office analysed the results of urine tests carried out on 839 people arrested in five areas of England (London, Cambridge, Manchester, Nottingham and Sunderland). The outcome was that nearly two thirds tested positive for at least one illegal drug. Moreover, the Home Office estimates that one third of acquisitive crime is drug–related (see NACRO, 1999). German official crime statistics reveal that among the total number of offences cleared by the police 7.5% were under the influence of illegal drugs and 7.6% were under the influence of alcohol in 1999 (Bundeskriminalamt, 2000). For robbery, the shares were 14.8% and 14.0%, and for homicides 6.4% and 27.1%, respectively.

Following Goldstein (1985) and Goldstein, Brownstein and Ryan (1992), criminologists provide three different explanations of drug–related crime (see also Corman and Mocan, 2000). First, system–related crimes include those that are related to the system of drug production and drug trafficking, in particular concomitant crimes such as corruption, intimidation, extortion and crimes of violence. Competition for drug markets and customers cause disputes and rip–offs among individuals involved in the illegal drug–market, murders as means of enforcing systemic codes, killing of informants, injury or death resulting from disputes over drug possession, territory, etc. (Goldstein, Brownstein and Ryan, 1992). On the one hand, these crimes originate from interdicting the production and traffic of drugs and on the other hand from

[1]Some stylized facts are provided in section 2.

the high rents, which can be obtained by violating the law. Concomitant crimes raise market entry barriers for potential concurrent suppliers in order to protect monopolistic rents from drug traffic.

Second, economic–related crimes are committed as a result of the drug users' compulsion to obtain drugs (Goldstein, Brownstein and Ryan, 1992). Seen from an economist's viewpoint, economic–related crimes are more related to the demand side of the illegal drug market, whereas systemic effects can be attributed to the supply side. The high costs of narcotics[2] combined with a possibly low price elasticity resulting from addiction require high income. If the drug addicts can afford their consumption out of current income or wealth, an increase of criminal offences is not to be expected from the demand side. However, a large fraction of drug addicts are younger people without finished education and other groups of the population with low income from legal activities. These addicts might finance their consumption through prostitution or illegal activities like theft and robbery.

Finally, victim/offender use–related crimes include those that are consequential to the consumption of drugs by the victim or offender, since the ingestion of a drug may cause irrational or violent behaviour. This effect of drug abuse is also called the pharmacological effect.

The major part of the empirical evidence in the literature on drug–related crime is based on correlative evidence between drug addiction or drug offences and criminal activity. However, third factors might be responsible for both drug consuming and crime, e.g. poverty and unemployment may be claimed to be the true underlying causes of both use of narcotics and acquisitive crime. In a rare exception to the criminological literature, Otero–Lopez et al. (1994) have found support of this view. Based on a survey of over two thousand male students between 14 and 18 years of age, the authors claimed support for the notion that peer, family, and individual factors were more predictive of both risk behaviours than either risk behaviour was on the other.

Economists who follow the general approach of "The Economics of Crime" (Becker 1968, Ehrlich 1973) for testing the deterrence hypothesis are used to control for "third factors". Changing economic incentives can influence

[2]Despite a falling trend in prices since the mid eighties due to increased supply, the price per gram of cocaine or heroine is still of the order of magnitude of 50 (Landeskriminalamt Baden–Württemberg 2001, p. 55).

crimes as was shown in numerous articles. Recent important examples focus on the impact of unemployment (Raphael and Winter–Ebmer 2001) or show that the introduction of minimum wages has led to a fall in crime rates in the U.K. (Hansen and Machin 2001). However, economists usually ignore the importance of illicit drug use in economic crime studies. Corman and Mocan (2000) and Kuziemko and Levitt (2001) provide remarkable exceptions. Based on monthly time series from New York City Corman and Mocan (2000) compare the relative magnitudes of the effects of local law enforcement activities on crime with the magnitude of variations in drug use on crime. They find that law enforcement effects on crime are stronger and more significant than drug usage, which only has a small effect on property crimes. Kuziemko and Levitt (2001) analyse the effect of imprisoning drug offenders and find that the reduction in violent and property crime associated with adding one additional drug prisoner was almost as great as the reduction in crime when a violent or property offender was sentenced to prison.

The purpose of this study is to provide an econometric assessment of the economics–of–crime model with a special focus on the impact of illicit drugs on crime. Unlike Corman and Mocan (2000), who were restricted to consider deterrence, poverty and drug usage as explanatory variables in their high–frequency data set coming from a big metropolis, we take a broader view to the crime problem, inspired by recent social and economic problems like unemployment, migration, inequality, and demographic changes in Europe. The focus of our contribution has changed from the traditional testing of the deterrence hypothesis to the analysis of socio–economic, drug–driven and demographic factors.

Evidence from a panel of the German Laender (the German "states") allows us to exploit the very heterogeneous experiences in densely populated urban areas such as Berlin and Hamburg (which are also states, so–called "Stadtstaaten", i.e. "city–states") and sparsely populated areas such as Lower Saxony. Some considerable heterogeneity is also given due to the German federal system, according to which state governments are responsible for their police and the fight against crime within the borders of the corresponding Laender. This gives us the interesting opportunity to test the performance of conservatively ruled governments against the performance of social democrats and other coalitions. Moreover, our disaggregate German data set allows to look at differences between West and East Germany, where a very quick

convergence towards the western drug addiction rates seems to take place, and where recent general crime rates were even exceeding West German figures. However, given the short time span of data for East Germany, our econometric analysis is restricted to West Germany.

Our results indicate that ignoring the effect of drug use in empirical models of the economics of crime would lead to an omitted variable bias. Drug offences have a relatively strong effect on property crimes and and on rape. The deterrence hypothesis of the economics of crime model is confirmed for property crimes, whereas no convincing evidence has been found for violent crime.

The remainder of this article is organised as follows. Section 2 describes general tendencies of drug abuse and crime rates and provides stylized facts on the direct crime–drugs nexus and potential third factors. The economic modelling framework and the choice of relevant variables are introduced in section 3, section 4 describes the data sources and provides some descriptive statistics while section 5 covers econometric considerations. The estimation results are summarized in section 6. They allow for conclusions on the extent to which illegal drug use contributes to the development of overall crime rates. In section 7, we present results of our sensitivity analysis of the estimates. The findings are linked to the public issue of drug related crimes in section 8.

2 Crime, drug offences and potential third factors of crime

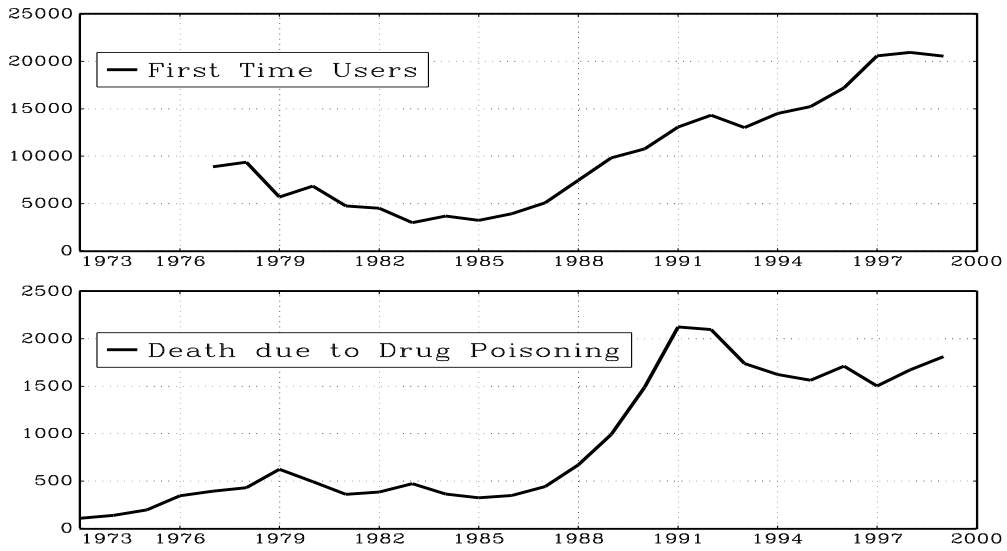
2.1 General tendencies

Due to the illegal nature of drug abuse and drug related crimes, it is difficult to obtain reliable data on the extent of these phenomena. Corman and Mocan (2000) use the number of deaths which are due to drug poisoning as a proxy for drug use. Figure 1 shows these numbers for Germany[3] in the lower panel, while the upper panel depicts the number of first time users of drugs, which

[3]The data are for West Germany until 1990, for West Germany and Berlin in 1991 and for Germany since 1992.

became noticed by the police.

Figure 1: First time users and deaths due to drug posisoning



Source: Bundeskriminalamt (1999, 2000); own calculations.

The number of deaths due to drug use are not a very close proxy for the development of drug use for several reasons. First, there exists a time lag between drug use and death caused by drug abuse, since a large fraction of these deaths is caused by physical decay due to persisting drug abuse.[4] Second, the number of deaths is influenced by changing concentration of narcotics within the drugs supplied (Bundeskriminalamt 2000). Furthermore, drug–addicted may move from rural areas to cities during their "drug career". Then, the use of death rates may overstate drug abuse in the German city states compared to the other states. Consequently, estimates based on a panel of German states might be biased using this proxy. Using the number of first time users is not a satisfying proxy either. First, the numbers depend on the awareness of the police officers who get into contact with the drug

[4]For example, no relevant number of deaths which are due to drug poisoning are yet reported for East Germany in 1999. In contrast, the number of reported first time drug users, increased by 23.4% in East Germany from 1998 to 1999, while a slight decrease of 1.8% in West Germany for the same time period corresponds to an increase in the number of deaths by 8.2%.

user. Thus, these numbers might be biased downward for areas where drug abuse is less common. Second, these numbers measure flows into the pool of drug users. Since no estimates of the outflow are available, it seems difficult to obtain a proxy of the stock of drug addicts which is more relevant for our analysis of the drug–crime nexus.

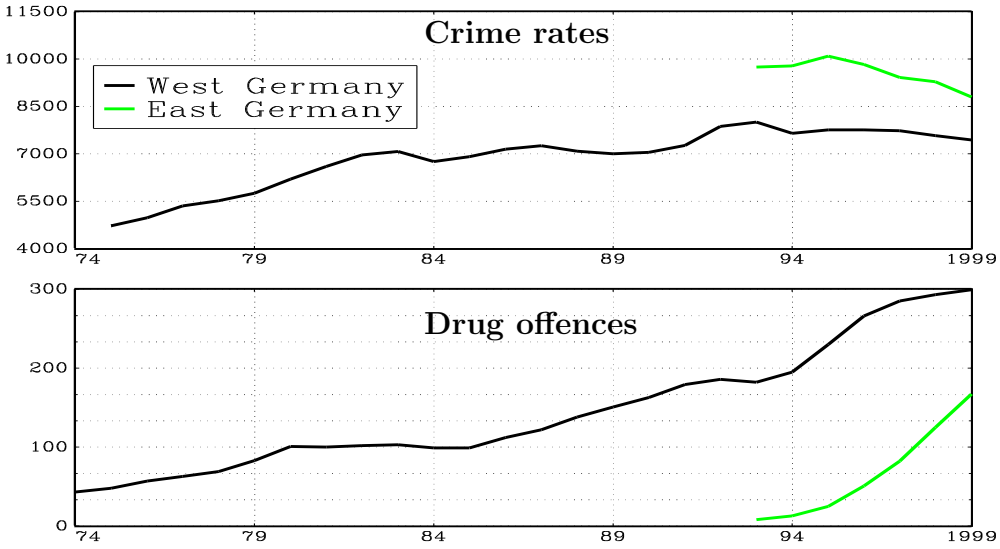
Given the limits of these proxies for drug abuse, the numbers on direct drug offences reported by the German Federal Criminal Police Office (Bundeskriminalamt) appear to be a more sensible proxy for the overall development of drug abuse. These numbers include reported cases of illegal drug trafficking, possession and consumption of drugs, but do not include procuring crimes like theft from pharmacies. While this measure shares the drawback to depend on the effort of the police spent on persecuting these crimes, it appears to be the most suitable proxy for monitoring the impact of drug abuse on overall crime rates.

The relevance of an analysis of drug abuse and its impact on overall crime rates is substantiated by the increase of drug abuse as measured by these numbers from the German Federal Criminal Office. Figure 2 and Table 1 show the development of overall crime rates and offences against drug related laws.

The upper panel of Figure 2 plots the development of overall crime rates in West and East Germany. While West German data exhibit no clear tendency during the 1990s, East German crime rates start at a higher level in 1993 and slowly adjust downwards. The development of drug offences shown in the lower panel shows a rising trend for West Germany and a fast adjustment of East German rates. From the early seventies to the end of the nineties, the numbers increase from less than 50 to almost 300 cases per 100 000 inhabitants for West Germany. However, the increase is not uniform. In recessionary periods like the early eighties and again in 1992/93, the numbers remain almost constant. In East Germany after unification almost no offences against drug related laws are reported. Reliable numbers are available only from 1993 on. They show a tremendous increase over the six year period to 1999, when East German figures amounted already to more than 50% of West German figures.

Like all crime related data, these numbers have to be interpreted with some care since an increase might result from a real increase in offences, a stiffening

Figure 2: Crime rates and drug offences (cases per 100 000 inhabitants)



Source: Bundeskriminalamt (1999, 2000); own calculations.

of relevant laws, or an increase of the share of known cases among all cases. However, a stiffening of relevant laws cannot be observed during the 1990s. Thus, although underreporting might have been more pronounced in East Germany immediately after unification, the sharp increase in cases from 1993 to 1999 indicates that the overall trend might be mainly determined by an increase in offences.

In Table 1, a disaggregation is undertaken with regard to the characteristics of the federal states. The first two entries show that the rate of offences is much higher in the city states, which might correspond to a supply side effect on the one side and higher income opportunities on the other. The numbers for the federal states in West Germany with highest and lowest case numbers exhibit some dispersion, which, at least partially, might be attributed to the higher share of urban population in Nordrhein–Westfalen as compared to the rather rural state Schleswig–Holstein. Finally, the last two entries show the enormous increase in cases for the East German federal states with highest (Brandenburg) and lowest (Sachsen) case numbers in 1993.

Table 1: Drug offences (cases per 100 000 inhabitants)

federal state	1993	1999	Change
Federal state corresponding to cities			
Hamburg	437	771	76%
Bremen	450	590	31%
Other federal states, West Germany			
Max.: Nordrhein–Westf.	213	321	51%
Min.: Schleswig–Holstein	85	243	186%
Other federal states, East Germany			
Max.: Brandenburg	11	184	1573%
Min.: Sachsen	6	142	2267%

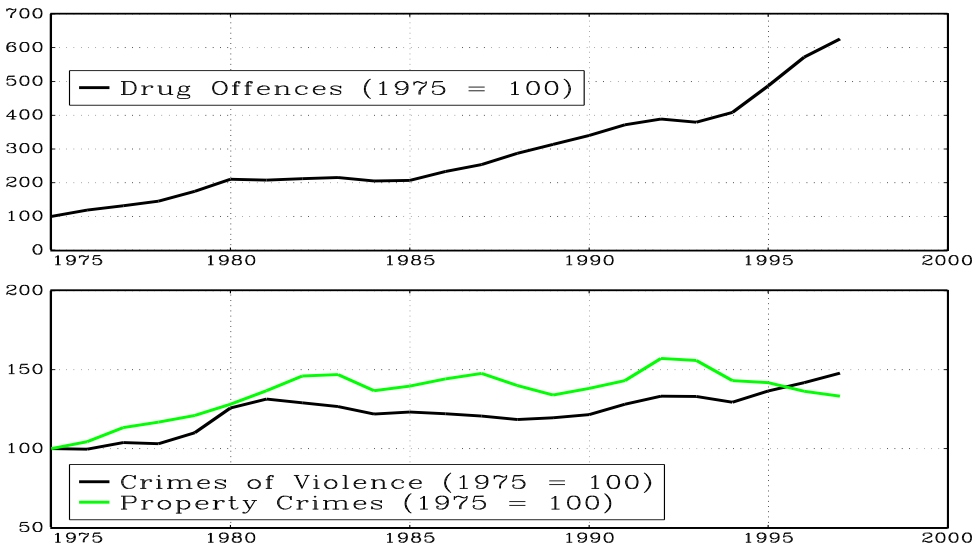
Source: Bundeskriminalamt (1994, 2000); own calculations.

The statistics of the German Federal Criminal Police Office also provides some further information on the link between (illegal) drug use and other crime categories. Unfortunately, these data are not very comprehensive and do not allow for a causal interpretation. Nevertheless, they may provide some further stylized facts. For example, Bundeskriminalamt (1998), p. 68, indicates that in 1997 14% of robbery cases, which have been solved, were committed by drug addicts. For robbery of shops and handbags this rate increases to 26% and 25%, respectively. Furthermore, shop–lifting under aggravating circumstances was committed in 33% of solved cases by drug addicts. However, a large share of unsolved cases makes it difficult to draw inferences from these findings. Comparable figures for crimes of violence are not provided for drug addicts, but Bundeskriminalamt (1998), p. 69, reports that 60% of violent bill dodging and 41% of solved cases of manslaughter were committed under influence of alcohol. Consequently, at least the pharmacological effect of drug abuse might have an even stronger impact on overall crime rates, in particular for crimes of violence, when legal drugs like alcohol are also taken into consideration.

2.2 General crime trends and the direct crime–drugs nexus

Obviously, the reported figures on drug offences do not cover all crimes, which might be related to drug–addiction and the market for illegal drugs. Neither do they include direct procurement crimes such as theft from pharmacies[5] nor further economic or system–related crimes. In order to obtain a first hint on a potential direct crime–drugs nexus, Figure 3 plots the development of drug offences in the upper panel against the developments of crimes of violence and property crimes in the lower panel. All data are for West Germany and indexed to the base year 1975.

Figure 3: Trends in crime rates (West Germany)



Source: Bundeskriminalamt (1999, 2000); own calculations.

The crime rates of all considered crime categories exhibit a positive trend. However, the trend in drug offences is much more pronounced than in the other crime categories. The correlation between drug offences and the other

[5]Surprisingly, the statistics indicate, that only about 60% of these directly drug related crimes are committed by drug–addicted. In Bundeskriminalamt (1998), p. 68, this observation is explained by a non complete assessment of drug–addiction among criminals.

two crime categories is substantial. In fact, the correlation with crimes of violence amounts to 0.80, and the correlation with property crimes to 0.61.[6] However, given that the trends in all crime categories might be determined by further (common) factors, it is not appropriate to draw far reaching causal conclusion from these findings. In particular, it is not adequate to deduce a stronger effect on system–related crimes, which are more likely to be crimes of violence, relative to the effect on economic–related crimes, which fall into the category of property crimes. An assessment of the impact of drug offences on overall crime rates requires a comprehensive model which controls for third factors.

To a certain extent, higher crime rates might be the result of a more intensive work of the police itself. This surprising conclusion might be drawn from Figure 4, which shows growth rates of expenditures on police per capita and (total) crime rates in Western Germany. The high positive correlation of 0.47 [7] indicates that a better financial endowment enables the police to light up the share of "dark figures" of official crime statistics, since more criminal acts can be processed and registered. As the share of unreported crimes renders official crime statistics suspect as a basis upon researchers wish to make inferences, we need to consider this helpful information in our econometric model (see Section 3).

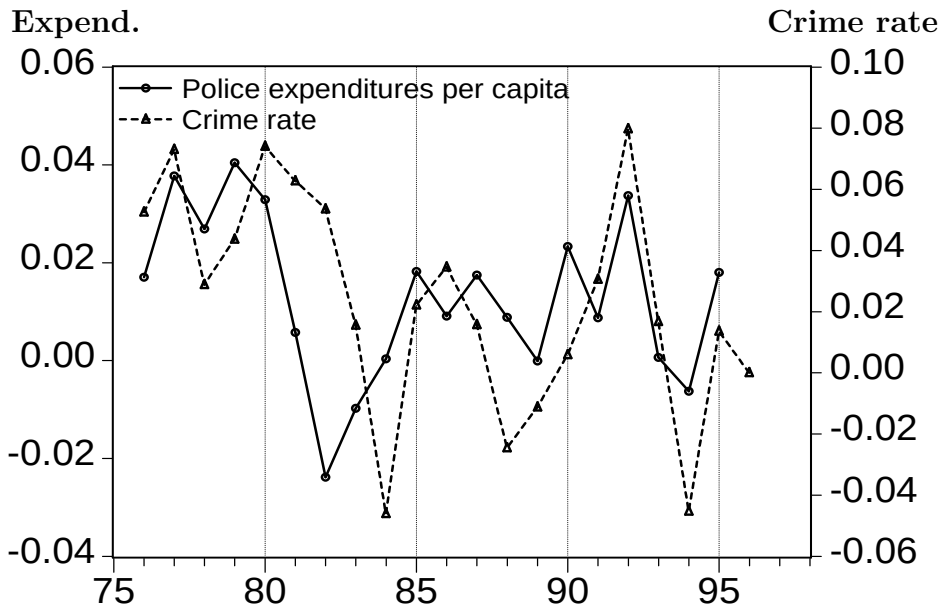
2.3 Potential third factors

Third factors, which might influence the crime–drugs nexus, are all those, which determine drug consumption, overall crime rates or both. Consequently, all the socio–economic variables, found to be important in the econometric modelling of crime rates, have to be considered, e.g. measures of income and income distribution (GDP, unemployment, share of young men), a distinction between rural areas and cities, or political factors such as ruling party or coalition. Since these factors might also be linked to drug consump-

[6] The highest correlation of drug offences with a more disaggregated set of crime categories is found with theft. It amounts to 0.93.

[7] As can be seen from the calculation of cross–correlation coefficients, police expenditures are rather leading than lagging with respect to crime rates: The coefficient is 0.46 if it is estimated using a one–year lag of crime, and it is -0.10 if crime would lead by one year.

Figure 4: Growth rates of police expenditures and crime rates



Source: Bundeskriminalamt (1999, 2000), Öffentliche Finanzen, (various years); own calculations.

tion, Table 2 shows some correlations between the number of drug offences per inhabitant and these factors.

Again, the bivariate correlations do not allow for a causal interpretation. For example, the positive correlation between a conservative government and the number of drug offences at the federal level might be due solely to the fact that a conservative government was in place for the whole period 1981 – 1997, i.e. during the period with highest increase in the number of drug offences. Nevertheless, the results indicate the potential importance of neglecting third factors, which exhibit some statistical correlation both with drug offences and overall crime rates.

Our estimation will include dummies for each year and each of the German Laender in order to control for further factors, e.g. the development of prices on the market for illegal drugs.[8]

[8]Unfortunately, the price data are not yet available on a Laender base.

Table 2: Drug offences and third factors

Correlation between drug offences and	Cross section of West German Laender in 1990	Time series for West Germany 1975–1997
Unemployment rate	0.71	0.61
Share of young men	-0.50	-0.76
GDP (1991 = 100) per capita	0.83	0.93
City states	0.89	—
Ruling party is conservative	-0.47	0.68

Source: Bundeskriminalamt (1994, 2000); own calculations.

3 Economic modelling and choice of Specification

As is well known, the standard theoretical framework of "The Economics of Crime" is based on Becker's (1968) seminal article. Becker's theory of deterrence is an application of the general theory of rational behaviour under uncertainty. Optimising individuals engage in criminal activities when expected payoffs of the criminal activity exceed the costs of criminal activity, mainly given by the probability and severity of sanctions. Ehrlich (1973) extended Becker's model by considering a time allocation model. Since time can be allocated to legal and illegal activities, besides deterrence "third" variables of legal and illegal income opportunities start to play a central role in empirical tests of the Becker–Ehrlich model, approximated by abilities, family income, human capital, and other socio–economic variables.

These considerations have led to the basic Becker–Ehrlich specification of the so-called "supply of offences" (see Grogger 1991, Ehrlich 1996, Levitt 1996, Corman and Mocan 2000, and Entorf and Spengler 2000, for recent

applications). It is commonly written in logarithmic form:

$$\ln O = \alpha + \beta \ln D + \gamma \ln Y + \delta \ln X \tag{1}$$

where O is the crime rate (number of offences per 100,000 inhabitants), D is deterrence, Y is income opportunity and X represents "other influences", with the latter becoming increasing influence in the recent literature.

In order to cover the whole spectrum of the potential drugs–crime nexus, we analyse the explanatory power of drug offences for murder, rape, assault, i.e. violent crimes that might be motivated as system–related crimes or as the result of pharmacological factors, and for robbery and theft (with and without aggravating circumstances), i.e. property crimes that are possibly drug–driven in the sense of economic–related crimes.[9]

In most studies, the effect of deterrence variables (clear–up or conviction rates, length of arrest, fines) are found to be more or less negative, i.e. in line with predictions from theory (see, for instance, Eide, 1994, for a survey). In our specification, as in most applications of the Becker–Ehrlich model, we measure deterrence by clear–up rates. We refrain from testing deterrence by use of an indicator of the severity of punishment, because the identification of state–specific law interpretations is difficult to obtain and is left to future research.

Legal income opportunities are represented by the unemployment rate (`UR`), i.e. the probability to find a legal job. Furthermore, we include a relative income measure defined as `GDP_R` $= (y_{it} - y_t)/y_t$, where y_{it} and y_t are state specific GDP per capita and West German[10] GDP per capita, respectively.[11] The expected sign of this variable is not clear. Persons who choose between legal and illegal income opportunities, and who are looking for a legal job

[9]The exact econometric identification of system–related crimes, economic–related crimes and of pharmacological effects is not subject of this paper. Tackling this aim would require information on prices of illicit drugs, which however, are not available for Germany at disaggregate levels over a long period of time. In our paper we try to find out whether there is any — perhaps confounded — influence stemming from illicit drugs in economics of crime models.

[10]We restrict our analysis to West German data, see below.

[11]Many econometric applications use (absolute) GDP as indicator of illegal (but also legal) income opportunities. Pretests, however, have shown that including relative GDP as defined above renders absolute GDP insignificant. Moreover, both variables show a high degree of covariation, such that we only present results based on relative income.

and/or certain reservation wage levels, would be more successful in prospering regions, suggesting that better legal income opportunities would lead to a negative sign. On the other hand, states that do better than the average provide lucrative targets and attract potential criminals who, moreover, might leave degrading regions. Such "crime migration" would result in a crime enhancing effect, i.e. a positive sign.

Unemployment rates measure absence of legal income opportunities, and are integral part of most empirical models of the Becker–Ehrlich type, although the expected positive sign cannot be observed in many econometric studies (Chiricos 1987, surveying 68 studies, shows that fewer than half find positive significant effects). Raphael and Winter–Ebmer (2001) argue that the failure to control for variables that exert pro–cyclical pressure may downwardly-bias estimates of the unemployment–crime effect. Given our measure of relative income, in line with Raphael and Winter–Ebmer (2001), Cook and Zarkin (1985) and related literature, we are able to adjust for any omitted variable bias of this kind.

Demographic factors are strongly correlated with crime, at least in a bivariate framework. For instance, of 100 suspects in 1999, more than 75 are male, and more than 40 are younger than 25 years. Young men aged 15–24 years are suspected to have committed 27% of all registered crimes, whereas the population share of this group is only 6% (Bundeskriminalamt, 2000). These facts have led us to consider the share of young men under 25 years of age in the crime–supply equation. Moreover, a high percentage of crimes in Germany is committed by foreigners. In 1999, more than 25% of all suspects were foreigners, whereas the population share is about 9% (Bundeskriminalamt, 2000). It should be noted, however, that there are many reasons why foreigners are over–represented in the group of suspects.[12] However, in order to avoid potential omitted–variable biases, we have included the

[12]First, they may be more often wrongly suspected than the native population. Second, there are some laws – like the foreigner and asylum laws – which can, by definition, only be broken by foreigners. Third, foreigners who reside in Europe are to a higher percentage young men. Fourth, some foreigners may be in European countries after fleeing their homeland, because they were offenders there. Finally, most foreigners enter European countries, because they had no economic success in their home country. The latter may be due to factors that foster crime, for example, lack of education. These points should be kept in mind when judging the coefficients of the foreigner variable in our empirical results.

share of foreigners as a further demographic factor in our set of explanatory variables.

As demonstrated in Section 2 of our paper, expenditures on German police are positively correlated with registered crime, most probably because additional financial means could be used by the police to reduce the share of unreported crimes. Thus, since the dependent variable is registered crime, available from official police statistics, and not (unobservable) actual crime, it is important to control for such "crime producing" factors in order to achieve crime rates adjusted for distortions arising as a consequence of varying government expenditures.

Finally, the description of our data seems to suggest that conservative governments are more successful in fighting or preventing crimes. In addition to correlative evidence presented in Section 2, it might be interesting to note that in our sample (1976 – 1995) conservative party participation in state governments is associated with crime rates being 33.7% lower in conservatively governed states and government periods. Of course, there are other ways of interpretation. For instance, voters of Christian–democrat parties may be more law–abiding than voters of other parties. Another explanation may be that conservative parties are more successful in rural or wealthy regions, whereas crime is an urban phenomenon, located in cities with social problems like unemployment and illicit drug use, rendering bivariate correlation coefficients potentially spurious. To judge suppositions of this kind would require the consideration of the conservative government effect in a multivariate context. In our framework, we use a dummy variable indicating whether conservative parties (CDU or CSU) belong to the ruling coalition of the respective state at time t.

4 Data

The data consist of a balanced West German panel containing annual data from all 11 states (Laender) that formed the Federal Republic of Germany prior to the German unification in 1990. Berlin, which contained a West and East German part, is treated as a West German state in our empirical anal-

ysis.[13] Since during the years following the unification there were difficulties in the registration of crimes and clear–ups in the five new states (Brandenburg, Mecklenburg–Vorpommern, Saxony, Saxony–Anhalt, Thuringia), we include time–region dummy variables for Berlin during the years 1990 to 1992.[14] In order to rely on relatively long time series, and since drug related crimes would need a different approach in East Germany, we refrained from including data from the five East German states.

Table 3 describes all variables used in our estimations. Crime and clear–up rates are taken from the German Federal Criminal Police Office. We use the rate of drug related crimes per inhabitant for the German Laender. This variable comprises illegal drug consumption and trade with narcotics, but does not include drug related crimes, such as theft of drugs from pharmacies or theft in order to obtain money for drug consumption. Therefore, our proxy variable does not simply coincide with "economic–related crimes" of drug offenders in the sense of Goldstein (1985). The variables `FOREIGN` (percentage of foreigners in the population), `GDP_H` (real Gross Domestic Product per capita in constant prices), `GDP_R` (relation of states' GDP to federal GDP), `M15-24` (percentage of males aged 15–24 in the population), and `CONSERV` (ruling party is conservative) are calculated on the basis of data from the Federal Statistical Office of Germany (Statistisches Bundesamt). The variable `UR` (unemployment rate) is taken from annual reports of the Federal Employment Service (Bundesanstalt für Arbeit). Data on police expenditures can be found in statistics on public finance (Öffentliche Finanzstatistiken) published by Federal Statistical Office of Germany.

[13] This can be justified by the fact that former West–Berlin is about 65% larger in population and 150% larger in GDP than East–Berlin. Because of the fast adjustment of East–Berlin's living conditions to West German standards the united city may be more appropriately considered West German than East German.

[14] According to notes provided in our data source (Bundeskriminalamt (1996)) East German police statistics of the years 1990 to 1992 are biased downwards due to administrative adjustment problems. Thus, 1993 is the first year after unification which allows for a reasonable comparison between East and West German crime figures.

Table 3: Descriptive statistics of pooled data

Variable			Mean	Std.Dev.
O1 - O5	=	Crime rates calculated as number of crimes known to the police per 100,000 inhabitants		
O1	=	Murder and manslaughter	5.22	2.21
O2	=	Serious assault	128.32	65.89
O3	=	Vandalism	725.96	270.76
O4	=	Robbery	74.04	68.47
O5	=	Theft (with and without aggravating circumstances)	5236.76	2635.17
P	=	Percentage of crimes cleared up by the police	45.73	6.15
P1 - P5	=	crime specific clear–up ratios (see O1 - O5)	24.0 – 93.4	-
DRUGS	=	Number of drug offences per 100,000 inhabitants	154.70	113.11
FOREIGN	=	Percentage of foreign citizens in the population	7.93	3.22
GDP_H	=	Real gross domestic product per capita in prices from 1991	37679.26	9750.14
GDP_R	=	(GDP per capita - West German GDP per capita)/(West German GDP per capita)	0.06	0.25
UR	=	Unemployment rate	7.93	3.22
M15-24	=	Percentage of males aged 15–24 in the population	7.36	1.07
POL/GDP	=	Police expenditures /GDP	0.0066	0.0058
CONSERV	=	Dummy variable that takes the value 1 if the state is ruled by a Christian party (CDU or CSU), or if a Christian party belongs to the ruling coalition of political parties	0.48	-

5 Econometric considerations

Empirical investigations on the causes of crime suffer from the fact that a substantial share of crimes is not registered by the police. This shortcoming is particularly severe for cross–sectional analysis. In contrast to cross–sectional studies, fixed–effect modelling allows us to control for unobserved heterogeneity within the used panel data of the German states. Since the share of reported crimes might differ between states, the inclusion of state dummy variables considers unobserved heterogeneity stemming from this potential source of bias. It should be noted, however, that this conclusion requires the assumption of a time invariant structure of unreported crimes between states. Experience with similar data (Entorf 1996, Entorf and Spengler 2000) has shown that the inclusion of state effects also covers the explanatory power of population density. It is excluded from the set of explanatory variables because it is dominated by fixed–effects which, of course, does not rule out that urban factors do play a crucial role for the heterogeneity of crime within Germany.

As regards institutional changes as, for instance, changes of the federal law, or other unobserved heterogeneity that applies to all cross–sectional units simultaneously, we include time–specific constants, i.e. we apply two–way fixed effect models. Statistical inference in applied fixed–effects panel econometrics is often based on (asymptotic) standard errors of the ordinary least squares estimator without consideration of any potential serial correlation of estimated residuals which would render standard t–values and F–statistics of only descriptive use. We inform about potential serial correlation by calculating a statistic provided by Bhargava, Franzini and Narendranathan (1982), who modified the classical Durbin–Watson statistic for the use of panel data, which we call BFN–DW. Moreover, we corrected for serial correlation of residuals of the crime–supply equation by considering the model

$$\ln O_{it} = \alpha_i + x'_{it}\beta + \epsilon_{it} \tag{2}$$

$$\epsilon_{it} = \rho\epsilon_{i.t-1} + u_{it}, \tag{3}$$

which is estimated using nonlinear regression techniques (for details, see Davidson and MacKinnon, 1996, pp. 331–341).

The significance of deterrence seems to be well documented for the US, where recent contributions by Corman and Mocan (2000) and in particular by Levitt

(1996, 1997, 1998) confirm early results of, for instance, Ehrlich (1973). In our German case study, deterrence is measured by the percentage of (registered) offences cleared by the police. Unfortunately, this variable causes some problems because the denominator of this variable (the number of crimes) is the dependent variable. To avoid this ratio bias, we lag the explanatory variable by one period (see Levitt, 1998).

Drug offences as explanatory factors of crime enter estimated equations in both instant and lagged form. Here contemporaneous values cover the direct impact, i.e. the stimulating influence of illicit drugs itself,[15] whereas lagged values are able to represent indirect effects which are based on growing poverty during a drug career which again would imply lacking legal income opportunities.

In general, we have chosen a one–year lag for variables which are characterized by relatively high (cyclical) variation and by some gestation lag that is necessary to make the impact on crime effective. These are the unemployment rate, income (or poverty), police expenditures and the indicator of conservative governments. Slowly changing demographic variables (share of young men and of foreigners in the population, ratio of state population to aggregate population) — which are rather characterized by their relatively high cross–sectional variance than by their time series dimension — enter the estimations without lag.

6 Estimation results

Panel regression results are summarised in Table 4 and Table 5. The drugs–crime nexus is significant for all crime categories except murder and assault. The highest impact seems to take place for rape, where the contemporaneous coefficient is 0.198[16], a result that might be at least partly explained by the pharmacological effect of illegal narcotics. All other estimated elasticities, if

[15] Of course, the expected sign is positive, although some narcotics as marijuana, for instance, seem more likely to reduce aggressive (i.e. violent) behaviour.

[16] The coefficient remains high also after adjusting for the potentially diminishing effect of lagged drug offences (which have a negative, but insignificant, sign: see Table 5): Omitting lagged drug offences results in a coefficient estimate of 0.196.

significant, are surprisingly stable across crime categories, ranging between 0.06 and 0.11. Thus, given the moderate magnitude of these effects, suppositions about the dominating influence of drug addiction on crime need to be put in perspective. The inclusion of third factors has shown the spurious nature of high bivariate correlation coefficients.[17]

Estimated results are similar to those of Corman and Mocan (2000), who report significant effects for burglary and robbery, but who did not detect any significance of drug use on both murder and assault (there was no analysis for rape). The latter outcome is somewhat surprising for the U.S., given the high death rate among the members of a drug selling gang reported in Levitt and Venkatesh (2000).

The economics of crime literature presumes variables of deterrence among the most important third factors. Estimation results show the expected negative sign of the clear–up rate in four out of six cases, but only one (highly) significant result can be observed (for theft under aggravating circumstances (u.a.c.), coefficient estimate = -0.20). Significance is very poor for violent crimes and for theft without aggravating circumstances (theft w.a.c.), although the latter result is perhaps not surprising given the construction of the clear–up rate for shoplifting and other delinquencies belonging to theft w.a.c. Here clear–up rates are relatively high (52% in West Germany, 1996) but not always informative, because often petty larcenies are reported only in case suspects get caught and the police can be informed immediately about the perpetrator. Since, however, also for robbery we find only a small and insignificant coefficient of -0.060, we might conclude that — with the notable exception of theft u.a.c. — there is no clear evidence in favour of the deterrence hypothesis of the economics of crime model. For instance, all estimated coefficients remain well below the median (-0.34) obtained for a sample of several studies surveyed by Eide (1994, p. 156).

Improvement of relative income reduces crime in all estimated equations (though only two of them are highly significant), supporting the view that (relative) wealth improvement leads to better legal income opportunities. Unemployment, however, has the ambiguous result usually found in the liter-

[17]For instance, regressing "log (theft under aggravating circumstances)" (theft u.a.c.) on "log (drug offences)" using pooled OLS (without any further regressor) would lead to a highly significant regression coefficient of 0.508 (result not reported elsewhere).

Table 4: Estimation results, property crimes

Independent Variables	Theft u.a.c.	Theft w.a.c.	Robbery
Deterrence			
- log (clear–up rate (-1))	-0.195**	-0.056	-0.060
	(0.042)	(0.094)	(0.081)
Drugs			
- log (drug offences)	0.058*	0.070**	0.112**
	(0.028)	(0.022)	(0.037)
- log (drug offences (-1))	0.003	0.000	0.053
	(0.028)	(0.022)	(0.037)
Income opportunities			
- log (ur(-1))	0.225**	0.025	-0.084
	(0.068)	(0.055)	(0.107)
- relative income (-1)	-0.184	-0.103	-1.330**
	(0.190)	(0.149)	(0.328)
Demographics			
- log (share of young men, 15–24)	0.307	0.947**	0.657
	(0.265)	(0.219)	(0.645)
- log (share of foreigners)	0.342**	0.215*	0.611*
	(0.126)	(0.102)	(0.251)
Control			
- conservative government (-1)	0.004	0.024	0.034
	(0.019)	(0.015)	(0.026)
- log (police expenditures (-1)/GDP(-1))	-0.173	-0.075	-0.304
	(0.168)	(0.135)	(0.245)
AR(1)–coefficient	0.544**	0.557**	0.832**
	(0.062)	(0.063)	(0.047)
BFN–DW–statistics	2.10	2.18	2.33
Adjusted R–squared	0.992	0.987	0.991

All estimates include time– and region–specific constants (two–way fixed–effect modelling), standard errors in parentheses, sample: West German states, 1976–1996 (220 observations)

ature. Positive (crime enhancing) significant effects of higher unemployment can be found for theft u.a.c., whereas estimated coefficients are insignificant for other categories. The reason for the existence of ambiguous results is often discussed in the literature, but we suggest to keep in mind that many studies (like ours) are dealing with regional data. Evidence using information on the mobility and origin of offenders in the German state Baden-Württemberg (Büttner and Spengler, 2001) reveals that criminals prefer regions with low unemployment over regions with high unemployment, a result that also holds for violent crimes, and that might be explained by the presence of more lucrative targets in advantaged regions. Thus, in exactly the same way as GDP p.c., also unemployment rates can be interpreted in the sense of both legal and illegal income opportunities, such that also negative signs are plausible when offender mobility is taken into account.

The effect of demographic variables on property crimes differs from that on violent crimes. Higher shares of young men and of foreigners lead to higher rates of theft and robbery (all signs are positive, four out of six coefficients are significant), whereas no significant effect can be observed for violent crimes. Only rape seems to be affected by varying shares of young men. Here the elasticity is relatively high (0.918), but only weakly significant (p=0.07).

Contrary to expectations based on simple correlation analysis, neither government participation of conservative parties nor police expenditures do show any significant impact on (recorded) crime. Regressing police expenditures/GDP on fixed time and region effects and adjusting for serial correlation reveals the reason for this lacking police effect: The adjusted R–squared of this unreported regression is 0.998, hence almost all variation can be explained by cross sectional differences, aggregate cyclical variation of the Federal budget and by serial correlation, all of which are controlled for in our specification of considered crime categories.

Likewise, after controlling for third factors given by demographic movements, unemployment, income possibilities etc., "conservative governments" do not perform any better than non–conservative governments.

Summing up, property crimes fit the economic model of crime much better than violent crimes, a result which is not surprising given that property crimes are supposed to be closer to the idea of the "rational" offender, whereas violent crimes often seem subject to irrational behaviour. The phar-

Table 5: Estimation results, violent crimes

Independent Variables	Murder	Assault	Rape
Deterrence			
- log (clear–up rate (-1))	0.021	-0.086	0.069
	(0.234)	(0.237)	(0.119)
Drugs			
- log (drug offences)	0.045	0.039	0.198**
	(0.076)	(0.031)	(0.053)
- log (drug offences (-1))	0.044	-0.035	-0.054
	(0.077)	(0.031)	(0.053)
Income opportunities			
- log (ur(-1))	0.122	-0.097	0.107
	(0.173)	(0.085)	(0.131)
- relative income (-1)	-1.259**	0.029	-0.087
	(0.473)	(0.246)	(0.368)
Demographics			
- log (share of young men, 15–24)	0.245	-0.362	0.918
	(0.633)	(0.389)	(0.509)
- log (share of foreigners)	-0.013	-0.016	0.038
	(0.300)	(0.187)	(0.249)
Control			
- conservative government (-1)	0.051	-0.014	-0.009
	(0.051)	(0.021)	(0.037)
- log (police expenditures (-1)/GDP(-1))	-0.844	0.081	0.282
	(0.448)	(0.196)	(0.329)
AR(1)–coefficient	0.440**	0.721**	0.554**
	(0.070)	(0.048)	(0.068)
BFN–DW–statistics	2.21	2.05	2.18
Adjusted R–squared	0.826	0.982	0.946

All estimates include time– and region–specific constants (two–way fixed–effect modelling), standard errors in parentheses, sample: West German states, 1976–1996 (220 observations)

macological effect of drugs, for instance, seems to be responsible for the high coefficient on rape. The economics of crime model performs best for theft u.a.c., both with respect to fitting the data and to accordance with effects predicted by theory.

7 Sensitivity Analysis

Some additional estimation results presented in the appendix reveal the robustness of our results. They are presented in Tables 6 and 7, where we do not consider murder and assault because of their poor performance in Table 5. We have re–estimated regressions without both control variables and lagged drug offences, which all were insignificant in Table 4 and Table 5. As can be seen from columns headed by (1), parameters which were significant before remain almost unchanged. The largest (still small) change takes place for the coefficient of young men on theft w.a.c. which increases from 0.947 to 1.110.

In columns (2), we have performed estimations without consideration of the drugs–crime channel. This is interesting for two reasons. First, we are able to quantify the degree of bias caused by omitting the influence of drugs in econometric models of crime. Second, there might be some simultaneity bias stemming from endogenous drug use, when illicit use of narcotics arises as a consequence of crime, for instance when within growing criminal milieus drug abuse belongs to the everyday pattern of criminal social interaction. However, results reveal that omitting drugs from the model has only a minor impact on the estimation of other effects. A somewhat larger difference can be detected for the coefficient of foreigners on theft w.a.c. Here, the influence of foreigners would be erroneously significant when drug offences were omitted. Since high shares of foreigners and drug offences both are phenomena of urban and densely populated areas, these variables are highly correlated in a bivariate regional setting, but not necessarily in any causal way. Leaving out one of these two variables bears the danger that the other variable takes over the effect of the neglected factor, which is a property of the classical omitted variable bias that seems to take place in case of the share of foreigners. The same upward bias of the estimated foreigner effect can be observed for all equations of Tables 6 and 7, though only in case of

theft w.a.c. there is a bias that would lead to a wrong statistical conclusion.

The variable "drug offences" is replaced by the "number of deaths due to drug poisoning" in Table 8. The sample, too, has changed since the latter variable is only available since 1984. Drug deaths, the indicator of drug problems used by Corman and Mocan (2000), in neither case works. One might suspect that this outcome is an artefact of the different sample period, but repeating regressions of Table 8 using "log (drug offences)" instead of "log (drug deaths)" results in coefficients which are almost the same as in Tables 6 and 7, as can be seen from the coefficients on theft u.a.c.: 0.064 (Table 6: 0.052), theft w.a.c.: 0.072 (Table 6: 0.064), robbery: 0.062 (Table 7: 0.093), and rape: 0.218 (Table 7: 0.205) (estimates not listed elsewhere). With respect to theft u.a.c., Table 8 confirms the significant roles of deterrence, unemployment and share of foreigners. The same holds for significant effects in the equation of theft w.a.c., although here the already high demographic influence of young men (aged 15 to 24) has increased even more from 0.95 to 1.38 in Table 8 (it reduces to 1.25 when drug offences were used). For violent crimes, however, besides effects arising via the drugs–crime channel, no significant result can be detected for the smaller data base of 1984 to 1996 (which also holds if drug offences are included instead of drug deaths). Thus, once again, this analysis confirms the better performance of economic property crime models compared to economic models of violent crime.

8 Conclusions and discussion

Drug addiction is a topic of major public concern. This is partially due to the assumption that there might exist a causal relationship from drug abuse to increasing crime rates. In fact, a cursory inspection of the problem might lead to this conclusion. Many surveys indicate that drug users are more likely to have a connection with the criminal justice system (through arrests and incarcerations) compared to non–drug users, and criminal justice system data indicate that a large percentage of arrestees test positive for illicit drug use at the time of their arrest (see French et al., 2000, for a survey of the related criminological literature). However, drug use may be, as French et al. (2000) put it, the "catalyst" for criminal activity, but the interrelationships between drug use and crime are more complex and require more than a

two–dimensional view of the drugs–crime nexus. In this paper, this link is analysed within the Becker–Ehrlich model of crime supply, augmented by the consideration of currently discussed factors like demographic changes, unemployment, and income inequality.

Estimation with panel data for 11 German states allows us to assess the importance of the drug abuse crime link, which comprises systemic, economic and pharmacological effects. According to our estimation results, which appear to be quite robust with regard to different specifications, a significant drugs–crime nexus appears to be relevant for several crime categories. This link has been ignored in most previous applications of the Becker–Ehrlich framework. Our analysis for the variable "share of foreigners" demonstrates the potential importance of the resulting omitted variable bias. Nevertheless, illicit drug use is far from being the only or exclusive driving force behind the evolvement of crime rates.

The highest impact of drug use is found on rape, a crime category not included in the analysis by Corman and Mocan (2000). Further significant effects are found on property crimes such as robbery and theft. These effects can be attributed to the economic effect of drug abuse. The overall performance of the economics of violent crime model is less convincing. Nevertheless, the lack of significance of the drug measure for murder and assault might be taken as weak evidence against a pronounced systemic effect of the market of illicit drugs on these crime categories. In spite of a different measure of the drug problem (we use drug offences and not deaths due to drug poisoning), different econometric methods (panel econometrics versus time series analysis) and different observational units (German states versus New York City), our results are similar to those presented by Corman and Mocan (2000), underlining the robustness of found results.

We are sceptical, however, with respect to the far–reaching policy implications made by Corman and Mocan (2000). Based on the comparison of estimated elasticities of robberies, for instance, which are, 0.18 to 0.28 for drug use and -0.71 to -0.94 for robbery arrests, they conclude that "increased law enforcement is a more effective methods of crime prevention in comparison to efforts targeted at drug use". Without consideration of any cost–benefit analysis, such suggestions are difficult to justify. They would require cost estimates of a one percent change of drug offences and arrests or clear–up

rates on the one hand, and estimation of benefits in terms of reduced costs of crime, more particularly of murder, assault, theft, robbery, vandalism etc. on the other. Corman and Mocan (2000) do not use such figures, although costs of crime are available for the U.S. (see, for instance, Anderson 1999; unfortunately, no comparable cost of crime estimates can be obtained for Germany).

Chronic drug users are also victims of crime. This is a neglected aspect when quantifying the benefits of crime reduction. French et al. (2000) find that, relative to non–drug users, chronic drug users are 16 percent more likely to become a victim of crime (and 23 percent more likely to be a perpetrator of crime, and 25 percent more likely to be either a victim or a perpetrator). This aspect might also be relevant for the strong impact of drug use on rape indicated by our estimates.

The most difficult task, however, is to evaluate the benefits of drug prevention programs, or rehabilitation programs. There is a variety of programs in use, and not all of them are ineffective. A substantial body of research in the US, mainly performed by the Department of Health, has found that treatment programmes can produce marked reductions in illegal drug use and drug related crime. For instance, the United States' 1996 National Treatment Improvement Evaluation Study found that clients reported a decrease of about 50% in the year following treatment and that arrests had declined from 48.2% to 17.2% (NACRO 1999). Of course, there are good reasons to be sceptical about these big successes, and econometricians might suspect some selectivity problems. However, just for this reason much more evaluative work needs to be done before strong conclusions like the one given by Corman and Mocan (2000) can be drawn.

Given the lack of reliable cost–benefit results, besides conventional measures, which try to increase the clear–up rate, programs aiming at reducing the economic effect of drug abuse can be considered. However, in order to obtain sustainable effects, such programs should not contribute to an increase in rents on the illegal drug market, but rather aim at reducing these rents. The development of actual proposals to this end remains on our research agenda.

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A Appendix: Results of Sensitivity Analysis

Table 6: Sensitivity analysis I

Independent Variables	Theft u.a.c. (1)	Theft u.a.c. (2)	Theft w.a.c. (1)	Theft w.a.c. (2)
Deterrence				
- log (clear–up rate (-1))	-0.192**	-0.182**	-0.068	-0.023
	(0.042)	(0.042)	(0.092)	(0.093)
Drugs				
- log (drug offences)	0.052*	–	0.064**	–
	(0.027)		(0.021)	
Income opportunities				
- log (ur(-1))	0.229***	0.236**	0.023	0.032
	(0.068)	(0.069)	(0.107)	(0.056)
- relative income (-1)	-0.269	-0.248	-0.139	-0.116
	(0.169)	(0.174)	(0.139)	(0.139)
Demographics				
- log (share of young men, 15–24)	0.339	0.322	1.110**	1.105**
	(0.250)	(0.259)	(0.216)	(0.212)
- log (share of foreigners)	0.322**	0.346**	0.196	0.230*
	(0.126)	(0.130)	(0.106)	(0.105)
AR(1)–coefficient	0.554**	0.571**	0.590**	0.571**
	(0.060)	(0.058)	(0.059)	(0.058)
BFN–DW–statistics	2.11	2.14	2.19	2.20
Adjusted R–squared	0.992	0.992	0.987	0.987

All estimates include time– and region–specific constants (two–way fixed–effect modelling), standard errors in parentheses, sample: West German states, 1976–1996 (220 observations)

Table 7: Sensitivity analysis II

Independent Variables	Robbery (1)	Robbery (2)	Rape (1)	Rape (2)
Deterrence				
- log (clear–up rate (-1))	-0.048	-0.084	0.079	0.032
	(0.081)	(0.081)	(0.117)	(0.121)
Drugs				
- log (drug offences)	0.093**	–	0.205**	–
	(0.036)		(0.051)	
Income opportunities				
- log (ur(-1))	-0.064	-0.037	0.085	0.126
	(0.105)	(0.106)	(0.131)	(0.139)
- relative income (-1)	-1.402**	-1.379**	0.014	0.127
	(0.321)	(0.323)	(0.327)	(0.348)
Demographics				
- log (share of young men, 15–24)	0.693	0.746	0.775	0.761
	(0.665)	(0.653)	(0.469)	(0.509)
- log (share of foreigners)	0.547*	0.626**	0.058	0.171
	(0.250)	(0.251)	(0.246)	(0.262)
AR(1)–coefficient	0.841**	0.830**	0.555**	0.576**
	(0.044)	(0.045)	(0.066)	(0.066)
BFN–DW–statistics	2.31	2.30	2.17	2.20
Adjusted R–squared	0.991	0.990	0.946	0.942

All estimates include time– and region–specific constants (two–way fixed–effect modelling), standard errors in parentheses, sample: West German states, 1976–1996 (220 observations)

Table 8: Sensitivity analysis III

Independent Variables	Theft u.a.c.	Theft w.a.c.	Robbery	Rape
Deterrence				
- log (clear–up rate (-1))	-0.217**	-0.105	0.201	0.082
	(0.051)	(0.119)	(0.261)	(0.137)
Drugs				
- log (drug death)	0.014	-0.006	0.013	-0.011
	(0.019)	(0.013)	(0.017)	(0.035)
Income opportunities				
- log (ur(-1))	0.283**	0.081	-0.016	0.118
	(0.082)	(0.060)	(0.092)	(0.191)
- relative income (-1)	-0.392*	0.038	-0.028	0.537
	(0.184)	(0.132)	(0.216)	(0.466)
Demographics				
- log (share of young men, 15–24)	-0.350	1.384**	0.048	1.224
	(0.312)	(0.226)	(0.380)	(0.813)
- log (share of foreigners)	0.371*	0.202	0.266	-0.166
	(0.160)	(0.115)	(0.190)	(0.410)
AR(1)–coefficient	0.292**	0.287**	0.498**	0.534**
	(0.094)	(0.094)	(0.075)	(0.086)
BFN–DW–statistics	1.81	1.85	2.18	2.20
Adjusted R–squared	0.992	0.990	0.984	0.942

All estimates include time– and region–specific constants (two–way fixed–effect modelling), standard errors in parentheses, sample: West German states, 1984–1996 (143 observations)