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Increasing the efficiency and efficacy of the war on drugs

Utilizing the STRIDE database to analyze cocaine seizures

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This paper analyzes the structure of the illicit cocaine market, and develops a theoretical model analyzing cocaine seizures made by the Drug Enforcement Agency inside the United States. I would like to thank Professor Jonathan Lipow for inspiring me to take on this particular research topic. Professors Barbara Craig, Hirshel Kasper, and Alberto Ortiz also provided needed guidance and assistance as I undertook this project. Special thanks also to Professor Luis Fernandez for chairing the honors seminar meetings, and Congressman John Hall and his staff for working with me to secure data. Most importantly, I would like to recognize my fellow honors students: Lucas Brown, Helen Hare, James Hepp, John Linder, Max Roessler, and Woan Foong Wong, for their input and assistance as I prepared this paper. Finally, I hope I will eventually be able to thank the Freedom of Information Office of the Drug Enforcement Administration for providing me with data essential to the focus of this project.

I. Introduction

The Drug Enforcement Administration (DEA), an agency of the United States Department of Justice (USDOJ), works to seize illicit drugs, prosecute those who partake in and provide illicit drugs, and coordinate drug enforcement activities with other agencies.[1] The DEA was recently accused of being unable to analyze the effectiveness of its policies, actions, and the illicit drugs market. Much analysis of the illicit drug market has been made with data maintained by the DEA within the System to Retrieve Drug Evidence (STRIDE) database. This database contains information regarding the quantity, purity, and price of illicit drugs seized in the United States. The location of each purchase or seizure of an illicit drug is also recorded. This data is obtained through the work of undercover agents, interviews with those who have been arrested for illicit drug activities, and the Metropolitan Police of the District of Colombia which is the only other agency which contributes information to the database. Understanding trends in illicit drugs prices allows policy makers and field agents to better devote their resources, and to understand what drugs are most likely to be abused.

The quality of research that can be accomplished using STRIDE price data of two drugs in particular, cocaine freebase (crack cocaine) and heroin, has been discussed in two recent papers. Horrowitz (2001) suggests that the price estimates in the database cannot be used to predict trends of illicit drug use. Using STRIDE data Horrowitz shows that there are large variations in the estimates of the price of the same quantity and type of drug within the same city by different law enforcement agencies. Arkes et. al. (2008)

[1] "DEA Staffing and Budget" DEA http://www.usdoj.gov/dea/agency/staffing.htm December 2008

argue that Horrowitz's accusations were flawed. The authors suggest that Horrowitz's analysis failed to account for the different scope of the agencies involved in making the drug seizures, and variations in the purity of the drugs that were seized or purchased. The authors develop a model that includes measures to control for the operations of drug enforcement agencies in a given region, and the purity of a seized drug. Their analysis suggests that there is less variation in the price of an illegal drug than Horrowitz originally concluded. The authors also use their predictions of drug prices to significantly predict drug-overdose emergency room visits, which they claim are an independent indicator of drug demand.

Arkes et al.'s proclamation of confidence in the quality of price data within the STRIDE database must have brought a modicum of comfort to the authors and federal employees that have used this database for research. There have been many published uses of STRIDE estimates of the street price of drugs. Caulkins (1994) and Rhodes et al. (1994) created a price-index for illegal drugs. Saffer and Chaloupka (1995), Chaloupka et al. (1998), and Grossman et al. (1996) used the data to estimate demand for illegal drugs, and DeSimone (1998) used it to study whether marijuana is a gateway drug for the use of cocaine. Yuan and Caulkins (1998), DiNardo (1993), and Crane et al. (1997) investigated the effects of enforcement actions on the prices of illegal drugs. Boyum et al. (1994) attempted to predict future trends of the market for heroin. Caulkins (1997) investigated the relative prices of crack and powder cocaine, and Bach et al. (1999) investigated the relation between heroin prices and changes in the use of heroin by users seeking methadone treatment. Many federal agencies and policy makers use STRIDE data to estimate quantities of illegal drugs consumed in the U.S, although the results of their research are not typically published. Considering the amount of effort that is spent by the federal government combating the use and trade of illicit drugs, it is likely that the government would want to be able to quickly predict the overall usage trends of a given drug. In fact the explicit purpose of the STRIDE database is to store all information regarding a particular piece of drug evidence, in order to study the trends of its use.[2]

Given the cocaine industry's nature it seems there are other economic factors driving demand and supply of illicit drugs, which are not systematically collected by enforcement agencies and could be used to study trends. For example, the real exchange rate between the United States and Colombia might be a useful indicator to predict trends in the illicit cocaine market. If an exogenous variable like the real exchange rate was significantly correlated with the use of cocaine this would allow the government a readily accessible variable to help analyze the cocaine market. Theoretically, if the dollar appreciated against the Colombian peso one would expect to see more cocaine use, and therefore more cocaine seized. If the dollar depreciated against the Colombian peso one would expect to see less cocaine use, less cocaine seized. The change in this particular exchange rate could also be related to use and seizures of other drugs that are potential substitutes for dollar holding cocaine users.

In this paper I develop a statistical model which analyzes the impact of several variables on quarterly seizures of cocaine by the DEA from 1981-2007. I develop this model utilizing what is known of the cocaine industry, and I analyze the model using two different measurements for the price of cocaine, and two different estimates of the price

[2] "Inventory of Federal Agencies Automated Systems" United States General Accounting Office April 1991

of substitute drugs. Data regarding the total number of seizures and estimates of the price of cocaine and substitutes for cocaine are from the STRIDE database. Initial results suggest that variation in the real exchange rate explains variation in seizures of cocaine, when analyzing seizure data that omits DEA estimates for the price of cocaine. Additional analysis of the data shows that cocaine price estimates from the STRIDE database are also correlated with cocaine seizures, though this relationship is stronger with other exogenous variables proposed in the model.

This paper is broken into four sections. In the first I provide an overview of the cocaine industry. I provide an overview of the theoretical model I developed and I outline the methodology for analyzing the data in the second and third sections, in the fourth section I offer analysis, and in the fifth conclusions.

II. Overview of the cocaine industry

Cocaine is the product of the coca plant. The plant grows best in hot damp forest clearings, though the plants which produce some of the most desirable leaves, those with the best taste, are grown on drier hillsides (Karch 2006). The plants are first allowed to mature as seeds in small highly nutrient rich plots that are protected from direct sunlight, and are then transplanted into burned out rainforest land or terraced hillsides. These plants are then regularly fertilized, weeded, pruned, and receive occasional applications of pesticide (Allen 2001). The cultivation of the coca plant is the most labor intensive aspect of the production process of cocaine. It takes up to 18 months for a plant to mature into a bush that can yield a sustainable crop, and a well maintained coca plant can continue to yield a desirable crop for many years.

A single coca plant can be harvested up to six times in a single growing season. After they are harvested the green coca leaves, known as matu, are spread in thin layers on the ground and dried in the sun for several days in order to be preserved. They are then packed in burlap sacks, which are kept dry in order to preserve the quality of the leaves.[3] It takes 350kg's of coca leaves to produce a single kilogram of cocaine base, which yields a little less than a single kilogram of precipitated cocaine crystals more commonly referred to as coke. Transforming coca into cocaine base depends on many kilograms of harsh chemicals which include sulfuric acid, sulfate salts, potassium permanganate, and ammonium hydroxide. This is commonly completed using kerosene, lime, and sulfuric acid. To transform the cocaine base into precipitated cocaine crystals requires ether, acetone, and hydrochloric acid (Allen 2001). It is important to note that "cocaine base" is not "freebase cocaine" or crack cocaine. Crack cocaine is made using coke, baking soda, and water. These ingredients are combined into a liquid solution that is then dehydrated, and the resulting solid is broken into tiny chunks that dealers sell as crack rocks (Saferstein 2007).

Three countries are responsible for the world's supply of cocaine: Bolivia, Peru, and Colombia. Colombia is responsible for processing a supermajority of the world's cocaine and 90% of the cocaine in the United States has been grown, processed, or simply passed through Colombia at some point.[4] Colombia is in a unique position to produce, process, and distribute cocaine given the monopoly the revolutionary cartels FARC (Fuerzas Armadas Revolucionarias Colombianas) and ELN (Ejercito de

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3 "Coca" Wikipedia—The free Encyclopedia http://en.wikipedia.org/wiki/Coca#Cultivation 8 December 2008

4 Source Countries and Drug Danger Zones, Office of National Drug Control Policy, http://www.whitehousedrugpolicy.gov/international/colombia.html 12 October 2008

Liberacion Nacional) have on cocaine industry. These organizations tax and protect coca growers, cocaine processers, and control the mechanisms by which the cocaine can be exported from the country. FARC in particular, controls a majority of the cocaine business in Colombia.[5]

Cocaine production in Colombia begins with the individual farmers that cultivate coca, and produce cocaine base. The base is then bought by the drug cartels and is processed into coke in labs deep in the Colombian jungle. These farmers are compensated for their work in local currency. After the drug is refined, it is shipped out of Colombia for distribution throughout North America. The total profits seen by the drug cartels of Colombia as a direct result of their involvement in the cocaine industry were estimated in 2000 to be between $2-10 billion. This is equivalent to 71% of Colombia's total legal exports of that year (Allen 2001).

Cocaine makes its way from Colombia the United States through one of 6 mechanisms. The according to 2001 estimates made by the DEA and the USDOJ cocaine is smuggled into the United States through: direct shipments out of Columbia by air (5%), from Mexico by land (45%), and Panama (15%) Puerto Rico (10%) Hispaniola (10%), Jamaica (10%) and the Bahamas (5%) by boat and is smuggled past US customs within licit commercial cargo. Distribution of cocaine throughout the United States depends on the mechanism by which it was smuggled into the United States, as is the ultimate street price of the drug (Allen 2001). Horrowitz (2001) also explains that different regions of the United States are used for different purposes of the cocaine

[5] Key Farc role in US cocaine trade, BBC http://news.bbc.co.uk/2/hi/americas/6353449.stm 12 February 2007

industry, and cities key to the import of cocaine demand different resources from the DEA than cities which are regional distribution points. Chicago, Dallas, and Cleveland are major regional distributers of cocaine; Houston, San Diego, El Paso are places where cocaine often initially enters the country. New York and Miami are cities where cocaine often enters the country and are places that serve as major regional cocaine distributers. Once inside the United States precipitated cocaine is often "cut" or mixed with other substances so that the cocaine product that is sold is not pure coke. Additionally, the product is weighed into small samples, usually around one gram, before it is sold to users.

III. Overview of theoretical model

I assume the amount of cocaine that will be seized in a given period depends on the resources available to pursue investigations of cocaine use and distribution. When examining how much cocaine the DEA will seize the resources available to the DEA and other law enforcement agencies must also be taken into account. The amount of tax dollars the DEA is allocated fluctuates over time. The level of operations the DEA will be able to conduct in a tight budget year will differ from the level of operations the DEA will be able to conduct when they are afforded more resources. Similarly the efforts of other law enforcement agencies to pursue and prosecute illicit drug activities will fluctuate over time. Additionally, I assume the level of corruption throughout these law enforcement agencies will negatively impact the amount of cocaine that can be taken off the market, and will affect the overall seizures the DEA can make.

Seizures of cocaine in the US also depend on the quantity of cocaine traded in the US market. This depends on the demand and supply of cocaine. Some factors that I assume will affect the supply of cocaine on the market include the success of the coca growing season and the amount of cocaine produced, the number of individuals involved in the cocaine industry in cocaine producing nations, and the ability of the cocaine producing nations to prohibit the production and distribution of the drug. As this paper described previously, coca grows best in warm wet climates. When examining the case of Colombia, coca producing regions in this nation are not immune to droughts and other climatic shocks, though dramatic fluctuations in the weather throughout the year given the nation's proximity to the equator are rare. The amount of people involved in the cocaine industry in Colombia depends on the state of the Colombian economy. Additionally, the Colombian government has been engaged in an extensive civil war, has a history of conflict, and the ability of the Colombian drug cartels to manipulate the government has been well documented. Colombia has an extensive history of smuggling, and a culture that rewards individuals that make fast profits (Allen 2001). The ability of the Colombian government to impact the production of cocaine in turn impacts the supply of cocaine on the illicit drug market.

I assume that demand for cocaine depends on the price of cocaine, the cocaine user population's size, and the income of cocaine users. The effects of each of these variables on the demand for cocaine are assumed as follows: if the price of cocaine increases cocaine demand falls, if the population of users increases the demand for cocaine rises, and if the income of cocaine users goes up cocaine demand rises. In a standard market, one might also immediately consider the effect the price of a substitute for cocaine would have on the market. If cocaine were traded in a licit market, a price increase in cocaine might drive regular cocaine users towards another drug. This is complicated in the existing cocaine market as many cocaine users are addicted to the drug, and are willing to pay any going price in order to experience the drug's effect. In fact, cocaine is the most addictive drug known to man.[6] Other drugs like Ritalin, PCP, epinephrine, and methamphetamine all produce effects that are similar to cocaine when used. A cocaine user might resort to using one of these drugs, if the price of cocaine became too high.

Considering these factors and assumptions this paper will use the following theoretical model to describe how cocaine is seized by the DEA:

$$S^{US}_t=F(R_t, OLE_t, C^D_t, Q^{UST}_t)$$

Here, seizures of cocaine (S^{US}_t) by the DEA is a function of the resources available to the DEA (R_t), the activities of other law enforcement agencies (OLE_t), the level of corruption within the DEA (C^D_t), and the quantity of cocaine traded on the US market (Q^{UST}_t).

The quantity of cocaine traded on the market is also a function that can be described generally, as is done below.

$$Q^{UST}_t=F(P^C_t, P^S_t, RF_t, Y^{US}_t, POP_t, P^{COL}_t, C^F_t)$$

Here, the quantity of cocaine trades on the market is a result of the price of cocaine (P^C_t), the price of substitutes for cocaine (P^S_t), the amount of precipitation in coca growing regions (RF_t), the income of cocaine users (Y^{US}_t), the size of the cocaine user population (POP_t), the level of productivity in Colombia (P^{COL}_t), and the amount of corruption in Colombia (C^F_t).

III. Methodology and Data

Quantitative analysis of the proposed theoretical model using OLS was complicated by several factors. First, quarterly data regarding seizures of cocaine is not

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6 Streatfeild, Dominic 2001 Cocaine—An unauthorized biography St. Martin's Press New York 86-93

readily accessible. Though pursued through a Freedom of Information Act request, this data has not yet been analyzed and applied to the model. Instead quarterly estimates of cocaine seizures were made by assuming that annual seizures of cocaine were made equally throughout each quarter of the year. Second, measuring corruption in both the United States and Colombia is challenging, and is often the result of extensive modeling. Third, though many national level crime statistics for the US are reported annually by the FBI, no information is available regarding how many arrests were made by law enforcement agencies around the country for cocaine specific crimes, nor for any other drug related activity. Fourth, as a government agency the DEA receives an annual appropriation and little information is available regarding how this appropriation is used within a given fiscal year. Fifth, although annual estimates are made of the amount of first time cocaine users or cocaine initiates, no estimates are made of the size of the entire cocaine user population.

To estimate corruption in the United States and Colombia two different approaches were used. To measure corruption in the United States the annual appropriation of the Office of the Inspector General of the USDOJ was analyzed as a percentage of the overall budget of the USDOJ. The Office of the Inspector General (OIG) has conducted internal investigations throughout the USDOJ since its inception in 1989. Since the data set detailing cocaine seizures spans from 1981-2007, the level of corruption in the US prior to the OIG's inception was estimated. This variable when regressed against cocaine seizures would be positive, if when more funding was devoted to fighting corruption (as a percentage of the USDOJ budget), more cocaine was seized. For the sake of simplicity, and given the lack of data, the amount of resources devoted to fighting corruption was assumed to be zero from 1981 through 1988. Quarterly estimates of the resources available to the OIG were made by assuming the office had the same amount of resources in every quarter of the year. When analyzed in the regression, the budget of the OIG was analyzed as a percentage of the overall budget of the USDOJ.

To measure corruption in Colombia the proportion of net errors and omissions to total exports on Colombia's capital account was examined. The theory behind this method of analysis is that in years where there are a tremendous amount of errors and omissions in the capital account there is less understanding of the movement of goods throughout the economy, and t therefore more corruption exists within the nation. This method for measuring corruption has been used by MacAfee (1980), O'Higgins (1989), Smith (1985), Petersen (1982), Del Boca (1981), and Park (1979). This is an extraordinarily rough measure of corruption and has been subject to much criticism. It seemed reasonable, however, to use this variable given the amount of time available to analyze this model. Quarterly error and omissions reports were not reported by Colombia before 1996. For these years where quarterly data was unavailable, the annual proportion of the errors and omissions relative to total exports was applied to all four quarters of the year.

While no data which summarized the total arrests made by law enforcement agencies for cocaine use, possession, or distribution throughout the US could be found, there is ample evidence that the crime most often committed by illegal drug users is Driving Under the Influence.[7] Arresting individuals of this action was assumed to be a

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[7] "Drug Related Crime—March 2000" Office of National Drug Control Policy http://www.whitehousedrugpolicy.gov/publications/factsht/crime/index.html 12 November 2008

rough proxy for arrests made for illicit activity. Available data in the Uniform Crime Reports maintained by the FBI regarding the number of DUI incidents in a given year was divided by the size of the US population in a given year to control for population changes. It was assumed that the annual number of arrests was the same in all four quarters of a given year.

The problems associated with analyzing the operating budget of the OIG in the regression were similar to the problems associated with analyzing the operating budget of the DEA, to measure the amount of resources available to the DEA. The DEA receives an annual budget appropriation form the US Congress, and there is no information available regarding how this funding is used throughout the year. It was assumed that the annual appropriation was used equally throughout the quarters of the fiscal year. When analyzed in the regression, the budget of the DEA was analyzed as a percentage of the overall budget of the USDOJ. It is important to note that all of the data was analyzed on a calendar year basis, not a fiscal year basis, and was all analyzed on the same time scale.

To estimate the size of the cocaine user population, data available in the Department and Health and Human Services National Survey on Drug Use and Health (NSDUH) was analyzed. This survey was formerly known as the National Survey on Household Drug Abuse. The survey makes an annual estimate of how many Americans used a wide variety of illicit substances for the first time in a given year. This population of individuals is called the initiate population. The survey's annual estimate of cocaine initiates was used as a proxy for changes in the size of the cocaine user population. It was assumed that an equal number of individuals used cocaine for the first time throughout the four quarters of a year. When analyzing this data in the regression, this variable was lagged back one period, as it was assumed that the amount of cocaine users from one period is likely to influence the number of users in the next.

An empirical model of seizures of cocaine must also recognize that incorporating a price variable in a model of any illicit drug also poses significant challenges. First, the purity of an illicit drug is unknown until after it has been purchased and used by an individual, and therefore the true value of the drug in question is not known at the time of its sale. Second, the price of a drug of a given purity may differ by volume of individual transactions. Third, the purity and quantity of drugs actually distributed for sale varies by location, and may be dependent on the relationship an individual has with a drug dealer. Generally, local variations in price will mirror national trends, but substantial variations in local and national market prices are possible (Arkes 2008). Given the nature of the cocaine industry in Columbia, suspecting that the real exchange rate might be helpful in measuring changes in domestic seizures of cocaine makes sense. Cocaine is like any other commodity of Colombia as the United States dollar strengthens against the Colombian peso, cocaine becomes cheaper for Americans to buy, and this is true regardless of the purity of a given sample of cocaine. As this paper has discussed previously both the dollar and peso are used throughout the production and sale of cocaine. Additionally, since the analysis in this paper is focusing on national level seizures, national estimates of the price of cocaine should be correlated with the total amount of cocaine seized by the DEA throughout the US.

To analyze the price of cocaine variable in the proposed in the theoretical model the real exchange rate between the Colombian peso and US dollar, and price estimates available through published reports of the Office of National Drug Control Policy were applied to the regression. These estimates are the result of analysis of the STRIDE database conducted by the RAND Corporation, and are real price levels pegged to a 1993 base year. To analyze the price of a substitute of cocaine price data available for methamphetamine, which was published in the same analysis of other price data within the STRIDE database conducted by the RAND corporation, was applied to the model. The price index of alcohol available through the Bureau of Labor Statistics was also used to estimate the cocaine substitute variable, as this index is the result of real data analysis of a widely distributed product, and is not the result of a series of investigations and interviews, unlike the data available through the STRIDE database. This index is pegged to a 1990 base year.

To evaluate the other variables in the proposed theoretical model, rainfall data collected in coca growing regions of Colombia made available through the National Oceanic and Atmospheric Association's National Climactic Data Center. To estimate changes in income of the cocaine user population changes in the median income of the US were analyzed. Since the median income of the US is analyzed only on an annual basis, it was assumed the median income remained the same in all four quarters of a given year. For the Colombian productivity variable, a productivity index that measures industrial productivity that is maintained by the Colombian Bureau of National Statistics was utilized. Additionally, a time variable to control for the fact that seizures and the other variables in the model might simply reflect changes over time are correlated with one another was included when analyzing the regression.

Summary of Data Applied and Collected

Theoretical Model	***Applied Variable***	***Source of Data***
Cocaine seizures	Cocaine seizures (kg's)	DEA
DEA Resources	Operating Budget of DEA, as	DEA, USDOJ

	percentage of USDOJ Budget appropriation	
Other US drug law enforcement activity	DUI arrests as percentage of US population	FBI—Uniform Crime Reports
US Corruption	Resources devoted to fighting US corruption: Operating Budget of the Office of the Inspector General, as percentage of USDOJ Budget Appropriation	OIG, USDOJ
Price of cocaine	Real Exchange Rate US and Colombia, Price estimates of gram of cocaine for sales under 2 grams	Central Bank of Colombia, IMF, DEA STRIDE Database—RAND Corporation
Price of cocaine substitute	Price estimates of methamphetamine, sales under ten grams, Alcohol Price Index	DEA STRIDE Database—RAND Corporation, BLS
Rainfall in Colombia	Rainfall in coca growing regions in Colombia	National Oceanic and Atmospheric Association (NOAA)-NCDC
Cocaine users income	Median Income US	US Census Bureau
Cocaine user population	Estimate of cocaine initiates in the US	NSDUH, DHH
Productivity in Colombia	Productivity index of industrial firms in Colombia	Colombian Bureau of National Statistics
Colombian Corruption	Errors and Omissions, Colombia Balance of Payments	Central Bank of Colombia, IMF

Table 1

IV. Analysis

Available data to test the theoretical model proposed by this paper was analyzed using OLS in four different ways. The variables that were available to estimate the price of cocaine were analyzed with against a single measure of the price of a cocaine substitute, and this analysis was repeated using the other measure available to measure the price of a cocaine substitute. This was first done in pure level terms, and the results of this analysis are below:

OLS Analysis of Regressions in level terms												
Number of Observations: 107	**Price estimate by DEA used for price of cocaine estimate**						**Real exchange rate used for price of cocaine estimate**					
Regressed against cocaine seizure data	**Price estimate of methamphetamine used for price of cocaine substitute**			**Price of alcohol used for price of cocaine substitute**			**Price estimate of methamphetamine used for price of cocaine substitute**			**Price of alcohol used for price of cocaine substitute**		
Variable	*Coefficient*	*t-Statistic*		*Coefficient*	*t-Statistic*		*Coefficient*	*t-Statistic*		*Coefficient*	*t-Statistic*	
C	40012.1223	2.439		41741.2313	1.440		40557.2729	3.067		45363.2982	1.707	
Cocaine Initiate Population (-1)	-0.0379	-2.641	***	-0.0371	-2.591	***	-0.0243	-2.124	**	-0.0249	-2.173	**
Colombian Corruption	-29316.5818	-2.404	***	-28930.9169	-2.331	***	-19645.4947	-1.718	**	-18542.2746	-1.603	*
Colombian Productivity	-47.0998	-0.886		-51.0358	-0.963		0.2269	0.005		-3.9270	-0.078	
DEA operating budget as percentage of budget of USDOJ	-289132.5572	-1.725	**	-275518.5235	-1.613	*	-231701.0477	-1.494	*	-210182.8069	-1.334	*
Activity of Other Law Enforcement Agencies	-9230058.0965	-8.876	***	-9160678.4050	-8.518	***	-7321550.7774	-6.896	***	-7202896.8207	-6.554	***
Rainfall in Columbia	0.0108	0.035		0.0153	0.049		0.0747	0.261		0.0797	0.278	
Resources aimed at US Corruption	-7583253.4873	-1.958	**	-8166926.0077	-1.708	**	-9150983.4475	-2.551	***	-9169699.3440	-2.081	**
US Median Income	0.6603	1.623	*	0.5743	1.344	*	-0.0193	-0.052		-0.1082	-0.260	
Time	238.0319	4.605	***	242.6895	1.050		266.2711	5.549	***	313.8575	1.489	*
Real Exchange Rate	XXXXX			XXXXX			1012538.8957	4.144	***	1024041.8496	4.192	***
Price estimate of cocaine	-3.8288	-0.486		-5.6401	-0.760		XXXXX			XXXXX		
Price estimate of methamphetamine	-3.0049	-0.612		XXXXX			-2.6821	-0.635		XXXXX		
Price of alcohol	XXXXX			8.7839	0.042		XXXXX			-31.2516	-0.164	
R-Squared	0.810366			0.809623			0.839003			0.838365		

Table 2

*=Significant at 10% confidence level
**=Significant at 5% confidence level
***=Significant at 1% confidence level

In all four regressions the cocaine user population proxy, the measure of resources available to the DEA, the Columbian corruption measure, and the drug enforcement activity of other law enforcing activities were all found to have a significant negative impact on cocaine seizures. The variable measuring corruption in the United States was found to be significant, but have negative impacts on cocaine seizures when analyzed in the different regressions. When applied, changes in the real exchange rate were found to a positive significant impact on cocaine seizures. Changes in the median income of the US were found to have a significant positive impact on cocaine seizures when analyzed in two of the regressions.

Some of the signs of these significant variables were expected and consistent with the proposed theoretical model. The real exchange rate of Colombian pesos to US dollars was found to have a positive impact on the amount of cocaine seizures. This suggests when the dollar appreciates against the Colombian peso cocaine is relatively cheap in the US, and cocaine seizures would increase due to the prevalence of cocaine on the market. It was also expected for the variables that measured Colombian corruption and the activities of other law enforcement agencies to have negative coefficients. This would imply that as Colombian corruption and the activities of other law enforcement agencies would ultimately reduce the total volume of cocaine seized solely by the DEA. Similarly that the variable that estimated the income of cocaine users had a positive coefficient is consistent with the proposed theoretical model—as the income of users goes up, the amount of cocaine on the market would increase, and more cocaine would be seized.

Surprisingly the variable which measured the cocaine user population's size had a negative coefficient. On the outset this would suggest as the cocaine user population increases, the total volume of seizures made by the DEA goes down, which might imply one of several things. It suggests that a large user population might manage to hide the cocaine on the market. Or it might imply that a larger population quickly consumes more of the cocaine brought on the market leaving less available for the DEA to seize. Both of these scenarios seem unlikely. In this situation, what might be getting observed is a reverse relationship. That is, when more cocaine is seized more people are inclined to mot use the drug. It is also hard to believe that as the amount of resources the DEA is given as a percentage of the overall department of justice increases, the quantity of cocaine seizures would go down. Additionally, the variable that measures expenditures fighting corruption in the US should not be negative. As this variable increases, the OIG of the USDOJ should have more money relative to the budgets of the entries USDOJ to pursue corruption within domestic law enforcement activates. Hypothetically, as more resources were devoted to this area, the amount of corruption in the US should go down, and more cocaine seizures should be made. This result is very puzzling.

Notably, the measure for the activities of other law enforcement agencies was also negative and significant in all four regressions. This suggests that as other law enforcement agencies enforce drug laws, there is less cocaine for the DEA to seize. Also if these agencies are seizing cocaine, the DEA will be seizing less cocaine as a result of only its own actions. The STRIDE database, however, is composed of data contributions form the DEA and another law enforcement agency. This result is more surprising than it might initially seem.

It was later noted that interpreting the amount of economic significance of a particular variable was hard to observe using these regressions. For instance, this analysis suggests that as net errors and omissions of Colombia's capital account becomes a larger absolute percent of total Colombian exports, fewer kilograms of cocaine are seized by the DEA. This is not a particularly meaningful observation, and it is also a mouthful. These regressions were therefore reanalyzed so that the coefficient estimates would be expressed as elasticity's. The results of this method of analysis are below:

OLS Analysis of Regressions as elasticity's												
Number of Observations: 77	**Price estimate by DEA used for price of cocaine estimate**						**Real exchange rate used for price of cocaine estimate**					
Regressed against cocaine seizure data	**Price estimate of methamphetamine used for price of cocaine substitute**			**Price of alcohol used for price of cocaine substitute**			**Price estimate of methamphetamine used for price of cocaine substitute**			**Price of alcohol used for price of cocaine substitute**		
Variable	*Coefficient*	*t-Statistic*		*Coefficient*	*t-Statistic*		*Coefficient*	*t-Statistic*		*Coefficient*	*t-Statistic*	
C	-8.7381	-0.554		-29.1249	-1.747		-9.6596	-0.625		-24.4524	-1.420	
Cocaine Initiate Population (-1)	0.2906	1.113		0.2177	0.874		-0.0996	-0.332		-0.0001	0.000	
Colombian Corruption	-0.0433	-2.361	**	-0.0442	-2.548	**	-0.0326	-1.755	**	-0.0375	-2.048	**
Colombian Productivity	-0.2250	-0.568		-0.2830	-0.762		0.1817	0.437		-0.0271	-0.068	
DEA operating budget as percentage of budget of USDOJ	0.4132	1.132		0.1586	0.441		0.2444	0.705		0.0630	0.178	
Activity of Other Law Enforcement Agencies	-3.0841	-7.593	***	-2.9521	-7.599	***	-2.5329	-5.596	***	-2.6453	-6.092	***
Rainfall in Columbia	0.0188	0.311		0.0315	0.549		0.0207	0.350		0.0283	0.490	
Resources aimed at US Corruption	-0.2341	-1.010		-0.5210	-2.259	**	-0.3837	-1.638	*	-0.5701	-2.424	***
US Median Income	-0.5920	-0.369		-0.4971	-0.352		0.4838	0.299		0.0257	0.018	
Time	0.9798	3.499	***	-1.0202	-1.286		0.7714	2.817	***	-0.7511	-0.894	
Real Exchange Rate	XXXXX			XXXXX			0.8530	2.723	***	0.5420	1.705	**
Price estimate of cocaine	0.3170	2.104	**	0.2740	1.947	**	XXXXX			XXXXX		
Price estimate of methamphetamine	-0.0843	-0.844		XXXXX			-0.1066	-1.079		XXXXX		
Price of alcohol	XXXXX			5.1248	2.800	***	XXXXX			4.1267	2.101	***
R-Squared	0.69415			0.724079			0.706763065			0.720488282		

Table 3

*=Significant at 10% confidence level
**=Significant at 5% confidence level
***=Significant at 1% confidence level

Here, the measure of the activity of other drug enforcement agencies, and the Columbian corruption measure both have a significant negative impact on cocaine seizures. In three out of the four regressions the measure for resources aimed at combating corruption in the US was also found to have a significant negative impact on cocaine seizures. When applied, changes in the real exchange rate, changes in the price estimate generated by the DEA's STRIDE database, and changes in the alcohol price index were found to have a positive significant impact on cocaine seizures.

That changes in the price estimate of cocaine generated by the DEA would have a positive impact on cocaine seizures is puzzling. As the price of cocaine increases, one would expect there to be less demand for cocaine on the market, and less cocaine for the DEA to seize. Perhaps what is getting observed in this regression is another reverse relationship, as was described previously. Perhaps as the DEA seizes more cocaine, the price of cocaine increases as there is a reduced supply of cocaine on the market. Yet is not clear whether the DEA's operations significantly affect cocaine prices throughout the US, so this seems to be an overly optimistic assessment. Another possibility is that this price increase is a result of an increase in demand for cocaine, which is in turn inspired by an increase in seizures. More individuals may wish to purchase cocaine for later recreational use if they perceive it will be harder to get in the future. More interestingly, the analysis suggests that changes in the real exchange rate have a greater impact on the amount of cocaine seized by the DEA then changes in the price estimate of cocaine.

Perhaps the most unexpected result from this analysis is the tremendous positive impact that changes in the price of alcohol have on cocaine seizures. It would seem from this analysis that alcohol is tremendous substitute for cocaine, as when the price of alcohol increases the number of cocaine seizures is positively impacted. That is, as the price of alcohol goes up more people are more likely to use cocaine, which then gets seized by the DEA.

I found it interesting that the elasticity for the price estimate of methamphetamine was negative. This would suggest that methamphetamine is a compliment to cocaine, not a substitute. Out of sheer curiosity, I reran these regressions running both the price of alcohol and price of methamphetamine variables, against the price of cocaine estimate generated by the DEA and the real exchange rate. I assumed, that methamphetamine might be a compliment to cocaine. The results are below:

Analysis of Data inspired regressions as elasticity's						
Number of Observations: 77 *Regressed against cocaine seizure data*	**Price estimate by DEA used for price of cocaine estimate**			**Real exchange rate used for price of cocaine estimate**		
Variable	*Coefficient*	*t-Statistic*		*Coefficient*	*t-Statistic*	
C	-51.0394	-2.736		-43.6361	-2.277	
Cocaine Initiate Population (-1)	0.1171	0.479		-0.1131	-0.395	
Colombian Corruption	-0.0490	-2.898	***	-0.0412	-2.297	**
Colombian Productivity	-0.1315	-0.360		0.1392	0.351	
DEA operating budget as percentage of budget of USDOJ	-0.0136	-0.038		-0.1160	-0.327	
Activity of Other Law Enforcement Agencies	-2.7974	-7.331	***	-2.4732	-5.731	***
Price estimate of methamphetamine	-0.2362	-2.337	**	-0.2107	-2.080	**
Price of alcohol	7.0224	3.605	***	5.7184	2.772	***
Rainfall in Columbia	0.0316	0.568		0.0272	0.483	
Resources aimed at US Corruption	-0.4807	-2.148	**	-0.5386	-2.342	**
US Median Income	1.2800	0.819		1.6897	1.054	
Time	-2.1938	-2.392	***	-1.7837	-1.862	**
Real Exchange Rate	XXXXX			0.6043	1.940	**
Price estimate of cocaine	0.3331	2.406	***	XXXXX		

R-Squared	0.745779	0.738192

Table 4

*=Significant at 10% confidence level
**=Significant at 5% confidence level
***=Significant at 1% confidence level

These regressions are interesting. The measure of the activity of other drug enforcement agencies, the US corruption measure, and the Columbian corruption measure still have significant negative impacts on cocaine seizures. Also, when the price estimate of cocaine generated by the DEA STRIDE data and the real exchange rate variables are applied to the regressions, both are found to have a significant positive impact on cocaine seizures. Here though, both the price of alcohol and the price estimate of methamphetamine are found to be significant, and the signs of these variables are the same observed in the previous analysis.

It was suggested that the theoretical model might be an overidentified equation. Specifically, it was questioned as to whether or not the price of cocaine variable was truly exogenous, as the proposed seizure model incorporates the total volume of cocaine traded on the market, and fluctuations in the quantity of cocaine traded effects cocaine price. The cocaine price variable may therefore already be defined within the model. To test this critique, I ran a Hausman Test for overidentifying restrictions. First, I ran a two staged least squares analysis of my regression. I used the real exchange rate as an instrument for the price of cocaine, and used the other variables of the regression as instruments for the purposes of analysis. The results of this are below:

First Stage of Hausman Test

Number of Observations: 77

Regressed against cocaine seizure data	Coefficient	t-Statistic
C	-49.49342118	-2.56185
Cocaine Initiate Population (-1)	0.165006927	0.652909

Colombian Corruption	-0.051580276	-2.94975
Colombian Productivity	-0.133667775	-0.3534
DEA operating budget as percentage of budget of USDOJ	-0.20012661	-0.55628
Activity of Other Law Enforcement Agencies	-2.844881693	-7.20501
Price estimate of methamphetamine	-0.191826254	-1.86326
Price of alcohol	6.871058357	3.406173
Rainfall in Columbia	0.020845629	0.363031
Resources aimed at US Corruption	-0.467864622	-2.0183
US Median Income	1.224158256	0.75621
Time	-2.224783286	-2.34137

Table 5-a

I then regressed the residuals from this regression, against the instruments used in the first stage of this test. The results of this are below:

Second Stage of Hausman Test		
Number of Observations: 77		
Regressed against residuals of first stage of Hausman test	Coefficient	t-Statistic
C	5.857342524	0.305697
Cocaine Initiate Population (-1)	-0.278088569	-0.97225
Colombian Corruption	0.010368162	0.577923
Colombian Productivity	0.272882999	0.688668
DEA operating budget as percentage of budget of USDOJ	0.084110626	0.236928
Activity of Other Law Enforcement Agencies	0.371637793	0.861163
Real Exchange Rate	0.604327797	1.940125
Price estimate of methamphetamine	-0.018912272	-0.18669
Price of alcohol	-1.152635347	-0.5587
Rainfall in Columbia	0.006387249	0.113382
Resources aimed at US Corruption	-0.070691667	-0.30744
US Median Income	0.465554269	0.290336
Time	0.441082595	0.460424
R-squared	0.055546893	

Table 5-b

The test statistic of this regression ($n*R^2=77*0.055547= 4.27711$) is distributed chi-squared asymptotically with degrees of freedom equal to the number of instruments in excess of the number of troublesome variables (12-1=11). The chi-squared statistic at the 5% level is 19.68, so I accept the null hypothesis that the extra instruments are valid. It should be noted, however, that the Hausman test suffers from considerable size distortions in small samples, and is not always useful when analyzing small samples (Murray 2006).

As can be observed when analyzing these regressions in the appendix, all of the regressions display some evidence of serial correlation. Further examination of the residuals, also in the appendix, explains that this evidence is for the most part a result of how the data was constructed. By transforming annual data into quarterly observations, the residuals of the regression vary dramatically once every four periods, or once whenever there is an actual change in the real data. While future work will hopefully allow access to real observations, attempts can also be made to smooth the estimates of these changes from period to period. For instance an average of two years can be applied to the fourth and first periods between a year's worth of data allowing for more variation throughout the data.

When examining these same regressions using annual versions of the data, there is little evidence of serial correlation. In these circumstances there is very little evidence of serial correlation. Interestingly, these regressions which use annual data, suggest some of the same relationships noted in the previously described regressions. Tables summarizing these regressions are below:

OLS Analysis of Regressions as elasticity's												
Number of Observations: 19	**Real exchange rate used for price of cocaine estimate**						**Price estimate by DEA used for price of cocaine estimate**					
Regressed against cocaine seizure data	**Price estimate of methamphetamine used for price of cocaine substitute**			**Price of alcohol used for price of cocaine substitute**			**Price estimate of methamphetamine used for price of cocaine substitute**			**Price of alcohol used for price of cocaine substitute**		
Variable	Coefficient	t-Statistic		Coefficient	t-Statistic		Coefficient	t-Statistic		Coefficient	t-Statistic	
C	44.5697	1.472		0.2976	0.005		25.6832	0.512		-57.5339	-0.999	
Cocaine Initiate Population (-1)	0.6946	1.142		0.1815	0.279		0.6001	0.612		0.3288	0.517	
Colombian Corruption	0.0109	0.198		-0.0724	-1.248		-0.0639	-0.856		-0.1062	-1.984	**
Colombian Productivity	1.3769	1.734	*	1.0988	1.137		0.6536	0.585		0.8393	0.898	
DEA operating budget as percentage of budget of USDOJ	1.7716	2.182	**	0.5776	0.651		1.2386	1.052		0.3946	0.445	
Activity of Other Law Enforcement Agencies	0.2399	0.173		-1.8445	-1.646	*	-2.7585	-1.455	*	-2.9784	-2.865	**
Rainfall in Columbia	1.4505	2.942	**	1.5529	2.263		1.1571	1.436	*	1.5516	2.201	**
Resources aimed at US Corruption	-0.2633	-0.519		-0.9628	-1.655	*	-0.5520	-0.725		-1.1718	-1.992	**
US Median Income	-4.2650	-1.284		-3.6512	-0.906		-5.3614	-1.057		-2.9566	-0.695	
Time	-0.2556	-0.371		-1.3367	-0.373		1.0003	1.043		-4.4613	-1.358	
Real Exchange Rate	-2.0952	-3.359	***	-1.5303	-1.831	*	XXXXX			XXXXX		
Price estimate of cocaine	XXXXX			XXXXX			0.6745	1.201		0.7660	1.710	*
Price estimate of methamphetamine	-0.4923	-1.936	*	XXXXX			-0.1219	-0.321		XXXXX		
Price of alcohol	XXXXX			4.7420	0.592		XXXXX			12.5143	1.756	*
R-squared	0.924606995			0.889761551			0.836768162			0.885009385		

Table 7

*=Significant at 10% confidence level
**=Significant at 5% confidence level
***=Significant at 1% confidence level

Analysis of Data inspired regressions as elasticity's						
Number of Observations: 19	**Price estimate by DEA used for price of cocaine estimate**			**Real exchange rate used for price of cocaine estimate**		
Regressed against cocaine seizure data	Coefficient	t-Statistic		Coefficient	t-Statistic	
C	-49.8342	-0.814		15.0105	0.309	
Cocaine Initiate Population (-1)	0.6895	0.802		0.7844	1.234	
Colombian Corruption	-0.0827	-1.248		-0.0059	-0.098	
Colombian Productivity	0.7745	0.790		1.2726	1.540	*
DEA operating budget as percentage of budget of USDOJ	0.7458	0.698		1.5108	1.685	*
Activity of Other Law Enforcement Agencies	-2.1160	-1.246		0.2042	0.143	
Price estimate of methamphetamine	-0.2225	-0.659		-0.5028	-1.922	**
Price of alcohol	13.3515	1.770	*	5.4070	0.793	
Rainfall in Columbia	1.7017	2.211	**	1.6860	2.871	**
Resources aimed at US Corruption	-0.9460	-1.346		-0.4368	-0.773	
US Median Income	-3.6174	-0.795		-4.0103	-1.170	
Time	-5.2720	-1.448	*	-2.6711	-0.854	
Real Exchange Rate	XXXXX			-1.8240	-2.511	**
Price estimate of cocaine	0.6651	1.353		XXXXX		
R-squared	0.892779501			0.93175983		

Table 7

*=Significant at 10% confidence level
**=Significant at 5% confidence level
***=Significant at 1% confidence level

Notably, when the real exchange rate was applied to the model this variable was consistently found to be significant, though these regressions suggest as the real exchange rate increase (becomes more favorable for the United States) the amount of cocaine seized goes down, which is inconsistent with the previous regressions and the theory proposed by this paper. More data and analysis is needed to truly determine what the impact of this variable is on cocaine seizures.

The correlation matrices included in the appendix present troubling data which also suggest flaws with this analysis. These matrices show that many of the variables, even in their unaltered annual form, are correlated with one another. Perhaps more real non-estimated data will eliminate this issue. But, the incorrect larger standard errors that may be generated as a result of these variables relationship may result in the incorrect conclusion that a variable in this proposed model is significant.

This analysis is most severely complicated by the weakness of the data that was applied to the regression. The process by which the data was cleaned so that the relationships between all of these variables could be analyzed leaves much to be desired. There are no independent observations of quarterly cocaine seizures, resources available to the DEA, resources available to the OIG, the size of the cocaine initiate population, and the activities of other law enforcement agencies that can be immediately applied to this model. This is not to say that this model is worthless. Given all these weaknesses the model accounts for over 69% of the variation in the data, every time it was run with the available data. But, the results presented in this paper leave much to be desired if one was to make an assertion regarding how the DEA might consider investing its resources if it would like to increase the amount of cocaine it seizes.

Analysis of the regression, however, does suggest that some aspects of the proposed model are weak or require further investigation. For instance it is clear that variations in rainfall in coca growing regions in Colombia might not be the best measure of coca production, or reflect the amount of cocaine produced in a given year. Future study of cocaine seizures might instead incorporate data regarding the price of the chemicals required to transform coca leaves into cocaine base and precipitated cocaine crystals. If data regarding the price of these goods could be developed into a price index that could be readily applied to a model that analyzes seizures, this might significantly estimate how much cocaine is produced in a given time period in Colombia.

It is also not clear what the impact changes in income in the United States and productivity in Colombia have on cocaine seizures made by the DEA. A better measure of income in the United States might look at the median income of specific groups that report to use cocaine more frequently than other segments of society. A better measure of the economic standing of Colombian citizens would also be useful to this model. As this paper discussed previously low economic periods in Colombia are often associated with more corruption. A measure of Colombian income might be useful to understand whether or not individuals would feel motivated to participate in the illicit cocaine market.

The significance and the strength of the relationship between the real exchange rate of the Colombian peso and US dollar suggested in the regressions is interesting. While there is not enough information here to suggest that this variable could be used as a proxy for the price of cocaine, the relationship presented here deserves further exploration, and suggests that this exogenous variable might be useful to the DEA. The reason that the real exchange rate displays any type of relationship with cocaine seizures cannot be fully explained by the analysis in this paper. Fluctuations in the real exchange rate variable might be reflecting fluctuations in the strength of the Colombian economy, something this paper previously showed impacted the amount of coca and cocaine produced in Colombia. Though this would still suggest that this variable would be useful for the DEA in analyzing the trends of the cocaine industry, it would also suggest that this instrument may not be measuring fluctuations in the price of cocaine.

V. Conclusions

Empirical analysis of the model proposed in this paper is inconclusive given the weakness of the data the analysis is based on. Yet it is clear that there are strengths within the model proposed. Various variables in the model that are significant are also interesting for purposes of continuing the recent evaluation of the STRIDE database, and perhaps might shift the focus of this debate. It would seem that it might be valuable for the DEA to appreciate the intricacies of the illicit cocaine market, and devote more energy understanding which variables it should analyze so that allow it might recognize whether or not there will be more cocaine on the market. While the DEA may be unable to collect accurate information regarding the street price of cocaine, the agency will be able to continue to record how much cocaine it has seized throughout a year. Recognizing why this might be, and understanding the tools available that might indicate the general nature of the market should help the DEA accomplish its goal of understanding the trends of the market for cocaine itself.

The DEA might also consider developing a strategy for strengthening the Colombian economy, if their goal is to reduce the amount of cocaine available to US citizens. While the theoretical model employed in this paper has not been tested fully, these initial results strongly suggest that the economic situation of Colombia significantly effects how much cocaine will be on the market. Establishing a firm trade relationship and developing policies that support Colombian industries may have a much greater long term impact on the total amount of cocaine that is traded on the illicit market, then the DEA’s current practices.

Appendix

Key

ALCP=Price of alcohol
CSKGS=Cocaine seizures in kilograms
COLCOR=Columbian Corruption (Errors and Omissions as percentage of exports)
COLPRO=Colombian Productivity
DEAOBAP=DEA Operating Budget as Percentage of Budget of Department of Justice
OLE=Activity of other drug law enforcement agencies (DUI arrests per capita)
PCOC=Price of Cocaine (STRIDE Estimate)
PMETH=Price of Methamphetamine (STRIDE Estimate)
RX =Real Exchange Rate Columbian peso to US dollar
RF=Rainfall in Colombia
USCOR=Resources aimed at US Corruption (Operating budget of Office of Inspector General as percentage of Budget of Department of Justice)
USINC= US Median Income
COCIP=Cocaine initiate population estimate of US
T=Time

Means, Standard Deviations, Max, and Min of Selected Variables

Variable	Mean	Standard Deviation	Max	Min
ALCP	148.8367	34.69370342	210.18	90.8
COCIP	263657.4	61724.90024	415000	158750
COLCOR	0.032253	0.032016439	0.187836	0.000112
COLPRO	95.75152	18.61539948	145.8638	60.0993
CSKGS	13232.2	7577.094024	29577.75	399.2747
DEAOBAP	0.020341	0.003234539	0.029206	0.015243
OLE	0.004705	0.000521515	0.005682	0.003916
PCOC	224.8819	137.1932918	669.05	87.57
PMETH	261.2619	110.3787502	580.08	101.54
RF	3033.632	1150.057472	5565	661
RX	0.009428	0.001973025	0.012689	0.005634
USCOR	0.000419	0.000286104	0.000811	0
USINC	45192.15	2854.907547	50233	40182

Correlation Matrices

Correlation Matrix Annual Data

Covariance Analysis: Ordinary
Date: 04/26/09 Time: 22:44
Sample (adjusted): 1989 2007
Included observations: 19 after adjustments
Balanced sample (listwise missing value deletion)

Correlation	LALCP	LCOCIP	LCOLCOR	LCOLPRO	LCSKGS	LDEAOBAP	LOLE	LPCOC	LPMETH	LRF	LRX	LT	LUSCOR	LUSINC
LALCP	1.000000													
LCOCIP	0.326072	1.000000												
LCOLCOR	-0.382669	-0.458592	1.000000											
LCOLPRO	0.834354	0.076929	-0.303021	1.000000										
LCSKGS	0.319370	-0.067480	-0.104337	0.196832	1.000000									
LDEAOBAP	0.581897	-0.101292	-0.246032	0.541807	0.519878	1.000000								
LOLE	0.481497	0.554182	-0.363226	0.405733	-0.472843	-0.165331	1.000000							
LPCOC	-0.680176	-0.099723	0.227604	-0.764921	-0.075440	-0.660884	-0.209948	1.000000						
LPMETH	-0.619858	-0.337808	0.423757	-0.562871	-0.350735	-0.208423	-0.261394	0.336394	1.000000					
LRF	0.507485	0.415240	-0.225508	0.444898	0.130487	0.142789	0.540371	-0.222935	-0.358053	1.000000				
LRX	0.343762	0.203214	-0.151094	0.525563	-0.579149	0.010417	0.732978	-0.392073	-0.265321	0.452602	1.000000			
LT	0.991887	0.403325	-0.408374	0.823797	0.256047	0.514961	0.564205	-0.652543	-0.635364	0.564214	0.408455	1.000000		
LUSCOR	0.529614	-0.426500	-0.203532	0.535442	0.460707	0.680620	-0.240973	-0.491319	-0.254253	0.032284	-0.118539	0.438329	1.000000	
LUSINC	0.742289	0.726513	-0.481538	0.581302	0.061865	0.345257	0.645832	-0.500511	-0.457980	0.618539	0.471929	0.799190	-0.009792	1.000000

Correlation Matrix Quarterly Data

Covariance Analysis: Ordinary
Date: 04/26/09 Time: 22:44
Sample (adjusted): 1988Q4 2007Q4
Included observations: 77 after adjustments
Balanced sample (listwise missing value deletion)

Correlation	LALCP	LCOCIP	LCOLCOR	LCOLPRO	LCSKGS	LDEAOBAP	LOLE	LPCOC	LPMETH	LRF	LRX	LT	LUSCOR	LUSINC
LALCP	1.000000													
LCOCIP	0.279049	1.000000												
LCOLCOR	-0.256064	-0.107009	1.000000											
LCOLPRO	0.736181	-0.037774	-0.293602	1.000000										
LCSKGS	0.322154	-0.066889	-0.211460	0.282738	1.000000									
LDEAOBAP	0.563870	-0.065891	-0.201182	0.626561	0.485969	1.000000								
LOLE	0.485669	0.532975	-0.147330	0.227517	-0.471211	-0.120267	1.000000							
LPCOC	-0.685464	-0.103970	0.136136	-0.561759	-0.143190	-0.535851	-0.286444	1.000000						
LPMETH	-0.619623	-0.179809	0.082031	-0.392754	-0.247225	-0.304877	-0.292787	0.547148	1.000000					
LRF	0.122588	0.093306	-0.174715	0.276031	0.021633	0.037952	0.127705	-0.127564	-0.052758	1.000000				
LRX	-0.344157	-0.000359	-0.061791	-0.421734	0.426593	-0.104993	-0.602938	0.417162	0.298440	-0.170812	1.000000			
LT	0.990080	0.346651	-0.249329	0.711789	0.246041	0.501661	0.565444	-0.678042	-0.644871	0.140114	-0.404901	1.000000		
LUSCOR	0.533669	-0.406272	-0.241850	0.580422	0.482639	0.618814	-0.247325	-0.405260	-0.289874	-0.008711	0.066188	0.449040	1.000000	
LUSINC	0.747757	0.699133	-0.140102	0.446090	0.061734	0.339221	0.648447	-0.480764	-0.358207	0.162717	-0.366936	0.792866	0.025770	1.000000

Regressions in Table 2

Real exchange rate used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

Dependent Variable: CSKGS
Method: Least Squares
Date: 02/26/09 Time: 00:49
Sample (adjusted): 1981Q2 2007Q4
Included observations: 107 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	45363.30	26570.10	1.707306	0.0910
COCIP(-1)	-0.024932	0.011476	-2.172572	0.0323
COLCOR	-18542.27	11568.61	-1.602809	0.1123
COLPRO	-3.927001	50.13023	-0.078336	0.9377
DEAOBAP	-210182.8	157535.9	-1.334190	0.1853
OLE	-7202897.	1099049.	-6.553754	0.0000
RX	1024042.	244285.8	4.191983	0.0001
ALCP	-31.25162	190.6393	-0.163931	0.8701
RF	0.079698	0.287058	0.277636	0.7819
USCOR	-9169699.	4406021.	-2.081175	0.0401
USINC	-0.108247	0.415693	-0.260402	0.7951
T	313.8575	210.7522	1.489225	0.1397

R-squared	0.838365	Mean dependent var	13352.14
Adjusted R-squared	0.819649	S.D. dependent var	7509.050
S.E. of regression	3188.924	Akaike info criterion	19.07810
Sum squared resid	9.66E+08	Schwarz criterion	19.37786
Log likelihood	-1008.678	Hannan-Quinn criter.	19.19962
F-statistic	44.79483	Durbin-Watson stat	0.631056
Prob(F-statistic)	0.000000		

Real exchange rate used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

Dependent Variable: CSKGS
Method: Least Squares
Date: 03/04/09 Time: 00:42
Sample (adjusted): 1981Q2 2007Q4
Included observations: 107 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	40557.27	13224.41	3.066850	0.0028
COCIP(-1)	-0.024255	0.011417	-2.124355	0.0362
COLCOR	-19645.49	11435.08	-1.718002	0.0891
COLPRO	0.226856	50.32693	0.004508	0.9964
DEAOBAP	-231701.0	155072.7	-1.494144	0.1385
OLE	-7321551.	1061684.	-6.896166	0.0000

RX	1012539.	244316.2	4.144378	0.0001
PMETH	-2.682079	4.222225	-0.635229	0.5268
RF	0.074733	0.286287	0.261042	0.7946
USCOR	-9150983.	3586627.	-2.551418	0.0123
USINC	-0.019264	0.367926	-0.052358	0.9584
T	266.2711	47.98958	5.548519	0.0000

R-squared	0.839003	Mean dependent var	13352.14
Adjusted R-squared	0.820361	S.D. dependent var	7509.050
S.E. of regression	3182.623	Akaike info criterion	19.07415
Sum squared resid	9.62E+08	Schwarz criterion	19.37390
Log likelihood	-1008.467	Hannan-Quinn criter.	19.19566
F-statistic	45.00661	Durbin-Watson stat	0.629596
Prob(F-statistic)	0.000000		

Price estimate by DEA used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

Dependent Variable: CSKGS
Method: Least Squares
Date: 03/04/09 Time: 00:42
Sample (adjusted): 1981Q2 2007Q4
Included observations: 107 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	40012.12	16406.96	2.438728	0.0166
COCIP(-1)	-0.037853	0.014333	-2.640933	0.0097
COLCOR	-29316.58	12194.97	-2.403989	0.0182
COLPRO	-47.09984	53.18545	-0.885578	0.3781
DEAOBAP	-289132.6	167618.6	-1.724943	0.0878
OLE	-9230058.	1039855.	-8.876294	0.0000
PCOC	-3.828785	7.884766	-0.485593	0.6284
PMETH	-3.004859	4.913548	-0.611546	0.5423
RF	0.010815	0.310643	0.034813	0.9723
USCOR	-7583253.	3872193.	-1.958387	0.0531
USINC	0.660268	0.406869	1.622802	0.1079
T	238.0319	51.69078	4.604920	0.0000

R-squared	0.810366	Mean dependent var	13352.14
Adjusted R-squared	0.788408	S.D. dependent var	7509.050
S.E. of regression	3454.099	Akaike info criterion	19.23786
Sum squared resid	1.13E+09	Schwarz criterion	19.53761
Log likelihood	-1017.225	Hannan-Quinn criter.	19.35938
F-statistic	36.90580	Durbin-Watson stat	0.562712
Prob(F-statistic)	0.000000		

Price estimate by DEA used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

Dependent Variable: CSKGS
Method: Least Squares
Date: 03/04/09 Time: 00:43
Sample (adjusted): 1981Q2 2007Q4
Included observations: 107 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	41741.23	28989.07	1.439895	0.1532
COCIP(-1)	-0.037082	0.014315	-2.590543	0.0111
COLCOR	-28930.92	12411.17	-2.331039	0.0219
COLPRO	-51.03582	52.97246	-0.963441	0.3378
DEAOBAP	-275518.5	170798.9	-1.613116	0.1100
OLE	-9160678.	1075507.	-8.517548	0.0000
PCOC	-5.640076	7.424707	-0.759636	0.4494
ALCP	8.783880	208.9348	0.042041	0.9666
RF	0.015253	0.311581	0.048952	0.9611
USCOR	-8166926.	4780182.	-1.708497	0.0908
USINC	0.574296	0.427406	1.343679	0.1823
T	242.6895	231.2380	1.049523	0.2966

R-squared	0.809623	Mean dependent var	13352.14
Adjusted R-squared	0.787579	S.D. dependent var	7509.050
S.E. of regression	3460.859	Akaike info criterion	19.24177
Sum squared resid	1.14E+09	Schwarz criterion	19.54152
Log likelihood	-1017.435	Hannan-Quinn criter.	19.36329
F-statistic	36.72806	Durbin-Watson stat	0.558705
Prob(F-statistic)	0.000000		

Regressions in Table 3

Real exchange rate used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

Dependent Variable: LCSKGS
Method: Least Squares
Date: 03/04/09 Time: 01:05
Sample (adjusted): 1988Q4 2007Q4
Included observations: 77 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	-24.49244	17.07991	-1.433991	0.1563
LCOCIP(-1)	0.000459	0.285612	0.001607	0.9987
LCOLCOR	-0.037238	0.017805	-2.091407	0.0403
LDEAOBAP	0.058649	0.344616	0.170186	0.8654
LOLE	-2.641049	0.426439	-6.193265	0.0000
LRX	0.549435	0.296200	1.854947	0.0681

LALCP	4.109932	1.934248	2.124821	0.0374
LRF	0.027140	0.054871	0.494613	0.6225
LUSCOR	-0.571990	0.231904	-2.466493	0.0162
LUSINC	0.027495	1.413885	0.019447	0.9845
LT	-0.748739	0.833031	-0.898814	0.3720

R-squared	0.720468	Mean dependent var	9.636644
Adjusted R-squared	0.678115	S.D. dependent var	0.370900
S.E. of regression	0.210430	Akaike info criterion	-0.147767
Sum squared resid	2.922522	Schwarz criterion	0.187062
Log likelihood	16.68904	Hannan-Quinn criter.	-0.013838
F-statistic	17.01092	Durbin-Watson stat	0.606241
Prob(F-statistic)	0.000000		

Real exchange rate used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

Dependent Variable: LCSKGS
Method: Least Squares
Date: 03/04/09 Time: 01:06
Sample (adjusted): 1988Q4 2007Q4
Included observations: 77 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.329762	15.06949	-0.552757	0.5823
LCOCIP(-1)	-0.098287	0.298465	-0.329309	0.7430
LCOLCOR	-0.033916	0.018175	-1.866129	0.0665
LDEAOBAP	0.282829	0.333505	0.848051	0.3995
LOLE	-2.568508	0.442501	-5.804532	0.0000
LRX	0.803783	0.290537	2.766544	0.0073
LPMETH	-0.096546	0.095486	-1.011103	0.3157
LRF	0.028019	0.056329	0.497428	0.6205
LUSCOR	-0.372275	0.231333	-1.609261	0.1123
LUSINC	0.390712	1.596812	0.244683	0.8075
LT	0.818834	0.249878	3.276939	0.0017

R-squared	0.705902	Mean dependent var	9.636644
Adjusted R-squared	0.661342	S.D. dependent var	0.370900
S.E. of regression	0.215843	Akaike info criterion	-0.096970
Sum squared resid	3.074814	Schwarz criterion	0.237860
Log likelihood	14.73333	Hannan-Quinn criter.	0.036959
F-statistic	15.84149	Durbin-Watson stat	0.580333
Prob(F-statistic)	0.000000		

Price estimate by DEA used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

Dependent Variable: LCSKGS

Method: Least Squares
Date: 03/04/09 Time: 01:03
Sample (adjusted): 1988Q4 2007Q4
Included observations: 77 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	-10.50381	15.39736	-0.682182	0.4975
LCOCIP(-1)	0.324160	0.253039	1.281068	0.2047
LCOLCOR	-0.042402	0.018166	-2.334113	0.0226
LDEAOBAP	0.357149	0.349713	1.021263	0.3109
LOLE	-3.081873	0.404077	-7.626953	0.0000
LPCOC	0.316985	0.149857	2.115257	0.0382
LPMETH	-0.093600	0.098130	-0.953842	0.3436
LRF	0.007405	0.056661	0.130686	0.8964
LUSCOR	-0.237573	0.230632	-1.030093	0.3067
LUSINC	-0.549079	1.593886	-0.344491	0.7316
LT	0.921713	0.259330	3.554207	0.0007

R-squared	0.692634	Mean dependent var	9.636644
Adjusted R-squared	0.646063	S.D. dependent var	0.370900
S.E. of regression	0.220658	Akaike info criterion	-0.052843
Sum squared resid	3.213535	Schwarz criterion	0.281987
Log likelihood	13.03444	Hannan-Quinn criter.	0.081086
F-statistic	14.87274	Durbin-Watson stat	0.696590
Prob(F-statistic)	0.000000		

Price estimate by DEA used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

Dependent Variable: LCSKGS
Method: Least Squares
Date: 03/04/09 Time: 01:04
Sample (adjusted): 1988Q4 2007Q4
Included observations: 77 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	-30.74121	16.48541	-1.864753	0.0667
LCOCIP(-1)	0.264557	0.240567	1.099725	0.2754
LCOLCOR	-0.042916	0.017212	-2.493366	0.0152
LDEAOBAP	0.089896	0.347204	0.258913	0.7965
LOLE	-2.954145	0.387236	-7.628796	0.0000
LPCOC	0.270703	0.140227	1.930463	0.0578
LALCP	5.120115	1.824510	2.806296	0.0066
LRF	0.017020	0.054049	0.314905	0.7538
LUSCOR	-0.531774	0.229486	-2.317235	0.0236
LUSINC	-0.520107	1.406282	-0.369846	0.7127
LT	-1.074044	0.787722	-1.363481	0.1774

R-squared	0.721614	Mean dependent var	9.636644
Adjusted R-squared	0.679435	S.D. dependent var	0.370900
S.E. of regression	0.209998	Akaike info criterion	-0.151875
Sum squared resid	2.910540	Schwarz criterion	0.182954
Log likelihood	16.84720	Hannan-Quinn criter.	-0.017947
F-statistic	17.10811	Durbin-Watson stat	0.749503
Prob(F-statistic)	0.000000		

Regressions in Table 4

Price estimate by DEA used for price of cocaine estimate

Dependent Variable: LCSKGS
Method: Least Squares
Date: 03/04/09 Time: 00:56
Sample (adjusted): 1988Q4 2007Q4
Included observations: 77 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	-52.36618	18.16588	-2.882666	0.0053
LCOCIP(-1)	0.135418	0.237769	0.569537	0.5710
LCOLCOR	-0.048556	0.016749	-2.898986	0.0051
LDEAOBAP	-0.049222	0.339431	-0.145013	0.8851
LOLE	-2.794122	0.378903	-7.374247	0.0000
LPCOC	0.333221	0.137541	2.422699	0.0182
LPMETH	-0.242663	0.098782	-2.456551	0.0167
LALCP	7.072279	1.929874	3.664632	0.0005
LRF	0.025051	0.052201	0.479892	0.6329
LUSCOR	-0.484500	0.222040	-2.182041	0.0327
LUSINC	1.318294	1.548392	0.851396	0.3977
LT	-2.250137	0.897628	-2.506758	0.0147

R-squared	0.745264	Mean dependent var	9.636644
Adjusted R-squared	0.702155	S.D. dependent var	0.370900
S.E. of regression	0.202419	Akaike info criterion	-0.214682
Sum squared resid	2.663279	Schwarz criterion	0.150587
Log likelihood	20.26525	Hannan-Quinn criter.	-0.068578
F-statistic	17.28784	Durbin-Watson stat	0.845197
Prob(F-statistic)	0.000000		

Real exchange rate used for price of cocaine estimate

Dependent Variable: LCSKGS
Method: Least Squares
Date: 03/04/09 Time: 00:56
Sample (adjusted): 1988Q4 2007Q4
Included observations: 77 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	-42.78505	18.87829	-2.266363	0.0268
LCOCIP(-1)	-0.112169	0.284078	-0.394854	0.6942
LCOLCOR	-0.042299	0.017552	-2.409930	0.0188
LDEAOBAP	-0.088382	0.343840	-0.257044	0.7980
LOLE	-2.500189	0.421810	-5.927284	0.0000
LRX	0.565482	0.289235	1.955095	0.0549
LPMETH	-0.203556	0.098545	-2.065616	0.0429
LALCP	5.746443	2.047571	2.806468	0.0066
LRF	0.032873	0.053633	0.612917	0.5421
LUSCOR	-0.530541	0.227257	-2.334540	0.0227
LUSINC	1.624398	1.581915	1.026856	0.3083
LT	-1.759914	0.949131	-1.854238	0.0682

R-squared	0.737687	Mean dependent var	9.636644
Adjusted R-squared	0.693296	S.D. dependent var	0.370900
S.E. of regression	0.205408	Akaike info criterion	-0.185371
Sum squared resid	2.742497	Schwarz criterion	0.179897
Log likelihood	19.13679	Hannan-Quinn criter.	-0.039267
F-statistic	16.61779	Durbin-Watson stat	0.634734
Prob(F-statistic)	0.000000		

Regression in Table 5-a

First stage of Hausman Test—Two Stage Least Squares

Date: 04/25/09 Time: 17:18

Sample (adjusted): 1988Q4 2007Q4

Included observations: 77 after adjustments

Instrument list: LRX LCOCIP(-1) LCOLCOR LCOLPRO LDEAOBAP LOLE LPMETH LALCP LRF LUSCOR LUSINC LT

	Coefficient	Std. Error	t-Statistic	Prob.
C	-49.4934	19.31938	-2.56185286	0.012739
LCOCIP(-1)	0.165007	0.252726	0.65290852	0.516118
LCOLCOR	-0.05158	0.017486	-2.94975191	0.004417
LCOLPRO	-0.13367	0.378239	-0.35339512	0.724936
LDEAOBAP	-0.20013	0.359762	-0.55627521	0.579933
LOLE	-2.84488	0.394848	-7.20500855	7.53E-10
LPMETH	-0.19183	0.102952	-1.86325942	0.066945
LALCP	6.871058	2.017237	3.40617303	0.001134
LRF	0.020846	0.057421	0.36303114	0.71776
LUSCOR	-0.46786	0.231811	-2.01829817	0.047691
LUSINC	1.224158	1.618806	0.75621039	0.452255
LT	-2.22478	0.950205	-2.34137189	0.02229

R-squared	0.722794	Mean dependent var	9.636644
Adjusted R-squared	0.675882	S.D. dependent var	0.3709
S.E. of regression	0.211158	Sum squared resid	2.898204
F-statistic	15.40753	Durbin-Watson stat	0.639879
Prob(F-statistic)	3.32E-14	Second-Stage SSR	2.898204

Regression in Table 5-b

Second stage of Hausman Test—Regress instruments against residuals from first stage

Date: 04/25/09 Time: 17:20

Sample (adjusted): 1988Q4 2007Q4

Included observations: 77 after adjustments

	Coefficient	Std. Error	t-Statistic	Prob.
C	5.857343	19.16061	0.305697076	0.760827
LCOCIP(-1)	-0.27809	0.286025	-0.97225338	0.334585
LCOLCOR	0.010368	0.01794	0.57792271	0.565344
LCOLPRO	0.272883	0.396248	0.688667946	0.493521
LDEAOBAP	0.084111	0.355005	0.236927827	0.81347
LOLE	0.371638	0.431553	0.861163226	0.392363
LRX	0.604328	0.311489	1.940124828	0.056773
LPMETH	-0.01891	0.101301	-0.18669469	0.852491
LALCP	-1.15264	2.063061	-0.55870154	0.578315
LRF	0.006387	0.056334	0.113381689	0.910083
LUSCOR	-0.07069	0.22994	-0.30743565	0.75951
LUSINC	0.465554	1.603504	0.290335615	0.772498
LT	0.441083	0.957992	0.46042432	0.646772

R-squared	0.055547	Mean dependent var	-1.26E-14
Adjusted R-squared	-0.12154	S.D. dependent var	0.19528
S.E. of regression	0.206807	Akaike info criterion	-0.16132
Sum squared resid	2.737218	Schwarz criterion	0.234383
Log likelihood	19.21098	Hannan-Quinn criter.	-0.00304
F-statistic	0.313674	Durbin-Watson stat	0.64638
Prob(F-statistic)	0.984545		

Regressions in Table 6

Real exchange rate used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

Dependent Variable: LCSKGS			

Method: Least Squares				
Date: 04/20/09 Time: 19:09				
Sample (adjusted): 1989 2007				
Included observations: 19 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
C	0.29755148	56.41863	0.005273994	0.995939
LCOCIP(-1)	0.18149818	0.650275	0.279110025	0.788227
LCOLCOR	-0.0724091	0.058029	-1.24780686	0.252223
LCOLPRO	1.09884382	0.966767	1.136617207	0.293107
LDEAOBAP	0.57759568	0.887201	0.651031308	0.535805
LOLE	-1.8444711	1.120272	-1.64644979	0.143665
LRX	-1.530276	0.835767	-1.83098454	0.109787
LALCP	4.74201988	8.012653	0.59181649	0.572583
LRF	1.55291254	0.686248	2.26290192	0.058082
LUSCOR	-0.9628254	0.581789	-1.65493869	0.141911
LUSINC	-3.6512065	4.028397	-0.906367	0.394869
LT	-1.3366859	3.587925	-0.37255128	0.720506
R-squared	0.88976155	Mean dependent var		11.02301
Adjusted R-squared	0.7165297	S.D. dependent var		0.381063
S.E. of regression	0.20288516	Akaike info criterion		-0.08772
Sum squared resid	0.28813673	Schwarz criterion		0.508764
Log likelihood	12.8333798	Hannan-Quinn criter.		0.013225
F-statistic	5.13624693	Durbin-Watson stat		2.485824
Prob(F-statistic)	0.01975078			

Real exchange rate used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

Dependent Variable: LCSKGS				
Method: Least Squares				
Date: 04/20/09 Time: 19:09				
Sample (adjusted): 1989 2007				
Included observations: 19 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
C	44.569663	30.27859	1.471986179	0.184502
LCOCIP(-1)	0.6946068	0.608499	1.141507807	0.2912

LCOLCOR	0.0108948	0.054905	0.198430561	0.848348
LCOLPRO	1.3768813	0.794081	1.733929474	0.126524
LDEAOBAP	1.771619	0.8119	2.182064572	0.065441
LOLE	0.2399042	1.390238	0.172563492	0.867878
LRX	-2.09516	0.623831	-3.358536485	0.012109
LPMETH	-0.492251	0.254285	-1.935823723	0.094112
LRF	1.4505166	0.493061	2.941859882	0.021656
LUSCOR	-0.263262	0.507065	-0.519187279	0.619637
LUSINC	-4.265023	3.321713	-1.283983026	0.24001
LT	-0.255595	0.689165	-0.370875694	0.721699
R-squared	0.924607	Mean dependent var		11.02301
Adjusted R-squared	0.8061323	S.D. dependent var		0.381063
S.E. of regression	0.1677835	Akaike info criterion		-0.46766
Sum squared resid	0.1970591	Schwarz criterion		0.128832
Log likelihood	16.442727	Hannan-Quinn criter.		-0.36671
F-statistic	7.8042554	Durbin-Watson stat		2.809379
Prob(F-statistic)	0.0059467			

Price estimate by DEA used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

Dependent Variable: LCSKGS				
Method: Least Squares				
Date: 04/20/09 Time: 19:09				
Sample (adjusted): 1989 2007				
Included observations: 19 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
C	25.68325	50.130272	0.512330144	0.624185
LCOCIP(-1)	0.600078	0.9802652	0.612158483	0.559784
LCOLCOR	-0.06392	0.0747093	-0.85562089	0.420527
LCOLPRO	0.653565	1.1168773	0.585171252	0.576801
LDEAOBAP	1.238637	1.1778454	1.05161264	0.32792
LOLE	-2.75847	1.8957977	-1.45504248	0.188987
LPCOC	0.674549	0.5615393	1.201249819	0.268717
LPMETH	-0.12191	0.3799011	-0.32089272	0.75766
LRF	1.15714	0.8060528	1.435563176	0.194265
LUSCOR	-0.55202	0.7612663	-0.72512877	0.491896
LUSINC	-5.36136	5.0736445	-1.05670854	0.325743
LT	1.000285	0.9594161	1.042597843	0.331798

R-squared	0.836768	Mean dependent var	11.02301
Adjusted R-squared	0.580261	S.D. dependent var	0.381063
S.E. of regression	0.24688	Akaike info criterion	0.304802
Sum squared resid	0.426649	Schwarz criterion	0.901289
Log likelihood	9.104385	Hannan-Quinn criter.	0.405751
F-statistic	3.262163	Durbin-Watson stat	1.770669
Prob(F-statistic)	0.063729		

Price estimate by DEA used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

Dependent Variable: LCSKGS				
Method: Least Squares				
Date: 04/20/09 Time: 19:10				
Sample (adjusted): 1989 2007				
Included observations: 19 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
C	-57.533901	57.59835	-0.998881021	0.351122
LCOCIP(-1)	0.32882153	0.635792	0.517183854	0.620964
LCOLCOR	-0.1062277	0.053539	-1.984115888	0.087648
LCOLPRO	0.83928974	0.934965	0.897669311	0.399183
LDEAOBAP	0.39461065	0.887567	0.444598056	0.670032
LOLE	-2.9783828	1.039572	-2.865007309	0.024164
LPCOC	0.76602431	0.447924	1.710166971	0.130978
LALCP	12.5143037	7.127409	1.755799901	0.122551
LRF	1.55159919	0.705016	2.200801471	0.063656
LUSCOR	-1.1717517	0.58823	-1.991994453	0.086636
LUSINC	-2.9566078	4.254742	-0.694896991	0.509521
LT	-4.4613167	3.285918	-1.35770788	0.216697
R-squared	0.88500939	Mean dependent var		11.02301
Adjusted R-squared	0.70430985	S.D. dependent var		0.381063
S.E. of regression	0.20721202	Akaike info criterion		-0.04552
Sum squared resid	0.30055774	Schwarz criterion		0.550968
Log likelihood	12.4324344	Hannan-Quinn criter.		0.05543
F-statistic	4.89768483	Durbin-Watson stat		1.815726
Prob(F-statistic)	0.02248924			

Regressions in Table 7

Price estimate by DEA used for price of cocaine estimate

Dependent Variable: LCSKGS				
Method: Least Squares				
Date: 04/20/09 Time: 19:10				
Sample (adjusted): 1989 2007				
Included observations: 19 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.
C	-49.834197	61.19894	-0.814298417	0.44658
LCOCIP(-1)	0.6895113	0.859616	0.802115109	0.453076
LCOLCOR	-0.0827125	0.066257	-1.248366509	0.258401
LCOLPRO	0.7744685	0.980104	0.790190163	0.459499
LDEAOBAP	0.745815	1.068008	0.698323228	0.511119
LOLE	-2.1160273	1.698803	-1.245599178	0.259346
LPCOC	0.6651196	0.491604	1.352957791	0.224823
LALCP	13.351548	7.541486	1.770413411	0.127051
LPMETH	-0.2224718	0.337384	-0.659402294	0.534113
LRF	1.7016894	0.769749	2.210708176	0.069076
LUSCOR	-0.9459845	0.702589	-1.346426175	0.2268
LUSINC	-3.6174499	4.549421	-0.795145124	0.456822
LT	-5.272006	3.641032	-1.447942925	0.197793
R-squared	0.8927795	Mean dependent var		11.02301
Adjusted R-squared	0.6783385	S.D. dependent var		0.381063
S.E. of regression	0.2161205	Akaike info criterion		-0.01022
Sum squared resid	0.2802485	Schwarz criterion		0.635976
Log likelihood	13.097083	Hannan-Quinn criter.		0.099143
F-statistic	4.1632874	Durbin-Watson stat		1.770819
Prob(F-statistic)	0.0456282			

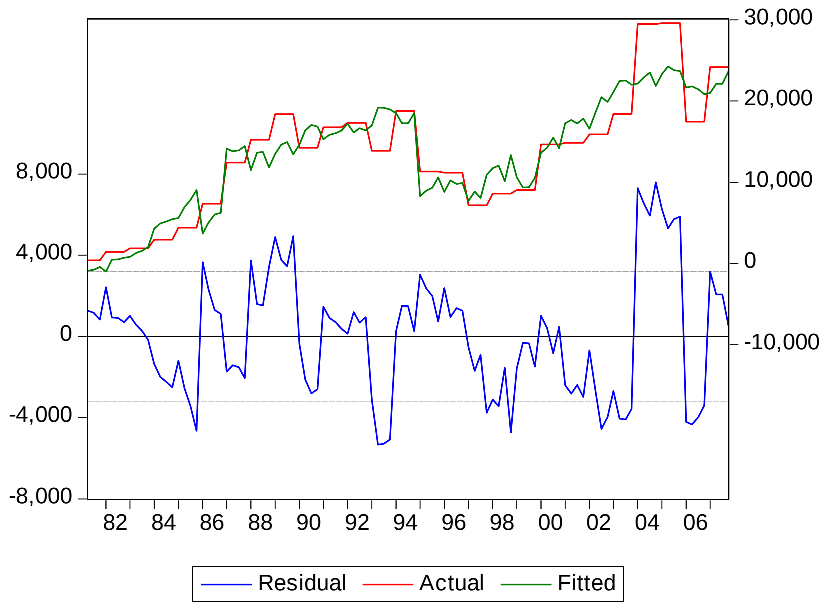
Real exchange rate used for price of cocaine estimate

Dependent Variable: LCSKGS				
Method: Least Squares				
Date: 04/20/09 Time: 19:10				
Sample (adjusted): 1989 2007				
Included observations: 19 after adjustments				
	Coefficient	Std. Error	t-Statistic	Prob.

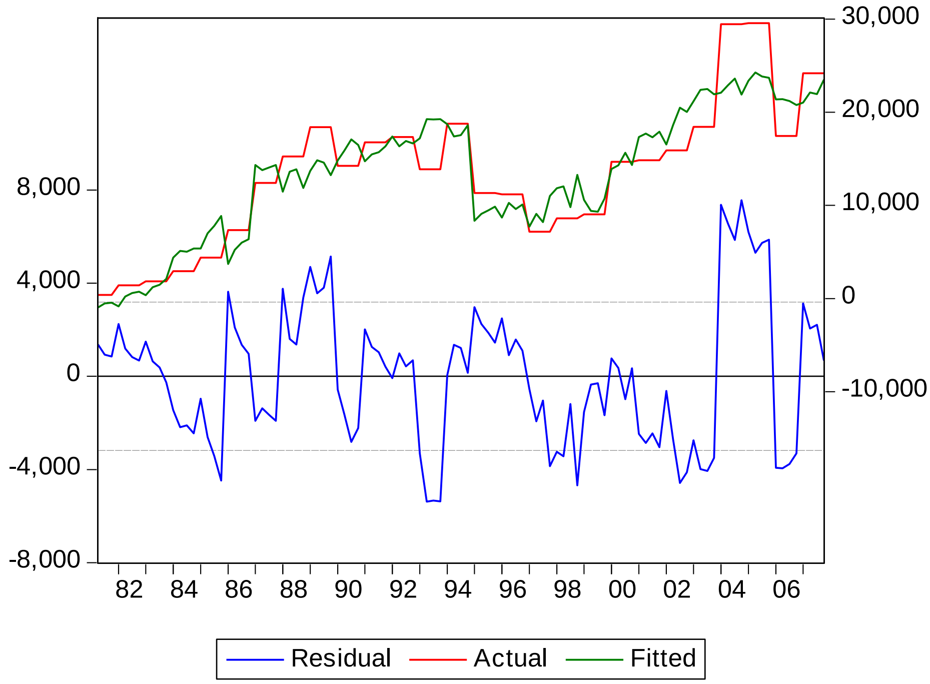
C	15.0105266	48.55316	0.309156557	0.767657
LCOCIP(-1)	0.78439054	0.635466	1.234354942	0.263219
LCOLCOR	-0.0058774	0.060255	-0.097543515	0.925472
LCOLPRO	1.27257629	0.826537	1.539648073	0.174573
LDEAOBAP	1.5107664	0.896815	1.684591276	0.14305
LOLE	0.20423245	1.429329	0.142886975	0.891057
LRX	-1.8240426	0.726517	-2.510667375	0.045862
LPMETH	-0.5027829	0.261643	-1.921636885	0.103032
LALCP	5.40702079	6.8181	0.793039289	0.457958
LRF	1.68601994	0.587287	2.870863734	0.028395
LUSCOR	-0.4367836	0.565141	-0.772875373	0.468939
LUSINC	-4.010251	3.428507	-1.169678431	0.286487
LT	-2.6711311	3.127169	-0.854169238	0.425795
R-squared	0.93175983	Mean dependent var		11.02301
Adjusted R-squared	0.79527949	S.D. dependent var		0.381063
S.E. of regression	0.17241585	Akaike info criterion		-0.46207
Sum squared resid	0.17836335	Schwarz criterion		0.184122
Log likelihood	17.3896971	Hannan-Quinn criter.		-0.35271
F-statistic	6.82706268	Durbin-Watson stat		2.656627
Prob(F-statistic)	0.01371132			

Plot of Residuals Table 2

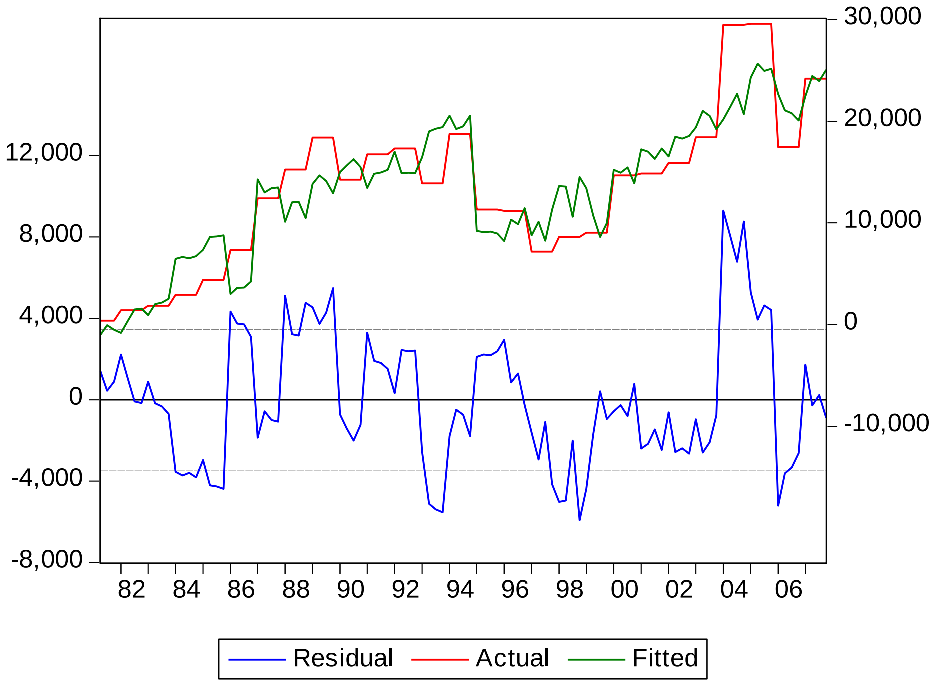
Real exchange rate used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute



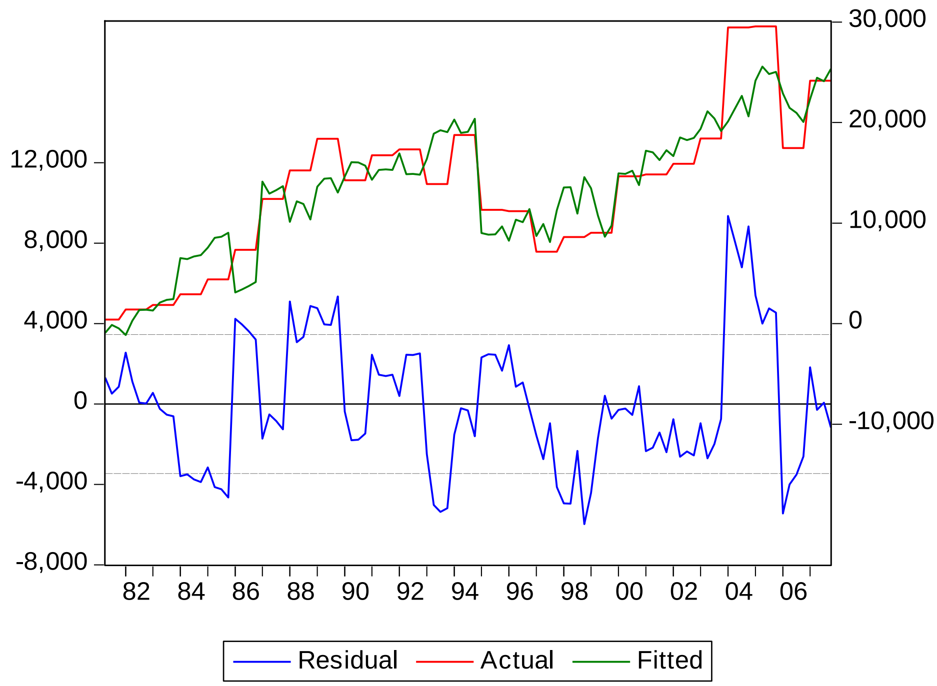
Real exchange rate used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute



Price estimate by DEA used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

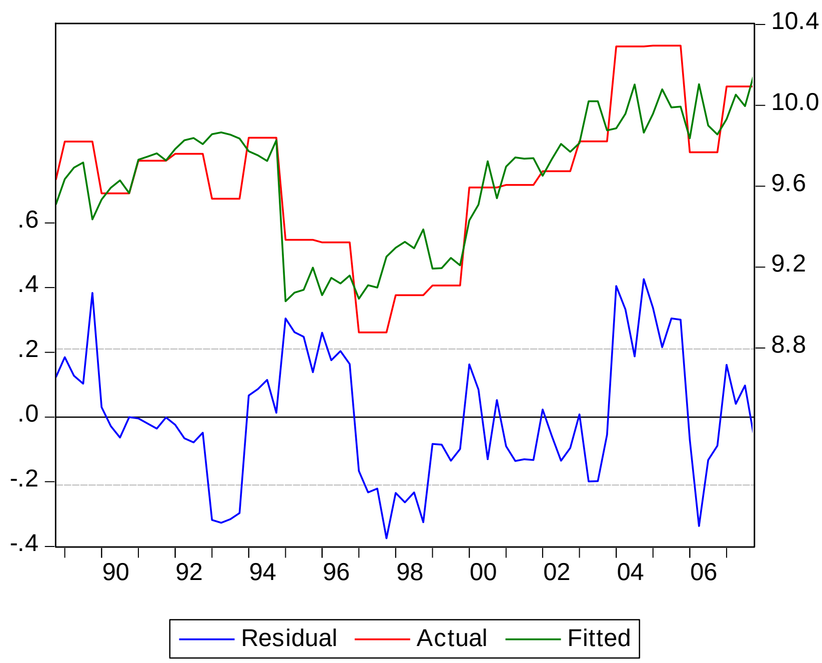


Price estimate by DEA used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

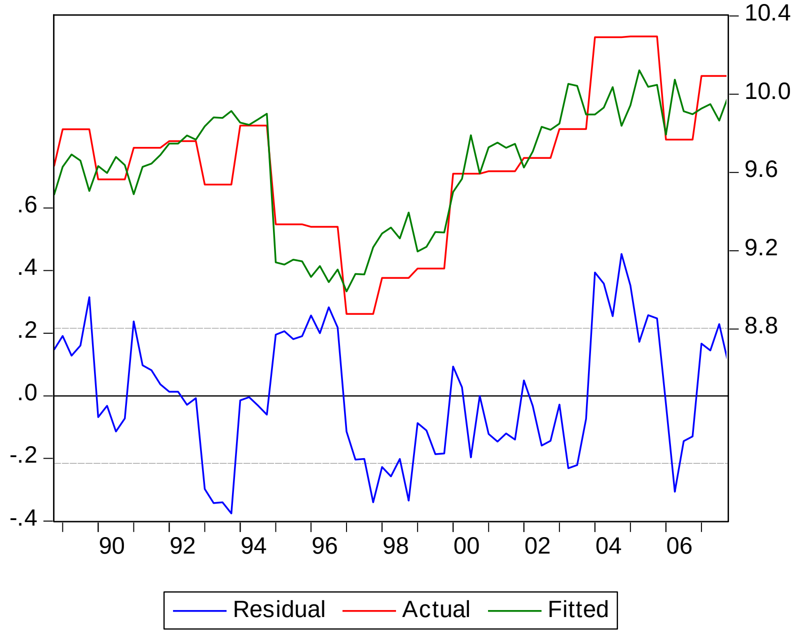


Plot of Residuals Table 3

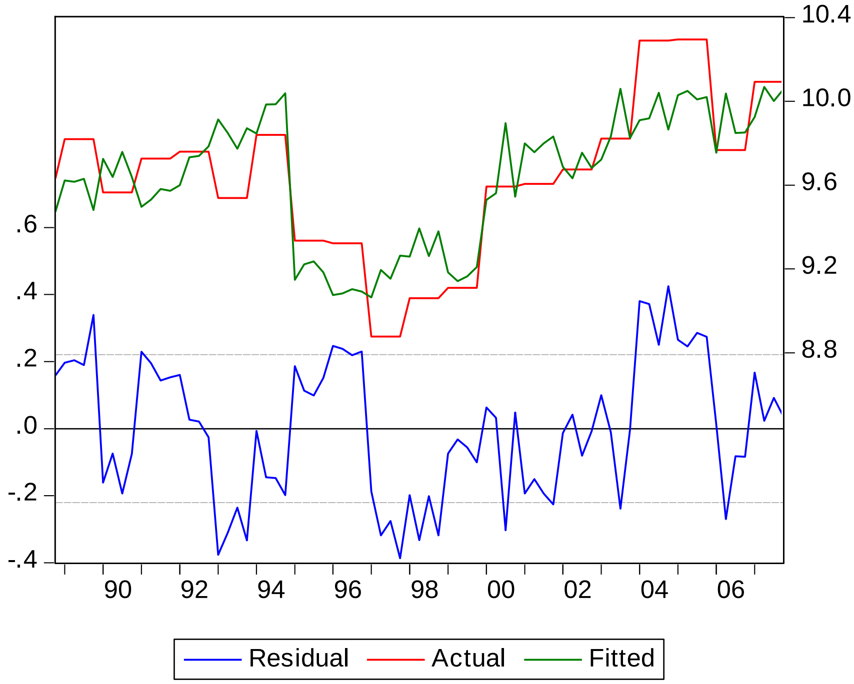
Real exchange rate used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute



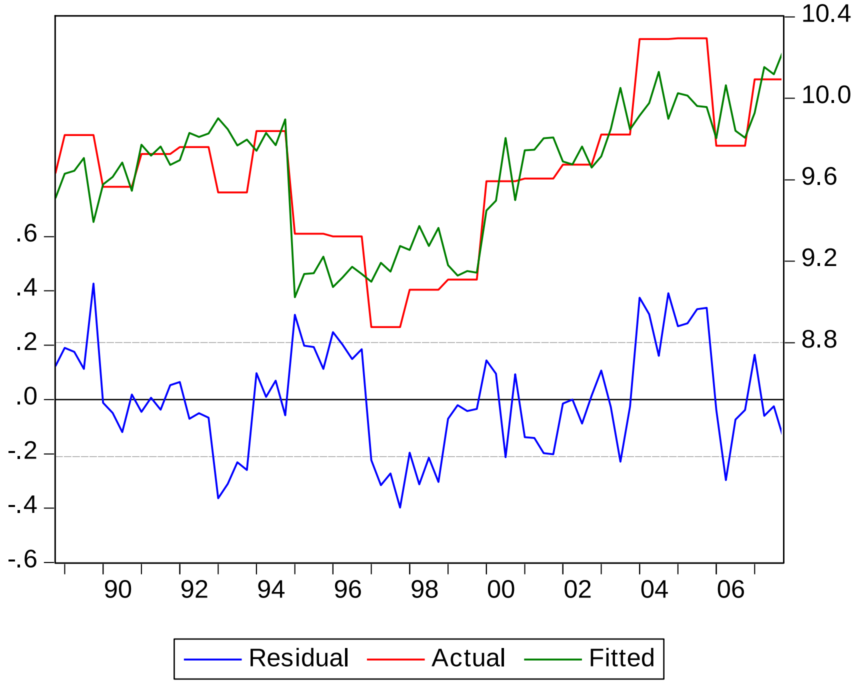
Real exchange rate used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute



Price estimate by DEA used for price of cocaine estimate—Price estimate of methamphetamine used for price of cocaine substitute

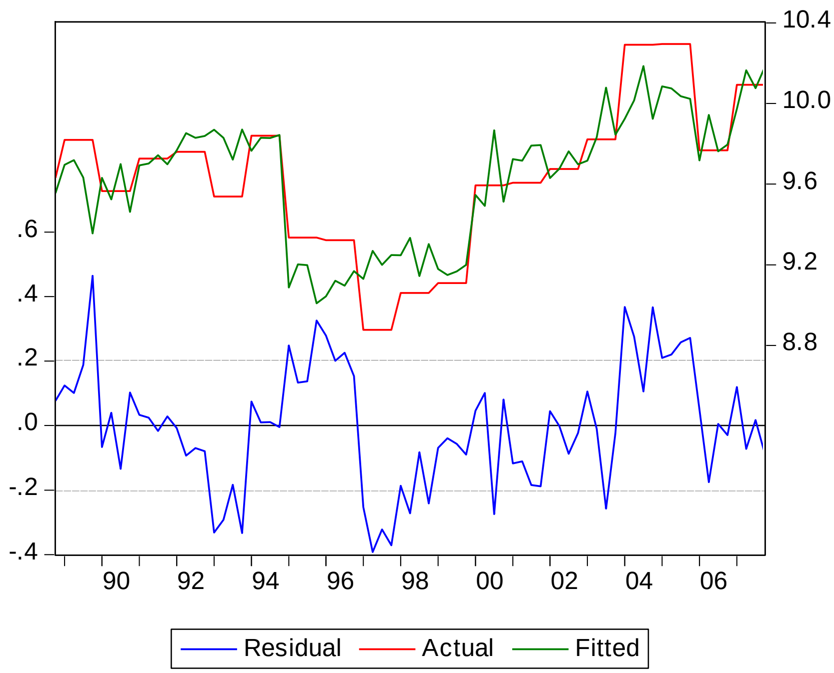


Price estimate by DEA used for price of cocaine estimate—Price of alcohol used for price of cocaine substitute

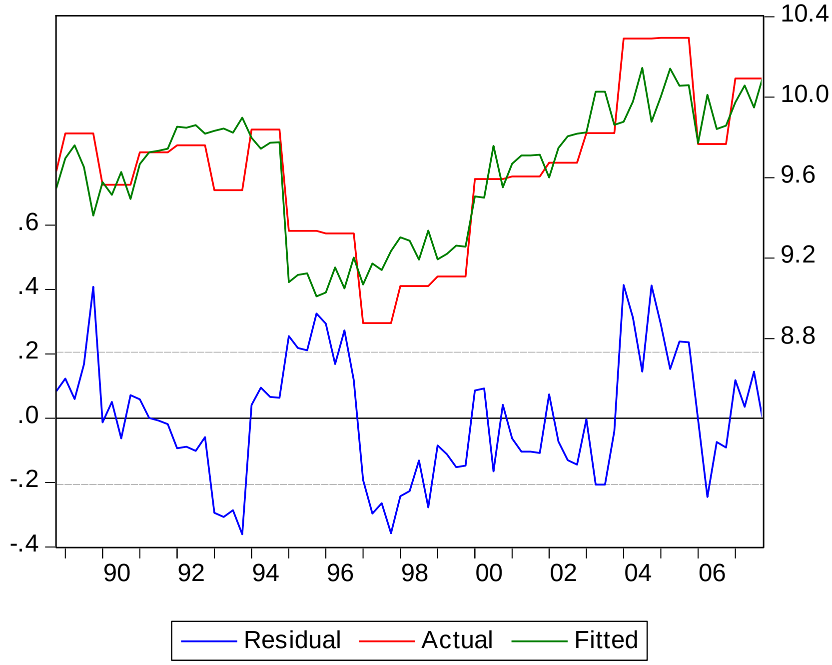


Plot of Residuals Table 4

Price estimate by DEA used for price of cocaine estimate



Real exchange rate used for price of cocaine estimate



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