Hard Drugs Addiction, Drug Violations and Property Crimes in the US

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Motivation

• Drugs and Crime are two important phenomena in the US.

• They involve many people: 1.5 million inmates, 85% are males, age 16-45. Lifetime prevalence rates of hard drugs use is 20% for the male general population, 60% for inmates.

• They involve high economic costs; criminal justice expenditure: 167 Billions.
Some Definitions

• **Hard Drugs**: Cocaine, Crack and Heroin.

• **Drug Violations**: Drug Possession, Drug Selling and Manufacturing.

• **Property Crimes**: Burglary, Larceny Theft, Motor Vehicle Theft and Robbery.
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• How much of the US Property Crime Rate is accounted for by predatory crime to finance Hard Drugs Addiction?

• By how much could treatment of hard drugs abusers reduce the Property Crime Rate?

• What would be the effects of a legalization policy?
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• What would be the effects of a legalization policy?
Approach

• Use a dynamic equilibrium model of rational drug addiction, drug selling and property crime decisions as a measurement tool.

• Perform counterfactuals to assess the effects of:
  – An ideal drug treatment scheme
  – Hard drugs legalization.
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Why a Model?

• To perform counterfactuals and ex-ante policy experiments.

• It is a feasible selection mechanism, i.e. it allows to exploit information on different populations (both non-institutionalized and inmates).

• To pin down variables which are not currently available in the data, i.e. the response of drug consumption to changes in prices and the value of drug selling.
Related Literature - 1

Crime


• Crime and **Drug Abuse**: Benson et al. (AE 1992), Corman and Mocan (AER 2000), Grogger and Willis (REcSt 2000).
Related Literature - 2

Addiction


- “**Harmful**” Addiction: Bernheim and Rangel (AER 2004), Gul and Pesendorfer (REStud 2006).
Main Results

• **Hard Drugs** account for 26% of the observed property crime rate. This number is a measure of the negative *externalities* induced by hard drugs.

• Effective rehab procedures would reduce crime by 11%.

• A change in the current public policy, from prohibition to legalization, would lead to a drop of 18% in the property crime rate.
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The Model - 1

• **OLG** model with heterogeneous agents.

• Two goods: a numeraire \((c)\) and hard drugs \((d)\) with price \(p_d\). There is no storage.

• \(c\) is produced with a 1-to-1 technology by competitive firms that use only labor as input.

• \(d\) is imported by international drug dealers, bought at cost \(p^m_d\) by “street-level” competitive dealers, and resold in the domestic market at price \(p_d\).
The Model - 2

- Addiction is rational, Becker-Murphy (JPE 1988).

- Habit formation \((h)\) in the addictive good \((d)\), with

\[ h' = f(h,d) = (1-\lambda)h + d; \; 0 < \lambda < 1. \]

- Per period utility function is:

\[ u(c,d,h,\varepsilon) = \alpha_{cc}c^2 + \alpha_c c + \alpha_{dd}d^2 + (\alpha_d + \varepsilon)d + \alpha_{dh}dh. \]
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The Model - 3

• Agents every period face two **uninsurable** shocks:

  1) a **stochastic employment** opportunity, \( \pi(h,.) \) affected by the stock of habits.

  2) a **“taste”** shock, \( \varepsilon \) affects marginal utility of hard drugs.

• For simplicity assume all agents buy an anti theft **insurance** at price \( p_I \) and the sector is perfectly competitive.
The Model - 4

• After having observed the shocks, the agents simultaneously decide on:

1) **Consumption** of the two goods ($d$ is illegal).

2) **Property Crimes** (steal a constant fraction $\eta$ of the average labour income $\bar{y}$ per crime).

3) **Drug Selling** (revenues are $p_d - p_d^m$ per unit sold).
The Model - 5

- **Heterogeneity:**

  **Ex-ante:** Age, $i=\{1,\ldots,I\}$;
  Education, $ed=\{hsd, hs, col\}$,
  i.e. different efficiency units $\omega_{i,ed}$;

  **Ex-post:** Employment status, $s=\{e,u\}$, $\pi(h,i,ed)$;
  Taste shock, $\varepsilon \sim N(0,\sigma^2_\varepsilon)$;
  Drug habits $h=[h, \ ]$. 
The Model - 5

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The Model - 6

**Government:**

- Provides the apprehension technologies: with probability \( \pi^a_{cr} (cr) = \pi^a_{cr} cr \), \((cr=pc,ds,d)\) a criminal is detected and immediately incarcerated. Inmates consume \( c_a \), paid by all households with a proportional tax \( \tau_j \).

- Runs the unemployment insurance benefits scheme (proportional tax \( \tau_U \) on the labour income of the employed workers, subsidy to the unemployed at the replacement rate \( \phi \)).
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Recursive Representation - 1

\[ V_{i,ed}(h, s, \varepsilon) = \max_{c,d,h',pc,ds} \]

\[
(1 - \pi^pc_a)(1 - \pi^ds_a)(1 - \pi^d_a) \left\{ u(c, d, h, \varepsilon) + \beta E_{\varepsilon'} \sum_{s'} \pi_{s'}(h', i + 1, ed) V_{i+1,ed}(h', s', \varepsilon') \right\}
\]
Recursive Representation - 1

\[ V_{i,ed}(h,s,\varepsilon) = \max_{c,d,h',pc,ds} \]

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\[ + \left[ 1 - (1 - \pi_a^{pc})(1 - \pi_a^{ds})(1 - \pi_a^{d}) \right] \left[ u(\bar{c},0,h,\varepsilon) + \beta J_{i+1,ed}(h',t = 0) \right] \]

S.to
Recursive Representation - 1

\[ V_{i,ed}(h, s, \varepsilon) = \max_{c, d, h', p_c, d_s} \]

\[
(1 - \pi^a_{p_c} p_c)(1 - \pi^a_{d_s} d_s)(1 - \pi^d_{a} d) \left\{ u(c, d, h, \varepsilon) + \beta E_{\varepsilon'} \sum_{s'} \pi_{s'}(h', i + 1, ed) V_{i+1,ed}(h', s', \varepsilon') \right\} 
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\]

\[ S.to \]

\[ h' = (1 - \lambda)h + d \]
Recursive Representation - 1

\[ V_{i,ed}(h, s, \varepsilon) = \max_{c,d,h',pc,ds} \]

\[
(1 - \pi^p_a p c)(1 - \pi^d_a ds)(1 - \pi^d_a d) \left\{ u(c, d, h, \varepsilon) + \beta E_{e'} \sum_{s'} \pi_{s'}(h', i + 1, ed) V_{i+1,ed}(h', s', \varepsilon') \right\}
\]

\[
+ \left[ 1 - (1 - \pi^p_a p c)(1 - \pi^d_a ds)(1 - \pi^d_a d) \right] \left\{ u(\bar{c}_a, 0, h, \varepsilon) + \beta J_{i+1,ed}(h', t = 0) \right\}
\]

S.t.

\[ h' = (1 - \lambda)h + d \]

\[ c + p_d d + p_l \leq y_{i,ed,s} + \eta \bar{y} pc + (p_d - p_d^m) ds \]
Recursive Representation - 1

\[ V_{i,ed}(h, s, \varepsilon) = \max_{c,d,h',pc,ds} \]

\[ (1 - \pi_a^{pc}) (1 - \pi_a^{ds}) (1 - \pi_a^d) \left\{ u(c, d, h, \varepsilon) + \beta E_{e'} \sum_{s'} \pi_{s'}(h', i + 1, ed) V_{i+1,ed}(h', s', \varepsilon') \right\} \]

\[ + \left[ 1 - (1 - \pi_a^{pc}) (1 - \pi_a^{ds}) (1 - \pi_a^d) \right] \left\{ u(\overline{c}, 0, h, \varepsilon) + \beta J_{i+1,ed}(h', t = 0) \right\} \]

\[ S.t.o \]

\[ h' = (1 - \lambda)h + d \]

\[ c + p_d d + p_I \leq y_{i,ed,s} + \eta_{ypc} + (p_d - p_d^m) ds \]

\[ \varepsilon \sim N(0, \sigma_{\varepsilon}) \]

\[ \pi_{s'}(h', i + 1, ed) = \frac{\exp\left(\gamma + \gamma_h h' + \gamma_i i + \gamma_{ii} i^2 + \gamma_{ed} ed\right)}{1 + \exp\left(\gamma + \gamma_h h' + \gamma_i i + \gamma_{ii} i^2 + \gamma_{ed} ed\right)} \]
Recursive Representation - 2 (Inmates)

\[ J_{i,ed}(h,t) = u(\bar{c}_a,0,h,\varepsilon) + \beta J_{i+1,ed}(h',t+1) \]

\[ J_{i,ed}(h,T_j - 1) = u(\bar{c}_a,0,h,\varepsilon) + \beta \left\{ \zeta_j \sum_{s'} \pi_s(h',i+1,ed)E_{\varepsilon,V_{i+1,ed}}(h',s',\varepsilon') + (1 - \zeta_j)J_{i+1,ed}(h',T_j) \right\} \]

\[ J_{i,ed}(h',T_j) = u(\bar{c}_a,0,h,\varepsilon) + \beta \sum_{s'} \pi_{s'}(h',i+1,ed)E_{\varepsilon,V_{i+1,ed}}(h',s',\varepsilon') \]

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\[ h' = (1 - \lambda)h \]
Equilibrium Recursive Stationary - 1

• For a given set of policies \{\phi, c_a\}, apprehension probabilities \{\pi_j\}, prison time by type of crime \{T_j\}, hard drugs retail price \(p_d\), and efficiency units \{\omega_i\}, a recursive stationary equilibrium is a set of individual value functions \{V_{i,ed}(s,h,\varepsilon), J_{i,ed}(h,t)\}, decision rules \{c_{i,ed}(s,h,\varepsilon), d_{i,ed}(s,h,\varepsilon), p_{ci,ed}(s,h,\varepsilon), ds_{i,ed}(s,h,\varepsilon)\}, prices for hard drugs and the property crime insurance \{p_d, p_I\}, taxes \{\tau_j, \tau_U\}, average legal income \(\bar{y}\), aggregate victimization rate \(\pi^pc_v\), and stationary distributions \{\mu_{i,ed}(s,h,\varepsilon), \mu^J_{i,ed}(h)\} such that:
Equilibrium Recursive Stationary - 2

- The aggregate property crime rate is given by:
  \[ \pi_{v}^{pc} = \sum_{s,i,ed} \int pc(.) \mu(.) \]

- The average legal income \( \bar{y} \) is given by:
  \[ \bar{y} = \sum_{s,i,ed} \int y_{s,i,ed} \mu(.) \]

- The insurance price \( p_{I} \) is given by:
  \[ p_{I} = \eta \bar{y} \pi_{v}^{pc} \]

- The drug price \( p_{d} \) is market clearing:
  \[ \sum_{s,i,ed} \int ds_{i,ed}(.) \mu(.) = \sum_{s,i,ed} \int d_{i,ed}(.) \mu(.) \]
The Hard Drugs Market

"Street" level demand

"Street" level supply

"Retail" level supply

$P_d$ $P'_d$

$d$ 0
The Hard Drugs Market

"Street" level supply

"Street" level demand

"Retail" level supply
The Hard Drugs Market

$\Delta p_d \approx 22\%$

$\begin{cases} p_d^* \\
p_d^m \end{cases}$

$d^* \approx 511$ Tons

Income from Drug Selling

"Street" level demand

"Street" level supply

"Retail" level supply
What does the GE features buy us?

- Effects of property crimes are relatively small (incidence is less than 5%, amount stolen around $1,250): insurance effects are not big.

- Non trivial effects of criminal justice system on equilibrium hard drugs price and consumption, hence on the incentives to both sell drugs and commit property crimes.
Data Sources

- NHSDA: Use of illegal substances for the non-institutional population (18,269 Obs).
- SILJ/SISFP: Drug use and expenditure, employment status, criminal charges and some demographics for inmates (4,311 and 11,334 Obs).
- UCR/NCVS/NCRP: Number of reported PC, and arrests by types of crime (PC & DV) / Sentence length by types of crime.
- STRIDE: Price, purity, quantity, location and date of purchase for illegal drugs obtained by DEA undercover agents (4,486 Obs).
- CPS: Labor force characteristics and labor market outcomes.
Some Basic Facts

• Crime participation and hard drugs use are prevalent among youth.

• Hard drugs use does not necessarily seem to be an absorbing state.

• Inmates show higher prevalence rates.

• There is substantial dispersion in hard drugs expenditures.

• Hard drugs use and unemployment are positively correlated.
Drug Violations (DV) and Property Crime (PC) Arrest Rates, Age Profiles 1996 (Males only)
(Source: UCR 1996)

PC & DV 96

PC 96
DV 96
Hard Drugs Use in 1996
(Source: NHSDA 1996)
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## Prevalence of Hard Drugs Use

Non-institutional population

(Source: NHSDA, 1996)

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<th>Hard Drugs Use</th>
<th>Lifetime Population</th>
<th>Last Year Population</th>
<th>Last Month Population</th>
</tr>
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<tbody>
<tr>
<td>Heroin</td>
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*Non-institutional population Vs. Inmates*
(Source: NHSDA and Survey of Inmates, 1996)

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Inmates’ Hard Drugs Expenditure
(Source: Survey of Inmates of Local Jails 1996)
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## Unemployment Rates, by Hard Drugs Use
(Source: NHSDA 1996)

<table>
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<tr>
<th>Unemployed Rates</th>
<th>No Hard Drugs</th>
<th>Hard Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>4.15%</td>
<td>11.09%</td>
</tr>
<tr>
<td>Age: 16 - 25</td>
<td>7.57%</td>
<td>16.30%</td>
</tr>
<tr>
<td>Age: 26 - 35</td>
<td>4.01%</td>
<td>10.38%</td>
</tr>
<tr>
<td>Age: 35+</td>
<td>3.12%</td>
<td>4.48%</td>
</tr>
</tbody>
</table>
## Inmates Unemployment at Arrest, by Drug Use
(Source: Survey of Inmates 1996)

<table>
<thead>
<tr>
<th>% Unemployed</th>
<th>No Heroin</th>
<th>Heroin</th>
<th>No Crack</th>
<th>Crack</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All</strong></td>
<td>33.30%</td>
<td>48.11%</td>
<td>34.47%</td>
<td>36.83%</td>
</tr>
<tr>
<td>High School Dropouts</td>
<td>36.63%</td>
<td>49.12%</td>
<td>37.93%</td>
<td>38.38%</td>
</tr>
<tr>
<td>High School Graduates</td>
<td>36.63%</td>
<td>46.07%</td>
<td>27.22%</td>
<td>34.17%</td>
</tr>
<tr>
<td>College Graduates</td>
<td>9.82%</td>
<td>42.92%</td>
<td>13.07%</td>
<td>16.69%</td>
</tr>
</tbody>
</table>
## Parameters - 1996
### First Stage - Calibration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Period</td>
<td>1 year</td>
<td></td>
</tr>
<tr>
<td>$I$</td>
<td>50</td>
<td>Active population 16-65 year old</td>
</tr>
<tr>
<td>Average legal income $\bar{y}$</td>
<td>1</td>
<td>$28,513$ (Normalization)</td>
</tr>
<tr>
<td>Discount rate $\beta$</td>
<td>0.989</td>
<td>Standard</td>
</tr>
<tr>
<td>Education shares $\mu_{ed}$</td>
<td></td>
<td>Education distribution (CPS)</td>
</tr>
<tr>
<td>Unemployment Benefit $\phi$</td>
<td>0.5</td>
<td>US scheme (BLS)</td>
</tr>
<tr>
<td>Hard drugs per unit &quot;retail&quot; price $p_{dm}$</td>
<td>0.153</td>
<td>$48.68$ per gram (STRIDE)</td>
</tr>
<tr>
<td>Property crime apprehension pr. $\pi_{pc}$</td>
<td>0.0492</td>
<td>Conviction Rate (UCR/BJS)</td>
</tr>
<tr>
<td>Income share stolen $\eta$</td>
<td>0.0439</td>
<td>$1,253$ Value of a crime (UCR)</td>
</tr>
<tr>
<td>Consumption in jail $c_a$</td>
<td>0.0984</td>
<td>$2,800$ (BJS)</td>
</tr>
<tr>
<td>Efficiency units $\omega_{i,ed}$</td>
<td></td>
<td>Wage regression (CPS)</td>
</tr>
<tr>
<td>$T_j, \zeta_j$</td>
<td></td>
<td>Actual prison time (NCRP)</td>
</tr>
</tbody>
</table>
Parameters - 1996

Second Stage - Simulated Method of Moments

• The model is estimated using the Simulated Method of Moments (SMM):

\[
\hat{\Theta}_{N,S}(\Omega) = \arg \min_{\theta} \left[ \sum_{n=1}^{N} M(x_n) - \sum_{s=1}^{S} m(x(u_n^s, \theta)) \right] \Omega_N^{-1} \left[ \sum_{n=1}^{N} M(x_n) - \sum_{s=1}^{S} m(x(u_n^s, \theta)) \right]^T
\]

• Given \( k \) empirical moments \( M(x) \), the solution of the dynamic programming problem serves as input in the estimation procedure, delivering the simulated moments \( m(x, \theta) \).

• The Nelder-Mead Simplex Algorithm is used to minimize the objective function.
## Parameters - 1996
### Second Stage - SMM

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source of Identification</th>
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</thead>
<tbody>
<tr>
<td><strong>Unemployment Probability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.27</td>
<td><em>U Rates by Age, Education and Drug Use</em></td>
</tr>
<tr>
<td>$\gamma_h$</td>
<td>1.09</td>
<td></td>
</tr>
<tr>
<td>$\gamma_i$</td>
<td>-0.13</td>
<td></td>
</tr>
<tr>
<td>$\gamma_{ii}$</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>$\gamma_{hs}$</td>
<td>-0.68</td>
<td></td>
</tr>
<tr>
<td>$\gamma_{col}$</td>
<td>-1.41</td>
<td></td>
</tr>
<tr>
<td><strong>Apprehension Probabilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\pi^d$</td>
<td>0.009</td>
<td><em>Inmates composition by type of crimes</em></td>
</tr>
<tr>
<td>$\pi^{ds}$</td>
<td>0.068</td>
<td></td>
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<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source of Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Utility Function</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\alpha_{cc}$</td>
<td>-0.57</td>
<td><em>Moments of the Hard Drugs Expenditure</em></td>
</tr>
<tr>
<td>$\alpha_c$</td>
<td>52.12</td>
<td></td>
</tr>
<tr>
<td>$\alpha_{dd}$</td>
<td>-0.35</td>
<td></td>
</tr>
<tr>
<td>$\alpha_d$</td>
<td>16.62</td>
<td></td>
</tr>
<tr>
<td>$\alpha_{dh}$</td>
<td>35.73</td>
<td></td>
</tr>
<tr>
<td><strong>Taste Shock and Habit Depreciation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_{e}$</td>
<td>3.99</td>
<td><em>Prevalence Rates of Hard Drugs Use</em></td>
</tr>
<tr>
<td>1-$\lambda$</td>
<td>0.83</td>
<td><em>Persistence of Hard Drugs Use</em></td>
</tr>
</tbody>
</table>
Results

Decision Rules - Property Crimes

![Graph showing the relationship between drug habits and number of crimes for different ages.](image-url)
## Results

### Model Fit - Data Vs. Simulations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prevalence Rates of Hard Drugs Use:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age: 16 - 18</td>
<td>6.5%</td>
<td>8.7%</td>
</tr>
<tr>
<td>Age: 19 - 21</td>
<td>5.6%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Age: 22 - 24</td>
<td>7.4%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Age: 25 - 27</td>
<td>3.9%</td>
<td>5.2%</td>
</tr>
<tr>
<td>Age: 28 - 31</td>
<td>5.3%</td>
<td>4.4%</td>
</tr>
<tr>
<td>Age: 32 - 35</td>
<td>5.8%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Age: 36 - 40</td>
<td>3.5%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Age: 40 +</td>
<td>0.4%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

**Persistence of Hard Drugs Use**

48.2% 57.1%

**Hard Drugs Users Unemployment Rates**

11.09% 10.21%
# Results

## Model Fit - Data Vs. Simulations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Drugs Expenditure Distribution:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25th percentile</td>
<td>$250</td>
<td>$277</td>
</tr>
<tr>
<td>40th percentile</td>
<td>$560</td>
<td>$503</td>
</tr>
<tr>
<td>50th percentile</td>
<td>$900</td>
<td>$782</td>
</tr>
<tr>
<td>60th percentile</td>
<td>$1,400</td>
<td>$1,116</td>
</tr>
<tr>
<td>75th percentile</td>
<td>$2,750</td>
<td>$2,124</td>
</tr>
<tr>
<td>Inmates Composition:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property Crimes</td>
<td>52.6%</td>
<td>56.7%</td>
</tr>
<tr>
<td>Drug Selling</td>
<td>34.9%</td>
<td>40.7%</td>
</tr>
<tr>
<td>Drug Possession</td>
<td>12.5%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>
## Results

**Property Crimes “Accounting”**

<table>
<thead>
<tr>
<th>Model</th>
<th>Property Crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Economy</td>
<td>4.3%</td>
</tr>
<tr>
<td>Economy without drugs</td>
<td>3.18%</td>
</tr>
<tr>
<td>PC by Drug Users</td>
<td>26.1%</td>
</tr>
</tbody>
</table>
Results
Assessing the Effects of Rehab on Crime

<table>
<thead>
<tr>
<th>Model</th>
<th>Property Crime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Economy</td>
<td>4.3%</td>
</tr>
<tr>
<td>Economy without drugs</td>
<td>3.82%</td>
</tr>
<tr>
<td>PC by Drug Users</td>
<td>-11.1%</td>
</tr>
</tbody>
</table>
## Results
### A Legalization Policy

<table>
<thead>
<tr>
<th>Model</th>
<th>Property Crimes</th>
<th>Hard Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Economy</td>
<td>4.3%</td>
<td>511 Tons</td>
</tr>
<tr>
<td>Legalized Economy</td>
<td>3.85%</td>
<td>594 Tons</td>
</tr>
<tr>
<td>Percent change</td>
<td>-18.6%</td>
<td>+16.2%</td>
</tr>
</tbody>
</table>
Caveats

• A legalization policy might eliminate also the “forbidden-fruit” type of consumption: if so, the structural parameters would not be policy invariant.

• We are neglecting some potential costs induced by legalization, such as DWI, surge in violent crimes, etc.

• We are assuming that the government is rebating the saved costs to the HH’s, i.e. it is not using those resources to increase the arrest rates for PC.
Conclusions

• We have presented a model to quantify the effects of hard drugs addiction on property crimes.

• Hard drugs account for 26% of the property crimes committed each year. Legalization seems to be an effective policy.

• Work in progress:
  Search for the “optimal” price under legalization, i.e. the crime minimizing one.
Computational Methods

- The model is solved numerically by backwards induction and by discretizing the continuous state variables $\varepsilon$ and $h$.

- The optimal value functions are computed with a collocation method and with Shumaker shape preserving splines approximation outside the grid.

- The simulations are based on a (convenience) sample of 200,000 individuals, with linear interpolation of the policy rules.
Results
Model Fit - Unemployment Rates

![Chart showing model fit for unemployment rates across different age groups.]
Cocaine, Crack and Heroin