

Market Size, Prices, and Purity

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Outline

- Estimating market size
- Fun with price & purity
- Other stuff on the supply side
- Concluding thought/comment on Belgium and supply side

Estimating Market Size

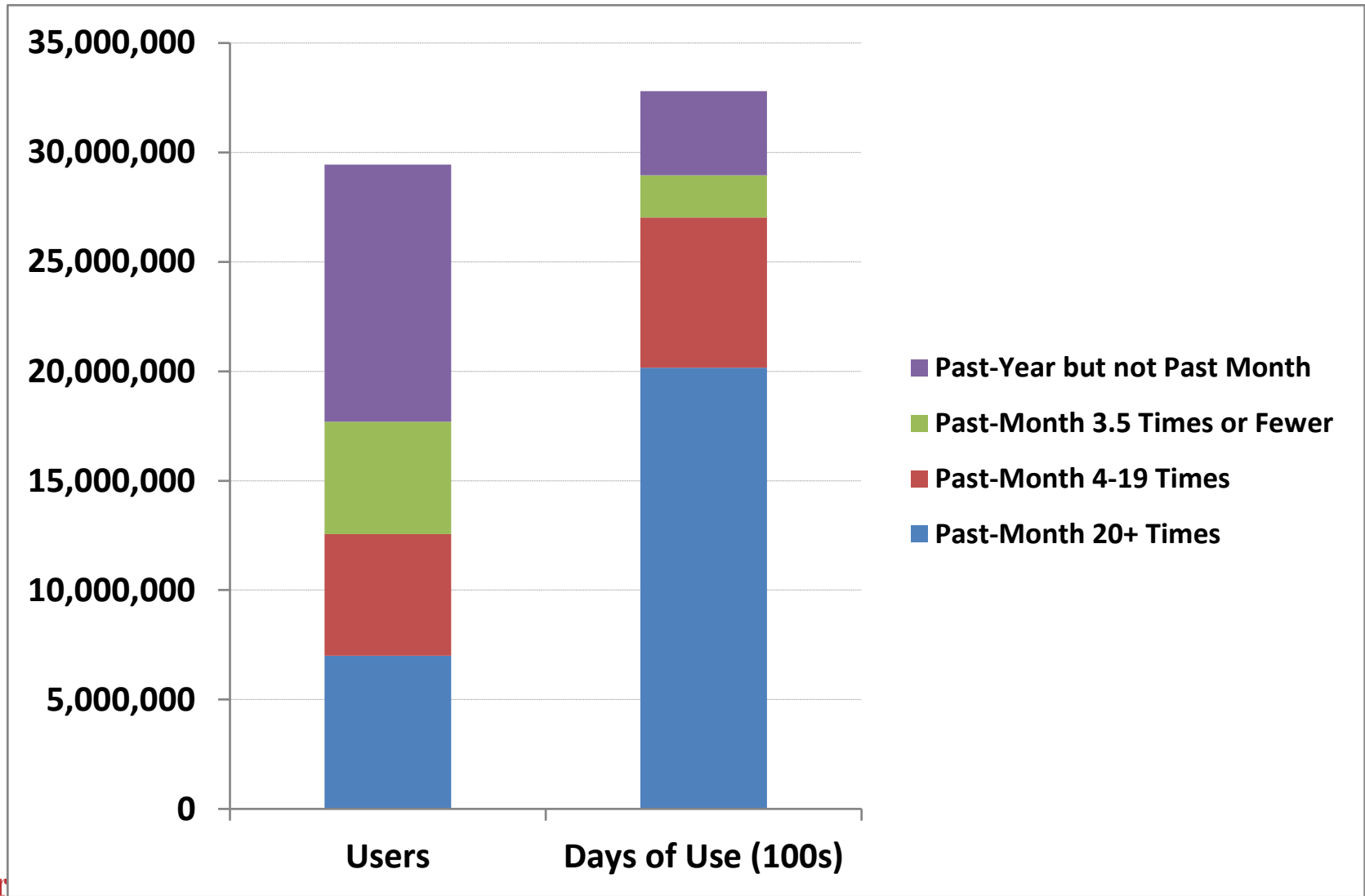
Supply side methods

- Seizures * 10
- Production – seizures – consumption elsewhere

Demand side methods

- # of users * consumption per user
- # of users * spending per user / price

Mr. Pareto's Curse: You can only count the users that do not matter (as much)



Uncertainty Comes from Factors that Have Not Been Studied

Recent estimate of US marijuana consumption.

R1	PM: # of Users	16,752,428	NSDUH 2009
R2	PM: Days used in past year	156.3	NSDUH 2009 (Mean)
R3	PM: Joints per use day	2.5	NHSDA <u>1994</u> (Mean)
R4	PY: Number of users	11,967,200	NSDUH 2009 (Mean)
R5	PY: Days used in past year	29.8	NSDUH 2009 (Mean)
R6	PY: Joints per use day	1.25	0.5 * R3 (<u>assumed</u>)
R7	Grams per joint	0.43	<u>Kilmer et al., 2010</u>
R8	PM: Total grams	2,815,145,011	=R1 * R2 * R3 * R7
R9	PY: Total grams	191,748,950	=R4 * R5 * R6 * R7
R10	% underreporting	20%	<u>Various sources</u>
	Baseline Total	3,800 MT	=(R8+R9) / (1 - R10)

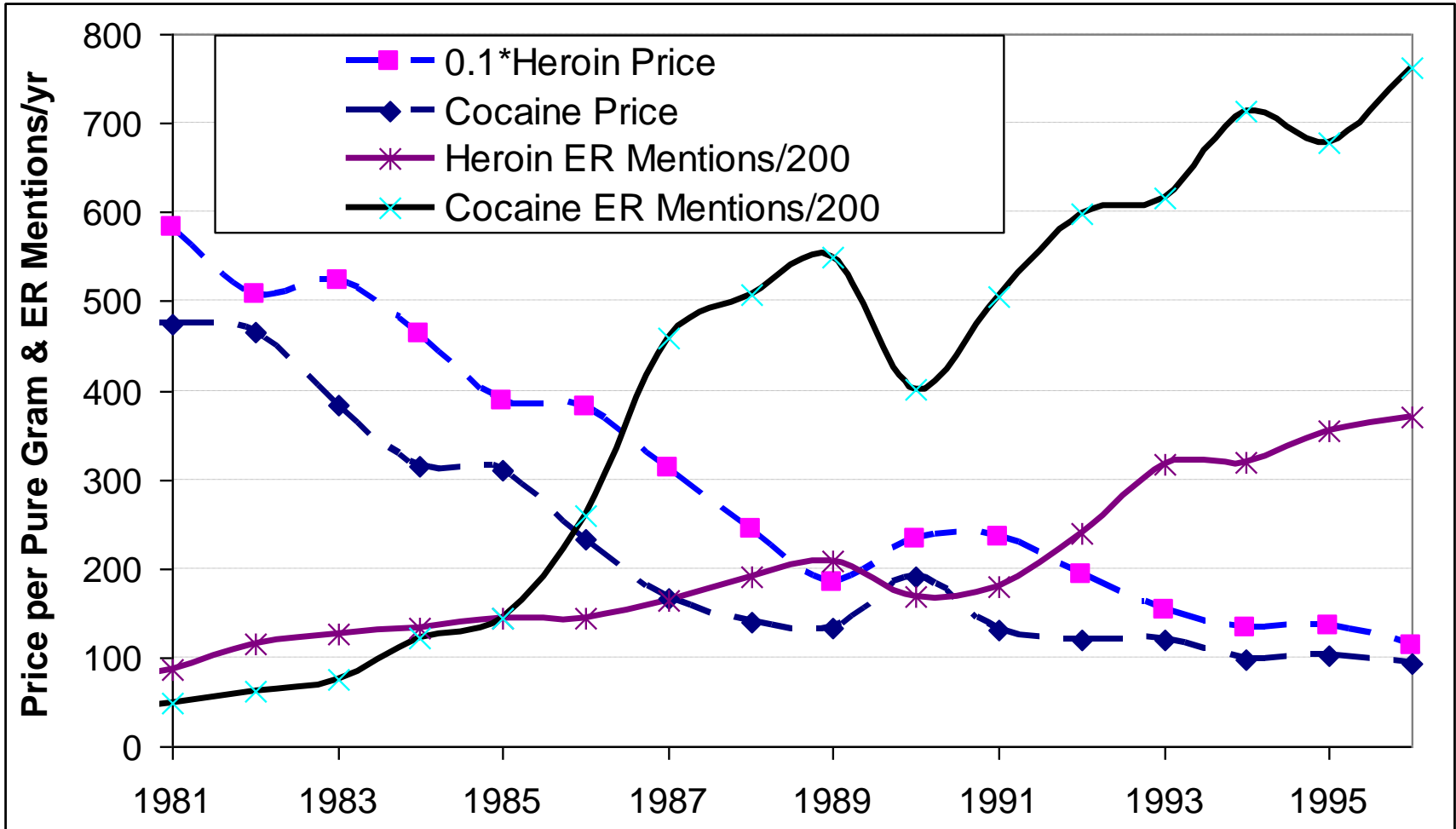
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Supply (Price, Purity, and Availability) Matters

- People used to think “Addicts will do anything to get their fix” so elasticity of demand is 0.
- Once learned how to estimate price series, could show that is not true.

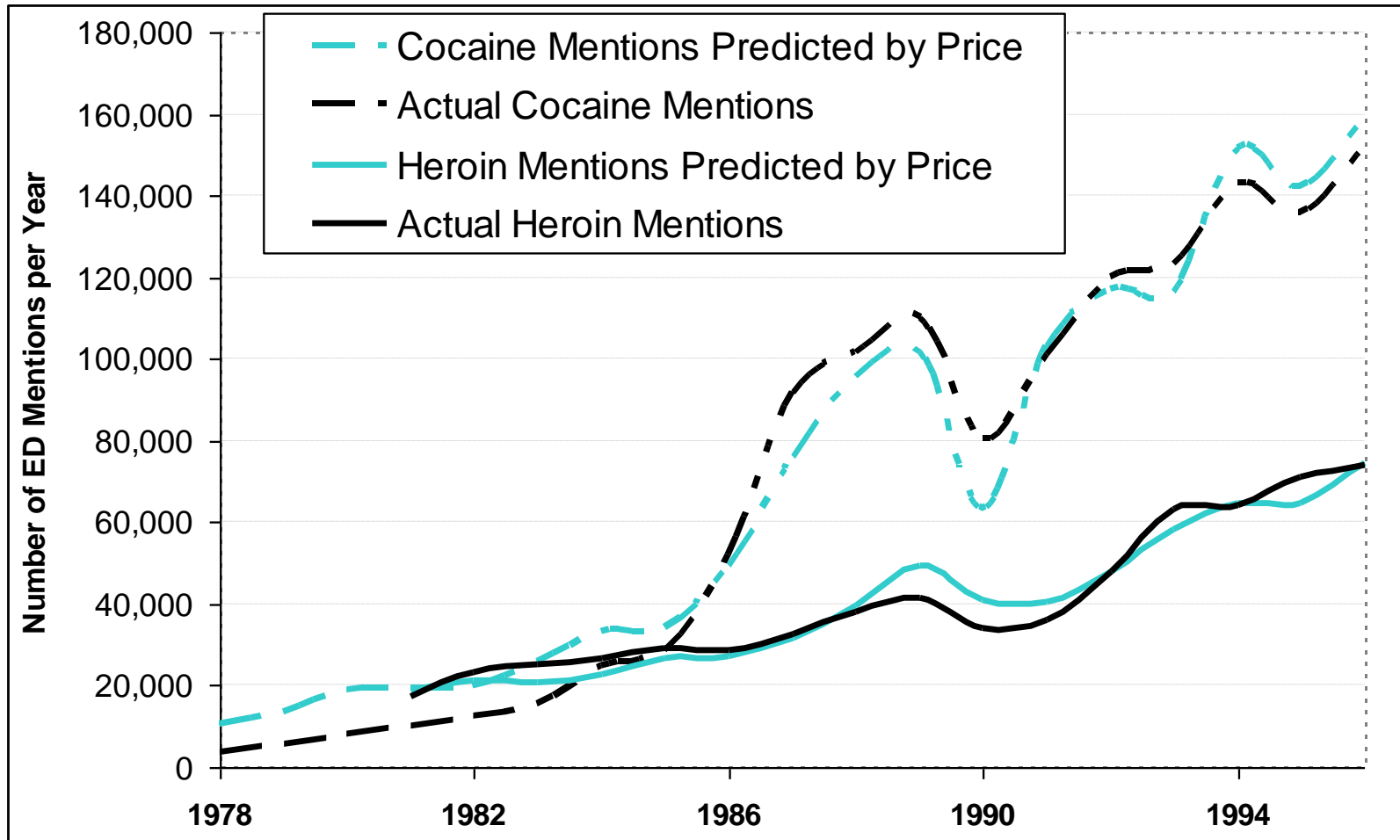
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US Cocaine and Heroin ED Mentions Inversely Related to Prices



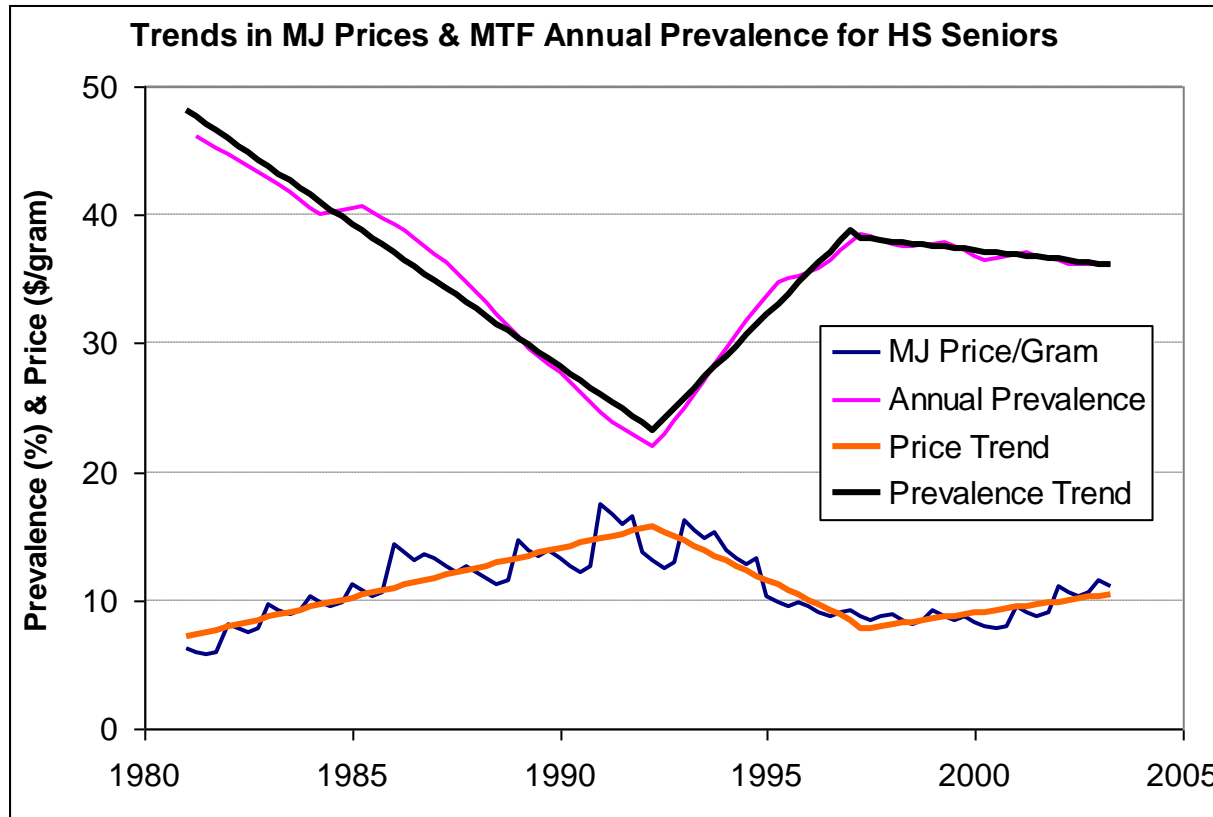
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Price Raised to a Constant Elasticity Can Explain Most Variation in ED Mentions



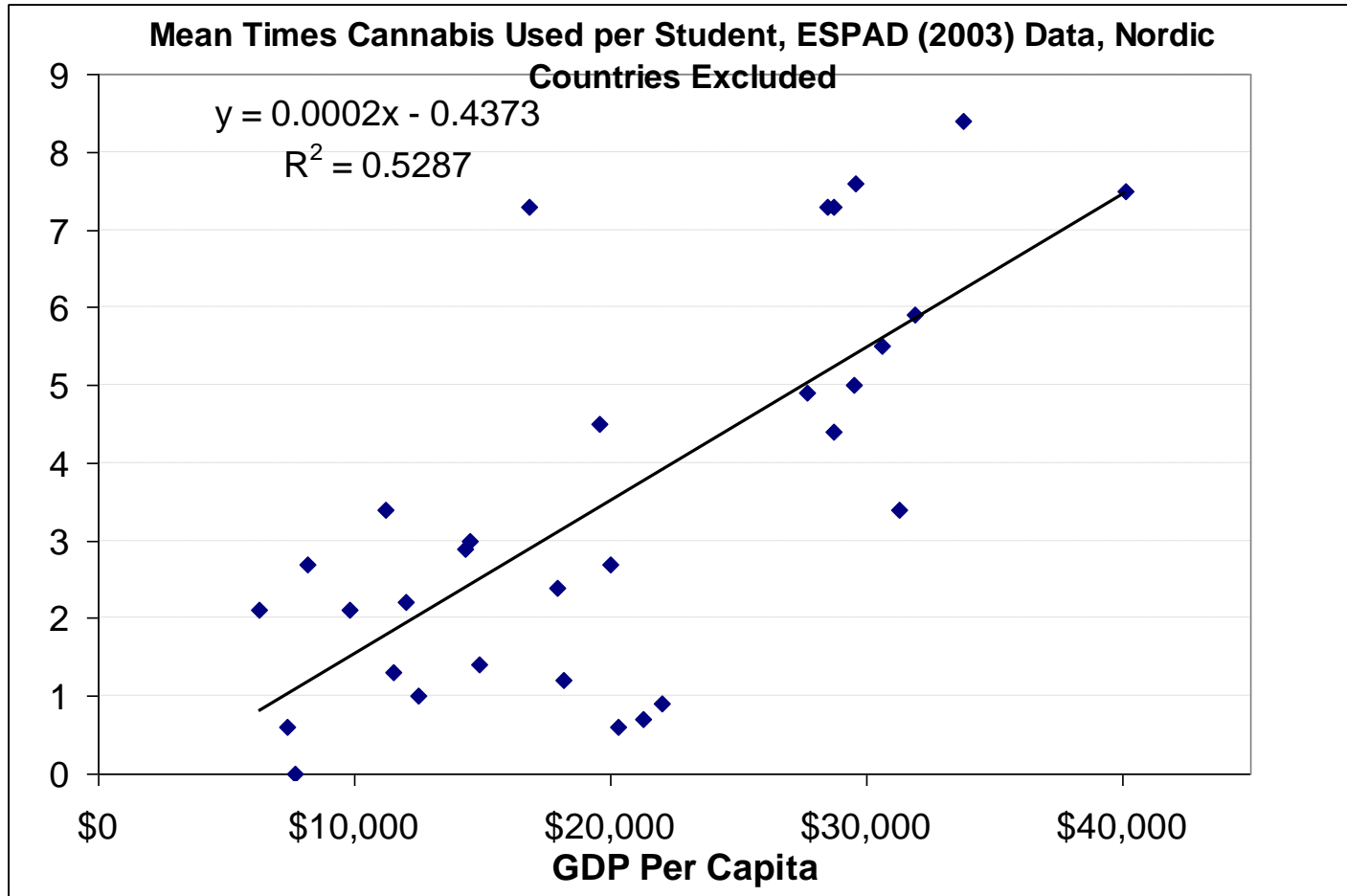
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HS Seniors Marijuana Use Inversely Correlated with Price



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Key May Be Affordability, Not Price Per Se

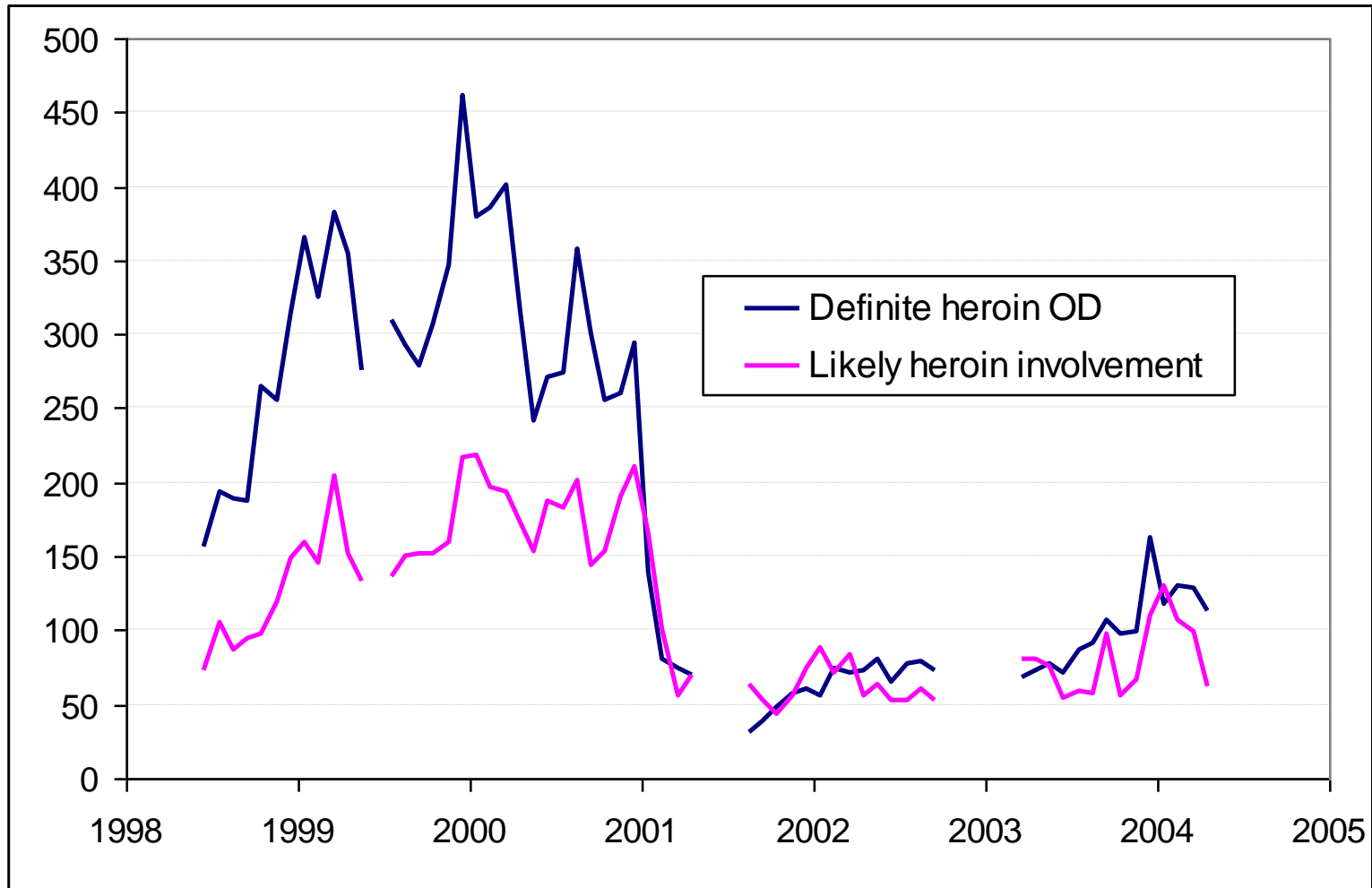


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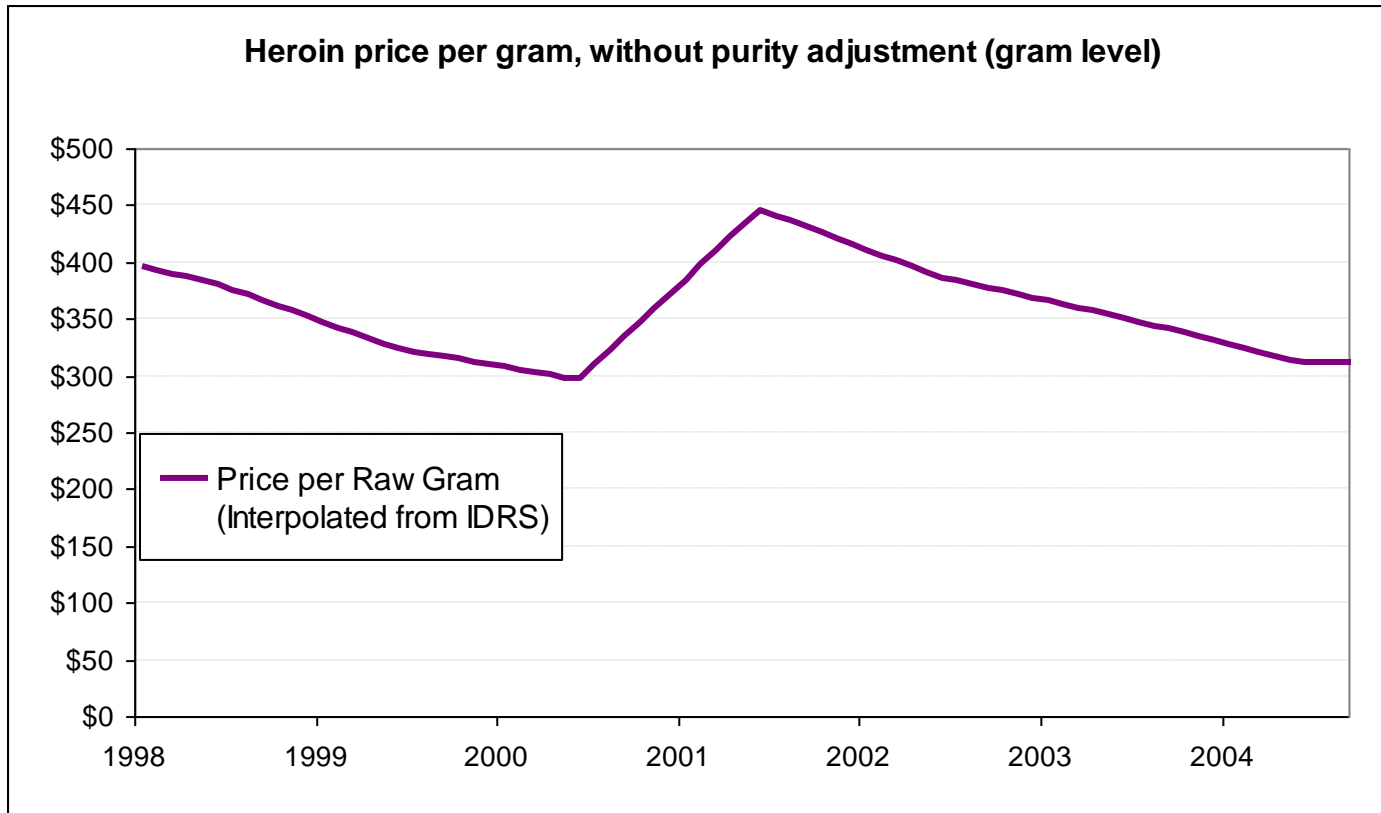
Disequilibrium Models & Detective Work

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Heroin Overdoses in Victoria

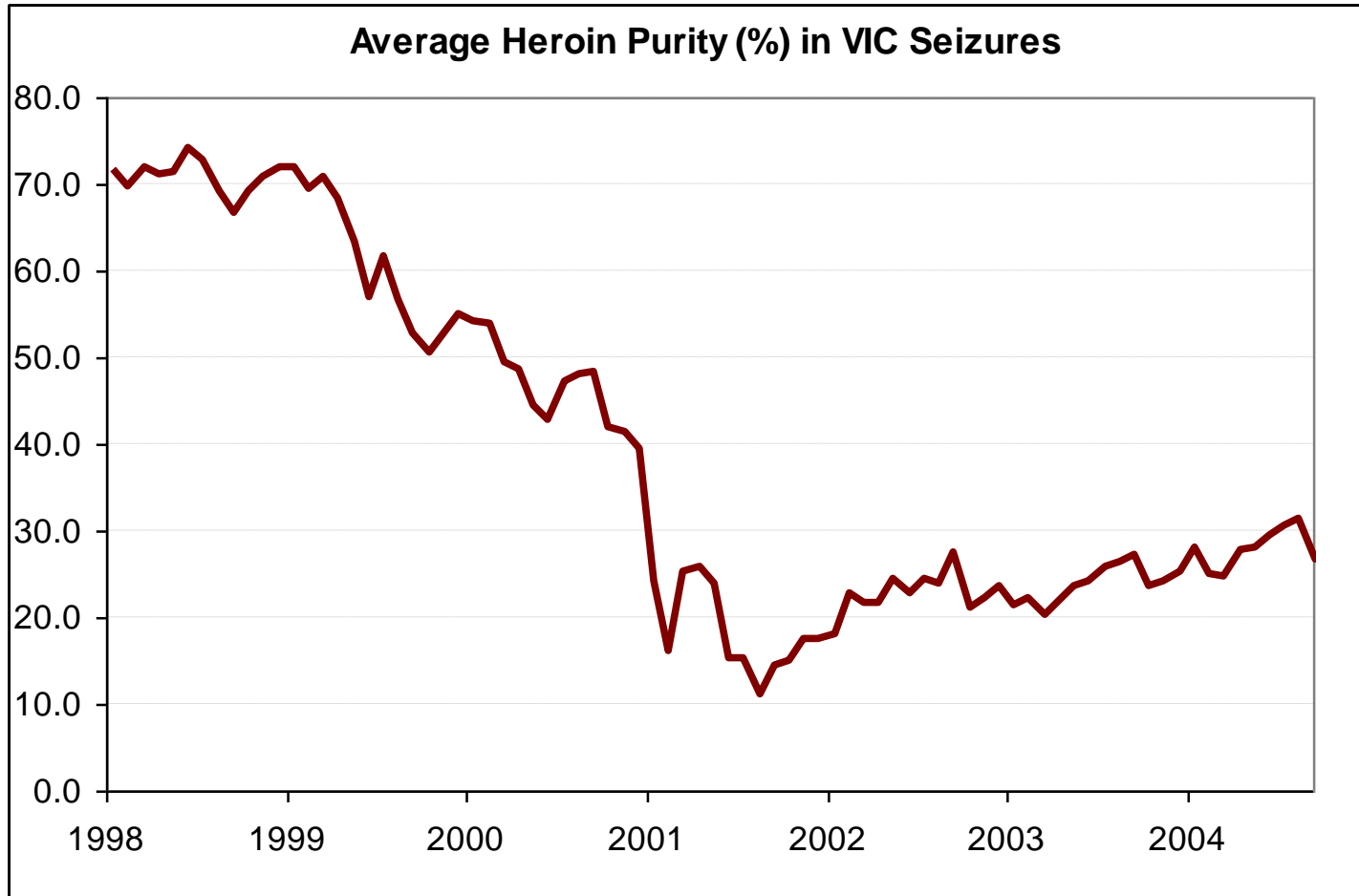


3 Little Change in “Raw” Price



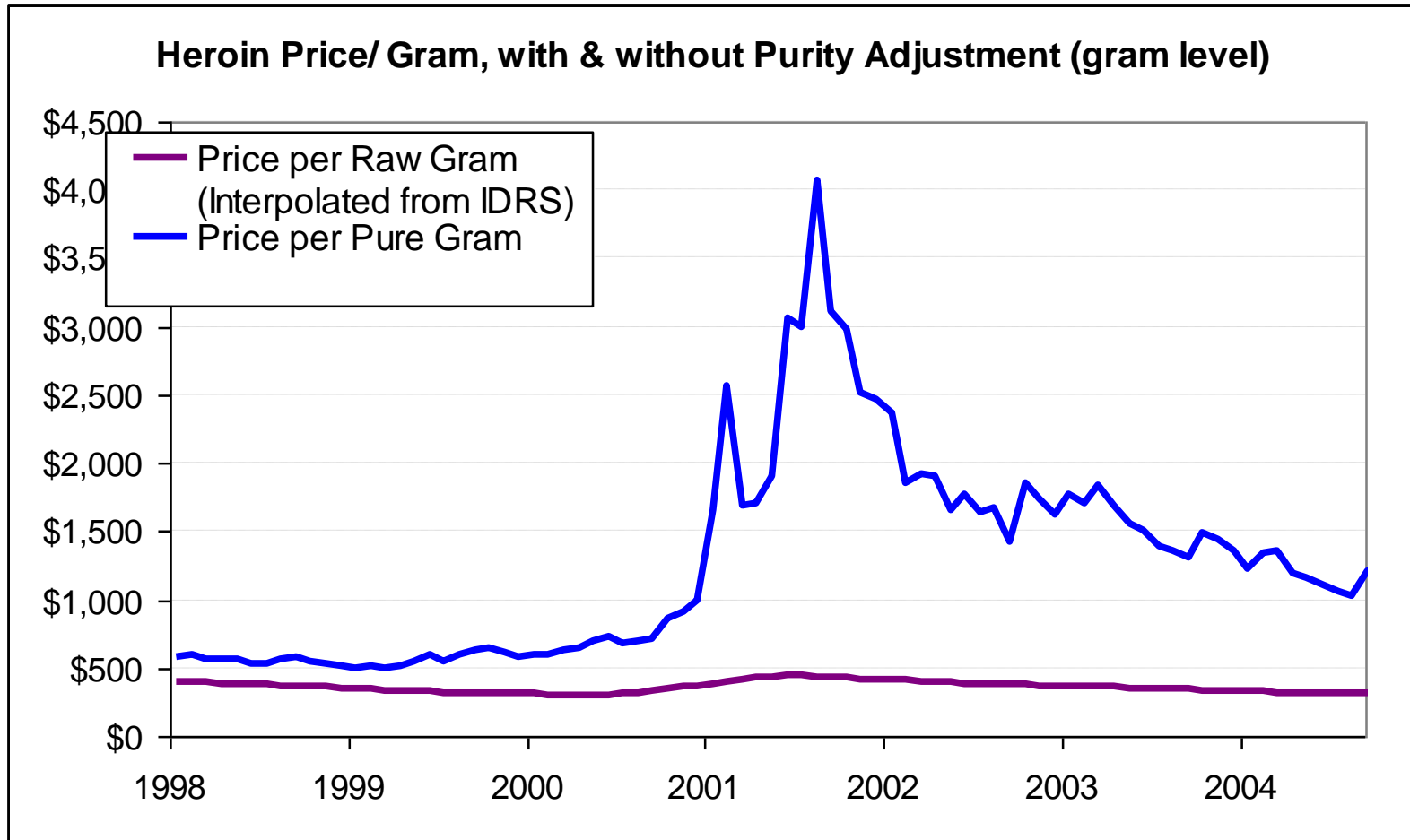
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Big Change in Retail Heroin Purity



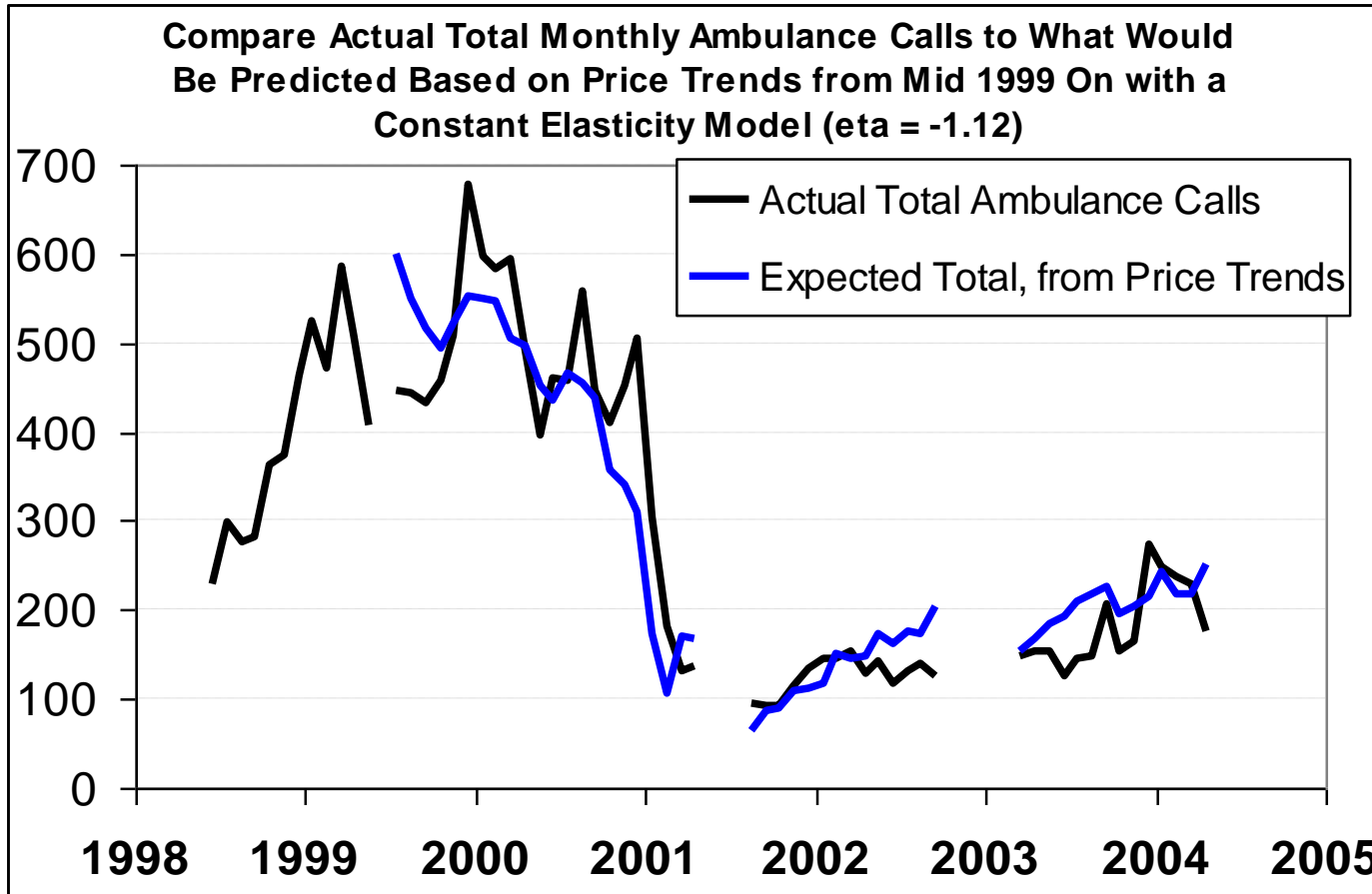
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So Purity-Adjusted Price Soared



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Which Can Explain Variation in Ambulance Call-Outs



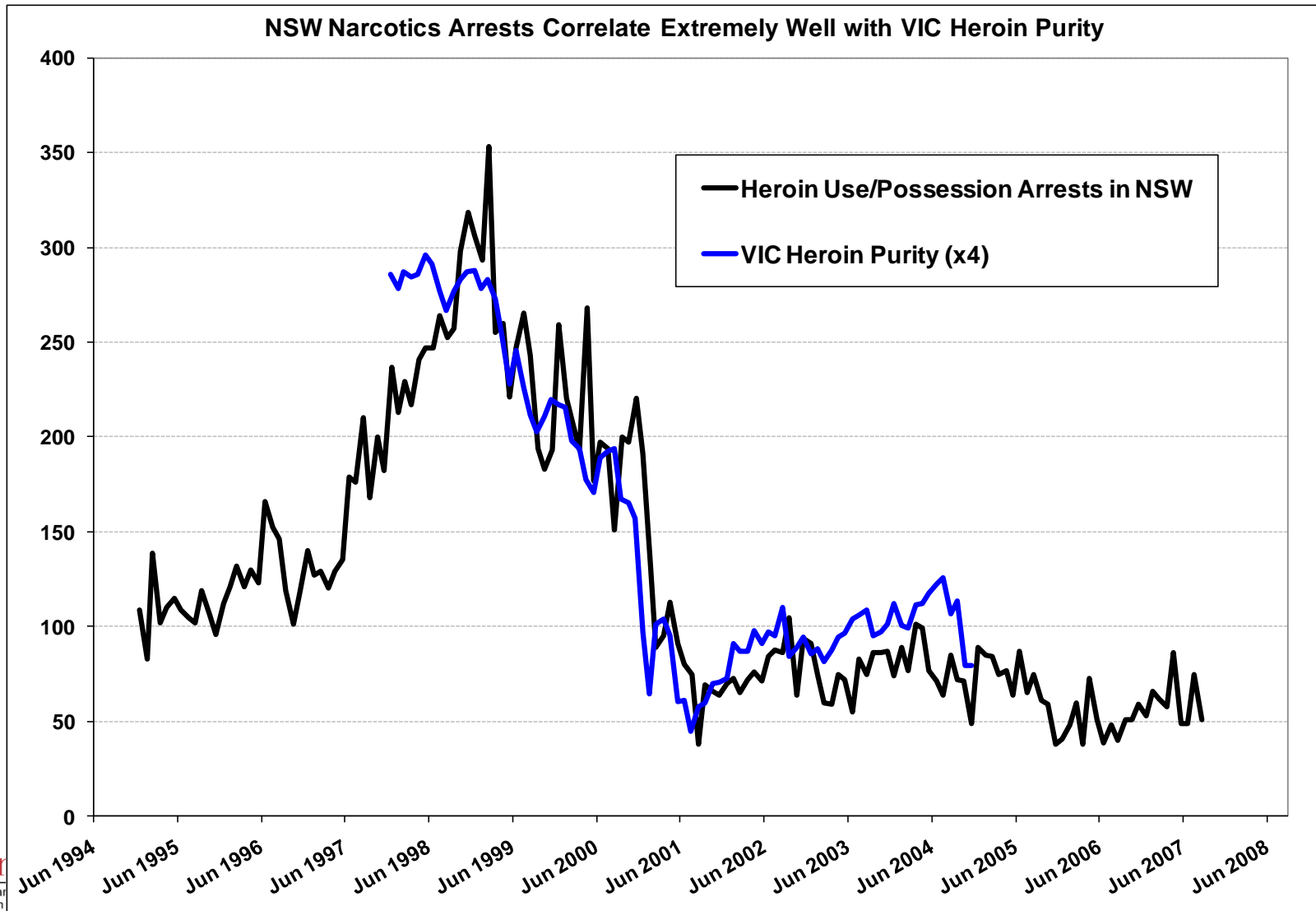
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If Drought Was A Supply-Side Event, Question is: “What Level?”

- Sub-national?
- Importation level?
- Source zone?
 - SE Asia (Myanmar, etc.)
 - SW Asia (Afghanistan, etc.)

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Market Decline & Shock Were National, not State Level Events

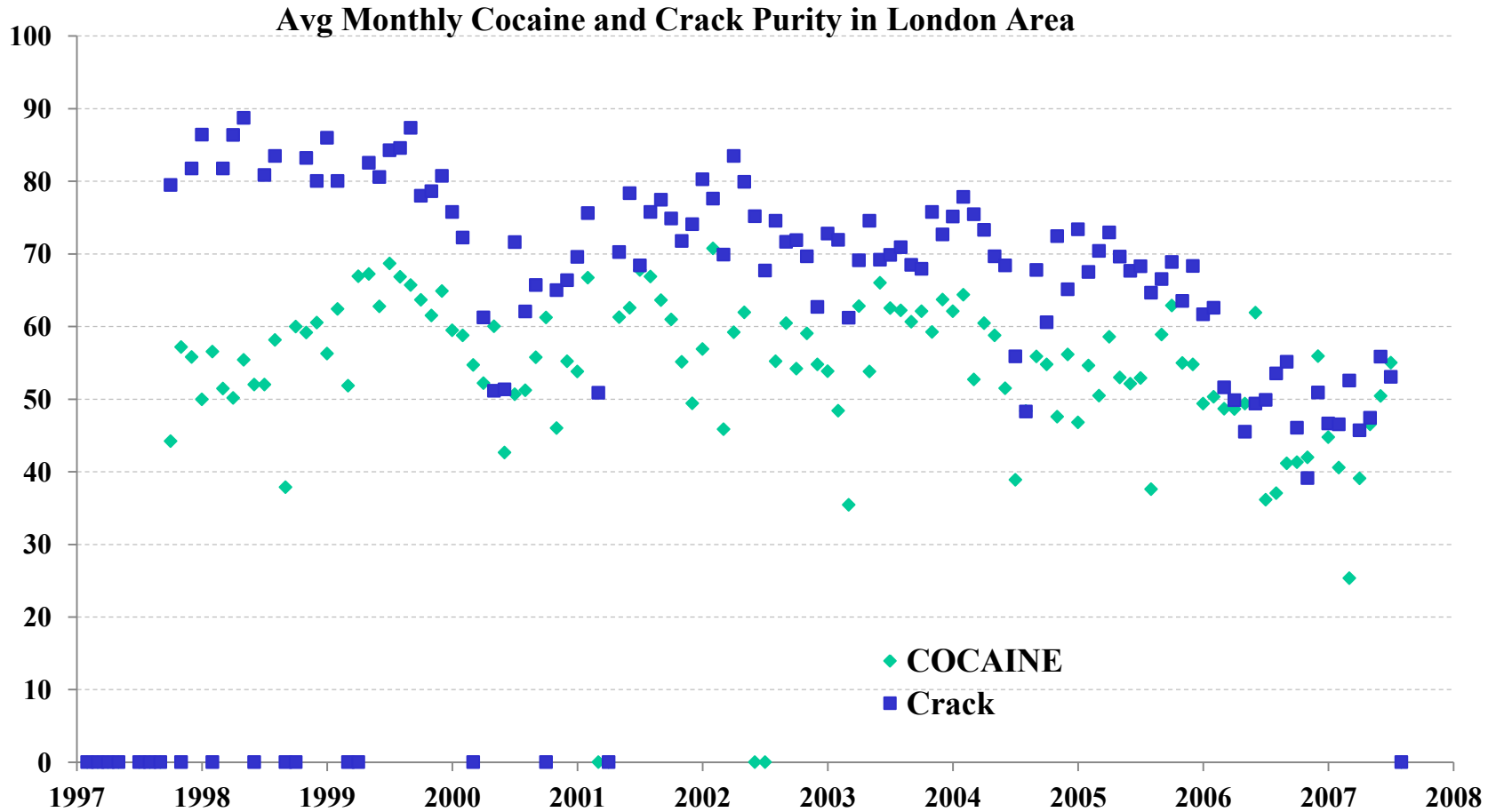


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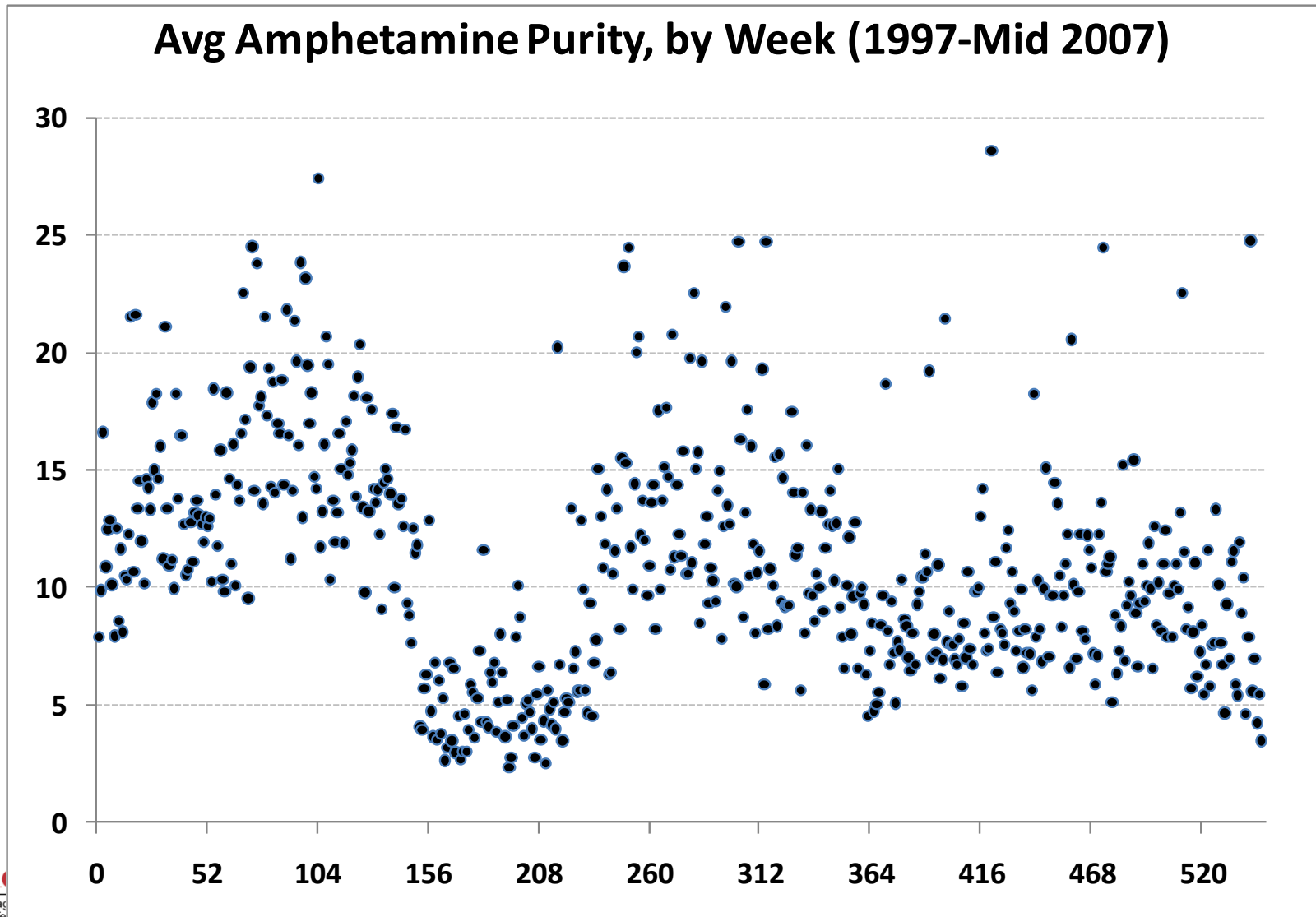
Similar Analysis for UK: Even Just Purity Can Be Useful

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Monthly Cocaine & Crack Purity in London

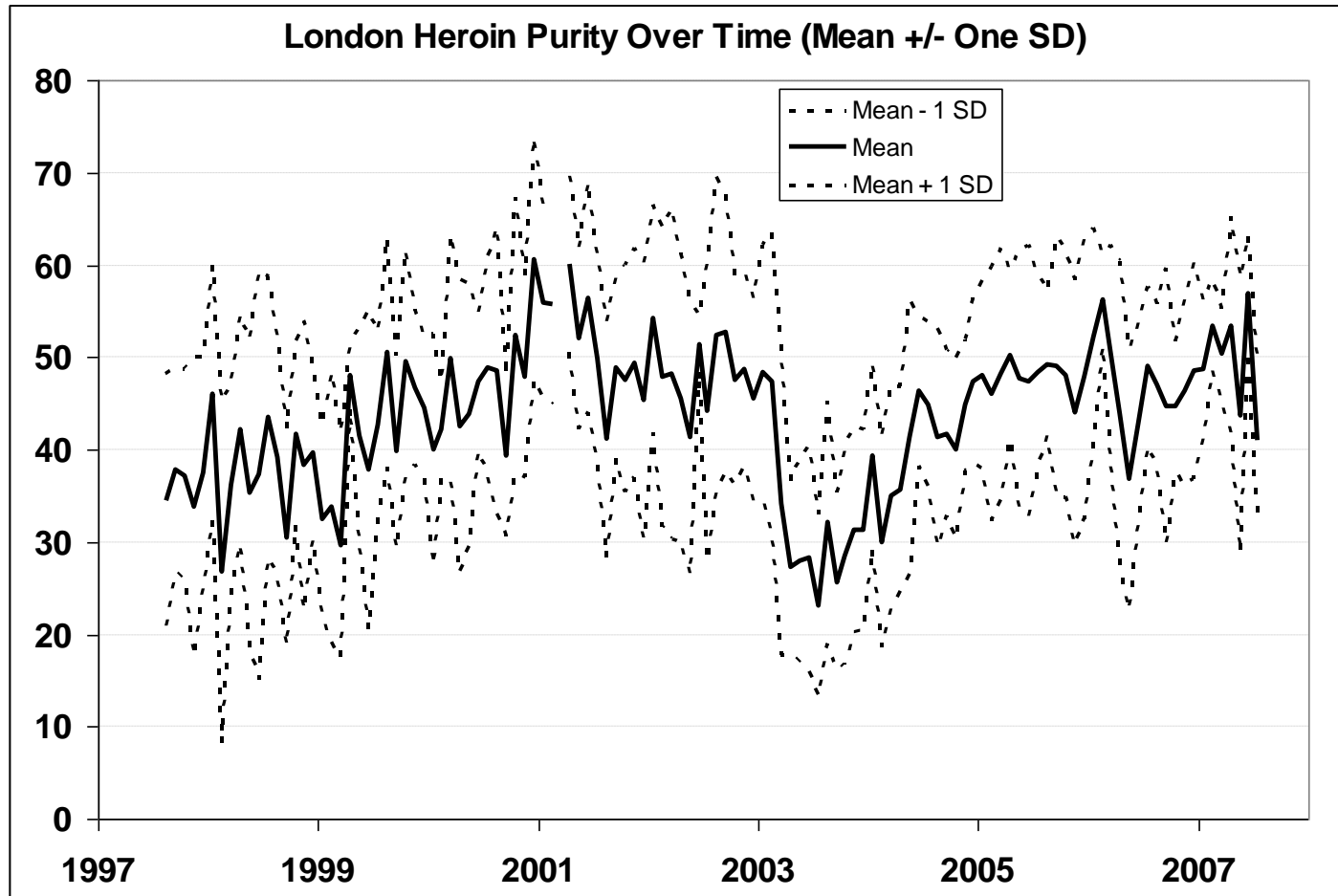


Weekly Amphetamine Series Shows Abrupt Decline in Early 2000



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Heroin Purity Series Also Suggestive of (Later) Market Shock



Other Stuff on the Supply Side

- The wisdom of suitcases
- Cycle times & transience of batches
- Distribution (not just mean) of seizure sizes in Australia
- Couriers' wages
 - (and existence of sacrificial sheep)
- Etc.

5 Supply-Chain Modeling

- Much like other distribution chains
 - Multi-layered network for heroin (and cocaine)
 - Log-linear price-quantity relationship
 - Price mark-ups may be slightly smaller
 - And curiously stable across drugs
- Other comments
 - High cycle frequency (low inventory holding?)
 - Importers are vertically integrated into domestic distribution

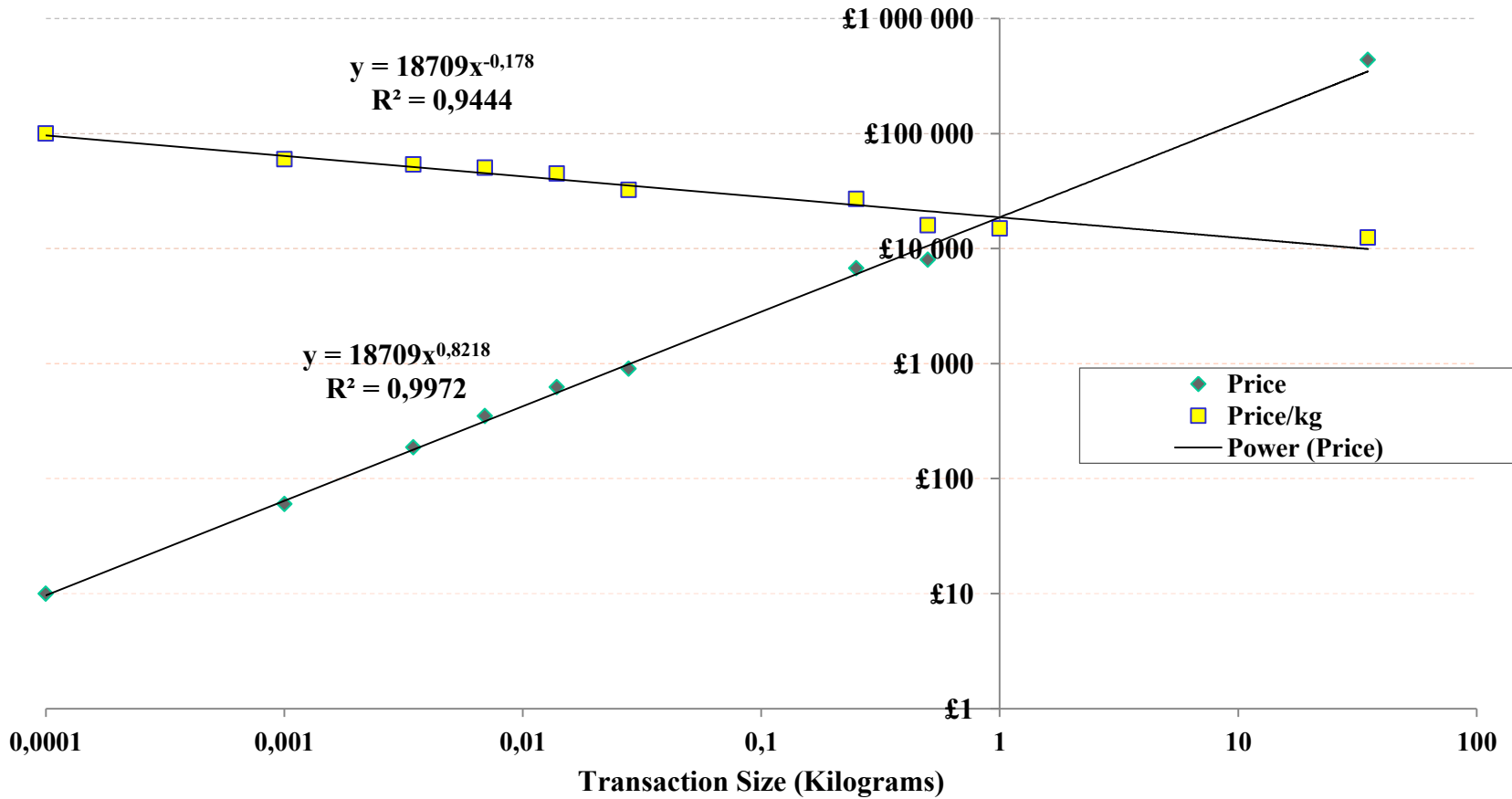
5 Typical Heroin Distribution

Transaction Level	Seller	Buyer	Amount	Price (per transaction)	Price/kg
4th Level Wholesale	Importer	Respondent B	10-60 kg	£437,500	£12,500
3rd Level Wholesale	Respondent B	Respondent A	1 kg	£15,000	£15,000
			0.5 kg	£8,000	£16,000
2nd Level Wholesale	Respondent A	A's Customers	9 oz.	£6,750	£27,000
			1 oz.	£900	£32,400
1st Level Wholesale	A's Customers	Retail Sellers	0.5 oz.	£625	£45,000
			0.25 oz.	£350	£50,400
			0.125 oz.	£187.50	£54,000
Retail	Retail Sellers	Users	1 gram	£60	£60,000
			0.1 gram	£10	£100,000

5

Prices Follow Classic Log-Linear Model:

$$P = \alpha Q^\beta$$



5

Price-Quantity Exponent Fairly Stable Across Substances

	# of Cycles	Average	Min	Max	Std Dev.
Cannabis	5	0.817	0.674	0.966	0.116
Cannabis Resin	4	0.851	0.775	0.932	0.076
Cocaine	7	0.869	0.792	0.920	0.040
Crack	5	0.827	0.731	0.886	0.058
Ecstasy	6	0.754	0.547	0.937	0.129
Heroin	28	0.834	0.253	0.975	0.142
Heroin (w/o outlier)	27	0.855	0.620	0.975	0.086

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Price-Quantity Exponent Larger in the UK, Which Makes Sense

	UK	US				
	Matrix Data (Avg.)	Caulkins & Padman (1993)	Arkes et al. (2004)			
			Retail	Level	Mid-Level	Top-Level
Cannabis	0.817	0.72 imported 0.76 domestic	0.573		0.802	0.783
Sinsemilla		0.850				
Cannabis Resin	0.851					
Hashish		0.770				
Cocaine	0.869	0.830	0.716	0.751	0.787	0.813
Crack	0.827	0.790	0.731		0.661	0.833
Heroin	0.834	0.83 brown 0.84 white	0.531		0.718	0.764

6

Modeling Suppliers as Businesses

- Project consequences of legalization
 - Production cost
 - Distribution cost
 - Price declines around the country

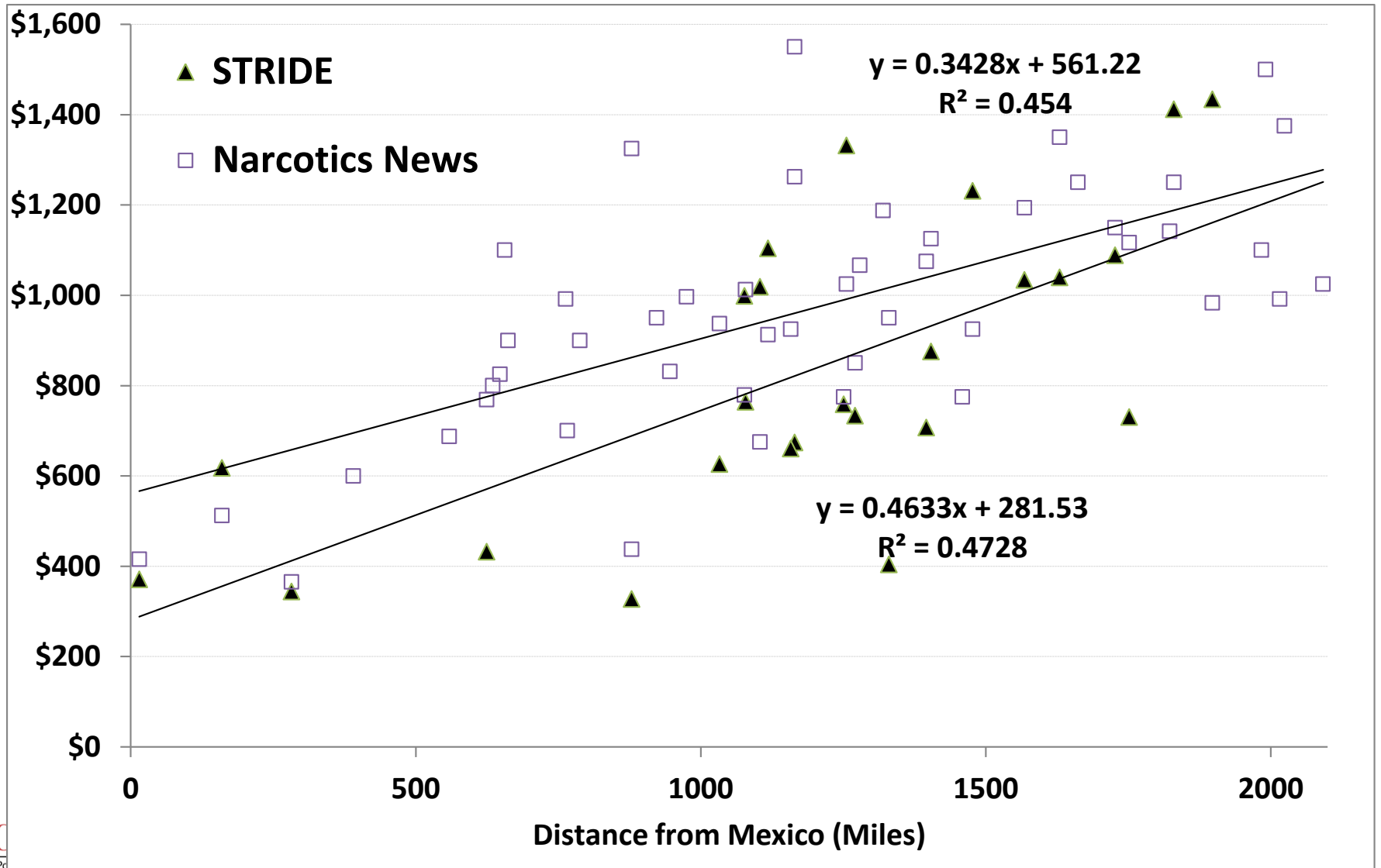
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Legal production and supply far cheaper than illegal wholesale prices

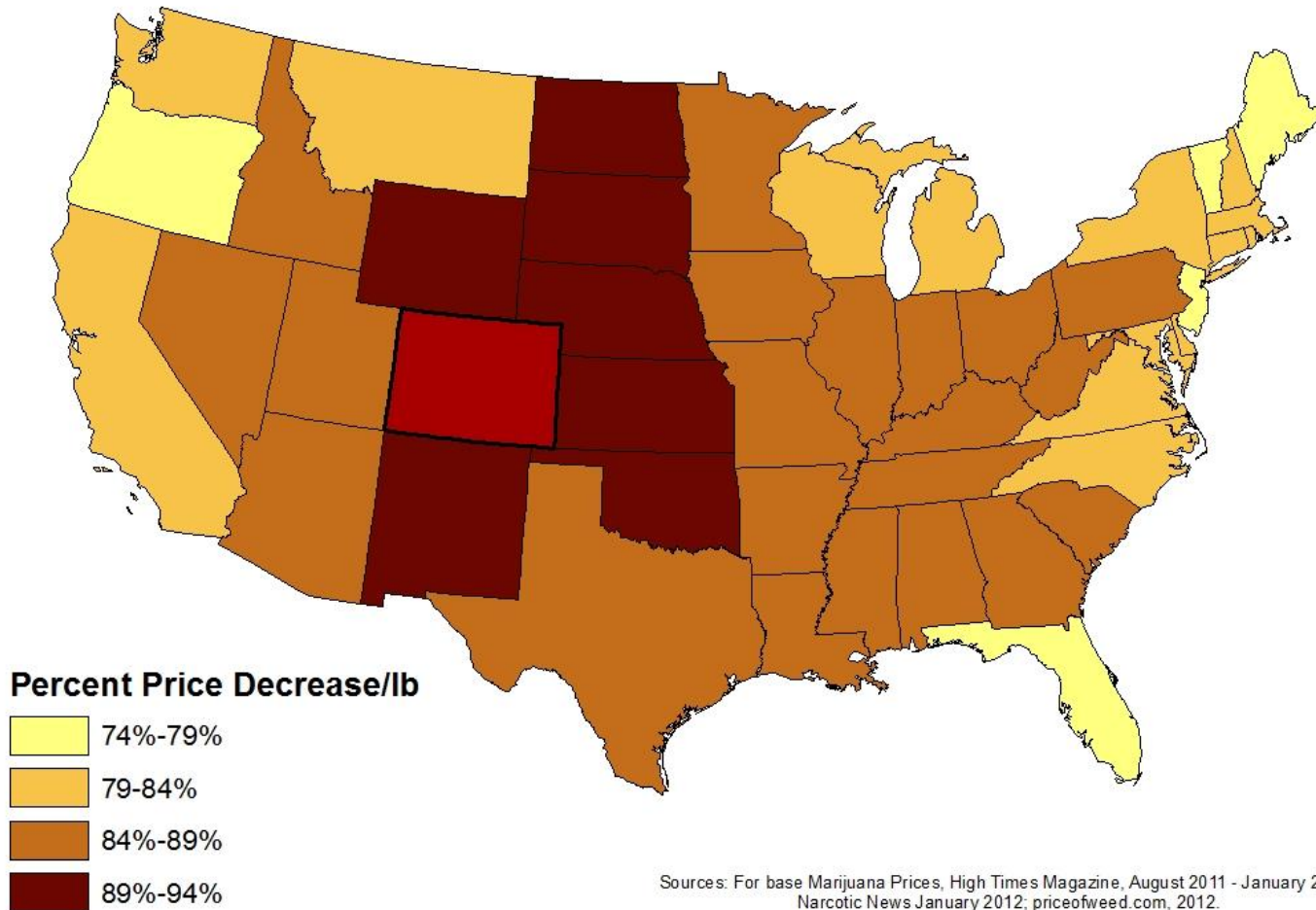


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US MJ wholesale prices increase systematically with distance from source



Trafficking legally produced MJ could lead to price collapse across U.S.



Sources: For base Marijuana Prices, High Times Magazine, August 2011 - January 2012; Narcotic News January 2012; priceofweed.com, 2012.

Concluding Comment

- Belgium is affected by supply but cannot affect (wholesale) supply
- Targeting retail supply
 - Possible in theory
 - Perilous in practice (at least for the US)