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LimitedRationalityandtheLimitsofSupplyReduction

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LimitedRationalityandtheLimitsofSupplyReduction

Abstract

Drugmarketshavebeentargetedforincreasinglytoughenforcementyetretailpricesfor cocaineandheroinfellby70   -80%.Noresearchhasexplainedadequatelywhyprices havefall en.Thispaperexploresthepossibilitythatpartoftheexplanationmaylieinthe failureofdrugdealerstorespondtorisksthewaythesimplestrationalactormodels mightpredict.

TheParadoxofIncreasingEnforcementandFallingDrugPrices

Inre centdecades,thepricesforcocaineandheroinintheUShavefallendespite increasinglystringentenforcement. [1]Thedeclineduringthe1980swasparticularly precipitous,buttheerosioncontinuedthroughouttheentireperiodexceptforafewbrief interruptions(e.g.,inlate1989andmid1995).   [2]

Fallingpricesareproblematicbecausedrugusevariesinverselywithprice. Formalestimatesoftheso   -called"elasticityofdemand"areusuallybasedonyouthand householdpopulations'self -reportsofma rijuanaandcocaineuse.(SeeChaloupka& Pacula,2000,forareviewofthatliterature.)However,thestrongnegativecorrelations observedbetweenbothcocaineandheroinpricesandcorrespondingemergencyroom mentionssuggestthattherelationshipis   notconfinedtoinitiationortocasualusers (Caulkins,2001).

Fallingpricesinthefaceofincreasingenforcementarepuzzlingbecausemostof theburdenofdrugenforcementfallsonsellers,   [3]andaccordingtoelementaryeconomics,

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[1]Drugarrestsincreasedfrom581,000in1980,to1.1millionin   1990and1.5millionin1999.Thenumber ofpeopleincarceratedfordrugoffensesgrewfrom42,000in1980to270,000in1990and470,000in 2000.Likewisethefederaldrugcontrolbudgetincreasedfrom$1.5Bin1981to$9.8Bin1990and$18.5B in2000.

[2]CaulkinsandReuter(1998)reviewtheevidenceondrugprices.TheofficialdatafromtheOfficeof NationalDrugControlPolicyusedtoshowdeclinesof60%between1981and1990andafurther51% declinebetween1990and1996forbothcocaineandher   oin.Thosedatawererevisedtoshowdeclinesof only42%and55%forheroinandcocaine,respectivelybetween1981and1990anddeclinesof31%and 46%between1990and1996.Thedataserieswehavecreatedforotherprojectsareconsistentwiththe firstsetofnumbers,butbothsetsshowsharpdeclines.Note:Theonlyconsistent,detailedpriceseriesare generateddirectlyorindirectlyfromwhatundercoveragentspayfordrugs.Thesetransactionsmaydiffer insystematicwaysfromtruemarketprice   s(seeManski,Pepper,&Petrie,2001,Chapter3).Itisunlikely, however,thattheapparentpricecollapseisapurelyanartifactbecauseanecdotalandethnographic accountsareconsistentwithsubstantialpricedeclines.

[3]Manyarrestsandconvicti   onsarefordrugpossession,butsomeofthoseindividualswereinvolvedin selling(e.g.,thosewhopleabargaindowntoapossessionchargeorwhopossessedquantitiesbeyondwhat issuitableforpersonaluse).Straightpossessioncasesarelesslikely   toleadtoincarceration.Alsothefact thatmostofthoseincarceratedfordrugoffensesparticipatedinsellingdoesnotimplythatusersarenot

interventionsthatr estrictorsuppresssupplytypicallydrivepricesupratherthandown. ReuterandKleiman'sclassicpaperon"risksandprices"(1986)presentsthisargumentin detail.Thekeypointsare:

- Peopleselldrugsprimarilytomakemoney,notforpathologicalo rideological reasons.

- Therearefewbarrierstoentrybecause(a)fewspecializedskillsandlittlecapitalare neededtobeadrugsupplierand(b)thedomesticdistribution"industry"is fragmented,soitisnotgenerallyintheinterestofindividuali ncumbentsupplier organizationstotakecostlyactiontopreventothersfromenteringthemarket.

- Hence,peopleenterthedrugdistributionbusinessuntilthereturnsfromdoingsoare biddowntoalevelcomparabletothatderivedfromotheractivities,i .e.tothe opportunitycostofbeingadealer.

- Theeconomicreturnfromdealingisthemonetaryoraccountingprofitminusthe dollarvalueofnon -monetaryrisksandcostsincurred.

- Conventionalcostsofproductionaretoosmalltoexplainordriveprices.

Thiscanbesummarizedinanequation:

$$\text{Economicreturnondealing} = \text{Revenuefromsellingdrugs} - \text{Costofobtainingthe}$$
$$\text{drugs} - \text{Conventionalbusinesscosts} - \text{Non-monetarycosts.} \qquad (1)$$

Ifthereturnondealingisgovernedbytheopportunitycostofdealing,thenit shouldberelativelyinsensitivetochangesinenforcement.Sinceconventionalbusiness costsarenegligible,thi simpliesthatthemark -up(i.e.,thedifferencebetweensales revenueandthecostofobtainingdrugs)isdrivenprimarilybythenon -monetarycosts. Thesumofthemark -upsfromonelayerofthedistributionchaintothenextiswhat determinesthereta ilprice.Therisksofenforcementandviolencearethedominantnon - monetarycosts.So,mathematically,onewouldexpectincreasingenforcementtodrive upnon- monetarycostsand,hence,prices.

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incarcerated;manysellersarealsousers.

Less formally, the risks and prices framework views enforcement as a sort of tax that drives up the cost of distributing drugs. Since drug dealers are essentially business people, one would expect them to pass those higher costs along to consumers in the form of higher prices. Both before and after any change in the amount of enforcement, drug dealers are viewed as having made a rational choice. They considered the risks. They considered the rewards (primarily monetary). And they chose the bundle of risks and rewards associated with dealing over whatever the alternative was. Raising the risks makes the bundle look less attractive, so to preserve an equilibrium in which the marginal individual is indifferent between choosing the risky bundle and the less risky default alternative, rewards must rise when risks do.

ConventionalExplanationsfortheConundrum

The previous section described a paradox. The bulk of this paper examines the possibility that various cognitive failures or failures of judgment might help explain that paradox. Before proceeding it is important to make two observations. First, it is unlikely that there is just one explanation for why cocaine and heroin prices fell when enforcement increased. That is why we say failures in judgment may *help* explain the paradox, not explain it entirely. Second, some of the other explanations do not involve judgmental failure. We review them next. They do not necessarily make this paper moot, however, because these explanations are not typically viewed as being sufficient in themselves to explain all of what happened with prices, even if they are an important part of the overall explanation.

PriceDeclinesWeretheResultofDemandShifts

A common explanation for falling prices is an upward sloping supply curve (the usual case) and declining demand. Superficially this might seem like a relevant explanation because the number of cocaine users (though not necessarily heroin users) has fallen. However, demand is dominated by heavy users, whose numbers grew in the 1980s. Everingham and Rydell (1994) estimate that the weighted sum of the number of light and heavy cocaine users, weighting by their relative propensities to consume, was stable during the 1980s, and Knoll and Zuba's (2002) update shows only very modest

declinesduringthe1990s.Heroinuseis   hardertoestimatebut,ifanything,mayhave beenincreasing(ONDCP,1999).Sofallingdemandcannotexplainthepricedeclines.

Conversely,thestabilityincocainedemandunderminesanotherexplanation, namelythatgrowingdemandcoupledwithadownwa   rdslopingsupplycurveisbehind thecocainepricedeclines.Downwardlyslopingsupplycurvesareunusualbutcanoccur whentherearefewscarcefactorsofproductionandthereareindustry   -wideexternal economiesofscale(Samuelson,1973),whichcould   bethecasefordrugdistribution.

Therisksandpricesmodelsuggeststhatpricesshouldbedrivenbytheintensity ofenforcement,ratherthanitstotalmagnitude.Thatis,itisnotthenumberofpeople lockedupthatmatters,butthenumberofpeo   plelockedupperkilogramsoldorpersome othermeasureofmarketsize.Hence,ifthemarketgrewfasterthanenforcementdid,this expansionmighthavedilutedenforcementrisks   --whatKleiman(1993)referstoas "enforcementswamping."Stabledemand   underminesthisexplanationforcocaine.It couldpossiblyhaveplayedaroleindecliningheroinprices,butReuter(1991)hasargued thatnotonlythelevelbutalsotheintensityofdrugenforcementgenerallyincreased between1980and1990,eventhoug   hitmighthavefalleninitiallybeforerisingsharply between1985and1990.

Learning-by-DoingandOtherEfficiencyGains

Drugpricesmayhavefallenforthesamereasoncomputerpricesdid.The producersmayhavebecomemoreefficientattheircraft   (cf.Cave&Reuter,1988; Kleiman,1989).Ifso,thenevenifincreasingenforcementkeptpriceshigherthanwhat theyotherwisewouldhavebeen,thoseincreasesmighthavebeenoverwhelmedbya general,secularpricecollapse.Thispossibilityisbeing   investigatedempiricallyby Bushwayandcolleagues(personalcommunications).Notethatlearningcantakeplace eitherattheindividuallevel(e.g.,iftheaveragesellertodayhasmoreyearsofexperience thandidtheaveragesellerin1980)orcollect   ively(e.g.,ifevenyoungsellerstodaycan emulateandbenefitfrominnovationsdevelopedbyothersinthepast).

ToughEnforcementMightHavePerverseEffects

Amorepessimisticexplanationisthatenforcementwasnotonlyswampedby naturallyoccurri nginnovationbutthatincreasingenforcementstringencyactually promptedthatinnovation.E.g.,Kleiman(1989)suggeststhattoughermarijuana enforcementencouragedsmugglers,dealers,anduserstosubstituteintococainebecause itwaseasiertoconce   al,andsomehavemadesimilarsuggestionsconcerningthe inventionofcrack(Friedman,1989).

Likewisetheincreasingstringencyofenforcementwasaccompaniedbyachange inwhowasusing,whowasselling,andwherethesellingoccurred.Tocaricature,   in 1980cocainewasarichperson'sdrugpurchasedthroughsocialnetworksfrompeople whomovedinthesameculturalandeconomiccirclesastheusers.In1990,itwasa ghettodrug.Eventhoughmostuserswerenotpoor,mostofthesmallernumberofhe   avy userswhoaccountedforthemajorityoftheconsumptionwere.Andmostsellingwas doneby"professional"sellerswhointeractedwiththeircustomersprimarilytotransact drugs.Oftenthesesellerswereyoungandhadlimitedopportunitiesinlegitim   atelabor markets.Itisnotclearwhichifanyofthesetrendscausedtheothers,butperhaps increasingenforcementdiscouragedsellersforwhomsanctionswereparticularlycostly.

Thecustomarychallengetoargumentsforperverseeffectsis,ineffect,   thatif supplierswereabletocutcostsandincreaserevenueunderprohibitionandstiffer enforcement,whywouldn'ttheyhavedonesounderprohibitionwithstandard enforcement,toimproveprofitsandbeattheircompetitors?Onecangeneratesome plausibleanswers(cf.RasmussenandBenson,1994).E.g.,inanatomizedmarketwith poorinformationflows,itcanbeoptimalforeveryindividualtodothingsinwaysthat othermarketparticipantsrecognizeandunderstand,sochangemaynotoccuruntilan exogenousforcesuchasenforcementmakesthestatusquountenable.Ingeneral, however,theseanswersarecompellingonlyforparticularcontextsandarenotlikelyto explaintheoverallparadoxofpricedeclines.

DiminishingMarginalEffectivenessto   IncreasedEnforcement

Thereareseveralreasonswhyenforcement'smarginaleffectonpricesmay diminishwithincreasingenforcementintensity.Bythemselvestheycanonlyexplain whypricesdidn'tincreaseverymuch,notwhypricesactuallyfell,butt   heycouldhave playedaroleinconjunctionwithotherfactors.

First,therearewhatReuter(1983)callsthe"structuralconsequencesofproduct inequality."Themerefactthatdrugsareillegal,andthatprohibitionisnotrendered vacuousbyacomplete   absenceofenforcement,compelsdrugsupplierstooperatein inefficientways.Forexample,theyhavetroubleestablishingfixedbusinesslocations, advertising,andenteringintoenforceablecontracts.

Second,theconsequencesofsubsequentconvictions   maybelessseverethanthe consequencesofthefirstintermsofreducedlabormarketopportunities,social approbationfromfriendsandfamily,ineligibilityforgovernmentalbenefits,etc. Likewise,extendingsentencesmaybelesscost   -effectivethan imposingshortersentences (Caulkins,Rydell,Schwabe,andChiesa,1997).

Third,ithasbeenhypothesizedthatthelargertheproportionofone'speergroup thathasbeensanctioned,thesmalleristhesocialstigmaofreceivingthatsanction(see Jacobsn&Hanneman,1992;McGraw,1985;Petersilia,1990),aphenomenonthat mightbecalled"stigmaswamping"(followingKleiman'sterm"enforcement swamping,"discussedabove).

TheMarketMayNotHaveBeeninEquilibriumin1980

Therisksandpricesargument   appliestothelong   -runequilibriumprices. Economicsingeneralisvagueabouthowlongonehastowaitforlong   -run considerationstodominate.Theeconomicsofdrugmarketsarenodifferentinthat regard.Cocaineasamass   -marketphenomenonwasrel   ativelynewintheUSin1980. Perhapspricesin1980were"toohigh"inthesenseofbeingoutofequilibrium,and dealersthenwerereaping"supernormal"profits.Ifso,thenthemysteryisnotwhy pricesfellbutratherwhypricesdidn'tfallfaster,   andtheanswermaysimplybethat informationflowsveryimperfectlyinillicitmarketssoittakestimefortheequilibriumto berestored.

Thesepointsarerelevantandmayhavecontributedtothedeclineincocaineand heroinprices.Butevenintot   al,theydonotpresentanentirelysatisfactoryexplanation forwhyenforcementhasbeensosingularlyineffectiveatdrivingupprices.Sowenow introduceanotherpossibleexplanation,namelythatdrugenforcementmaynotdeterdrug dealersinquiteth   ewaytherisksandpricesparadigmwouldsuggest.

TheLimitsofDeterrence

Therisksandpricesparadigmviewsdrugenforcementasworkingthrough deterrence.Agivenintensityofenforcementdeterspeoplefromsellingdrugsatprices thatprovideles sthanacertainmonetaryreward.Increasingenforcementriskreducesthe rangeofpricesatwhichdrugdealingwillbepursued,justasraisingtheriskofarrestfor burglaryrestrictsthenumberofburglariesthataresufficientlyrewardingtocommit.

Towork,deterrencedependsontheobjectoftheenforcementthreatbehaving withsomedegreeof"rationality"inthesenseofconsistentlychoosingcoursesofaction thatimproveone'swell   -beingrelativetothealternatives.AsKleiman(1992)pointsou   t, agentsofthestateincludingthepolicedonotoftenliterallyuseforcetoachieve compliance.Evenwhenapoliceofficerdrawsagunandordersasuspecttoliedown, theofficerisdependingonthesuspecttochoosethebenefitsofcomplyingwitht   heorder overthecostsofnotcomplying,namelybeingshot.Ifthesuspectisn'tcapableof respondingtoincentivesormakingself   -interestedchoices,deterrencewillnotachieve thedesiredend.

Inessence,thequestionweraisehereiswhetherration   alactormodelsdescribe drugdealers'behaviorwellenoughfordeterrencetoworkasisimpliedbytherisksand pricestheory.(SeeMacCoun[1993]forasimilaranalysisfocusingondruguserather thanselling.)Wedonotforaminutedoubtthatmosti   fnotalldrugdealersarecapable ofrespondingtoincentives.Certainly,weexpectmostwouldrespondtothethreatofa policeofficer'sdrawngun.Butthefactthatsomeonerespondstoincentivesisnot sufficientevidencetoconcludethattheyarem   aximizingexpectednetrevenues,utility,or anyotherobjectivefunction.Whenthepriceofagood(oractivity)goesup,individuals whoareconsistentlymaximizinganobjectivefunctionwillnotonlytendtoconsumeless ofthegood,theywillreducec   onsumptionbyaveryspecificamountasdictatedbythe

particularsoftheirobjectivefunctionandthepricechange.Iftheyreduceconsumption butbyadifferentamounttheyarerespondingtoincentivesbuttheirbehaviorwouldnot necessarilybewellp   redictedbyarationalactormodel.

Agapbetweenactualbehaviorandthepredictionsofrationalactormodelscould emergebecauseof"boundedrationality"(Simon,1957).I.e.,theindividualmight rationallychoosesnottomaximizeagiven,narrowobje   ctivefunctioniftheinformation collectionandprocessingcostsaretoogreat.Orthegapcouldstemfrombehaviorthatis notevenrationalinaboundedsense.AsBoyum(1992)observes,thelatterismuchmore plausiblefordrugsellersthanforlicit   businessesbecausedrugenterprisesareessentially neverdrivenoutofbusinessbynegativeaccountingprofits.Theycanoperate indefinitelywithnegativeeconomicprofits(return),butstillmeetpayrollifdealersare notreceivingfullcompensation   forrisk. [4]

Acentralpremiseofthisarticleisthatforthedecisiontoselldrugsdeviations fromanaïvenotionofrationalityarelikelytobelarge,whetherbecauseofbounded rationalityoreven"lessrational"behavior..Inparticular,wehypoth   esizethattheyare largeenoughtoplayanimportantroleinexplainingwhyincreasingenforcement intensityhasn'thadtheeffectonpricesthattherisksandpricesmodelwouldpredict. Fromamodelingperspective,theimplicationisthatthereturnto   dealingneedbeonly weaklyrelatedtothereturnonalternativeactivities.

Wehavenowayatpresenttoquantifythedeparturesfromsimplerationalchoice ondealerbehavior.Thegoalofthispaperissimplytomakeacaseforplausibilityby pointingoutthatthestructureofthedecisiontoselldrugsparallelsstructuresthatthe literaturereportsleadtoperversebehavior,eitherincontrolledexperimentsorin naturalisticsettings.

Thecasehasan   *afortiori* characterinthefollowingsense.   Westrivetoshowthat evenmodestdeparturesfromtheclassicalmodelofdecision   -makingaresufficientto breakthelinkbetweendrugenforcementanddrugprices.Totheextentthatinrealitythe

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[4]Thisimpliesthatthezerolong   -runeconomicrentsassumptionunderlyingtherisksandpricesparadigmis astrongerassumptionwhenappliedtodrugenterprisesthanitiswhenappliedtomoretypicalfirms.

decisiontoselldrugsisevenmorespontaneous,emoti   onal,andidiosyncraticthanwe describe,thentheconclusionholdswithevengreaterforce.

Consistentwiththisafortioricharacter,weconsiderhowthedecisiontodeal mightlooktosomeonewhotriestolookcarefullyandquantitativelyatdataconce   rning thebenefitsandcostsofselling.Thisdiscussionispursuedintwoparts.Firstwe considersomeonewhohasaccurateandrepresentativedataconcerningtheprobabilities andconsequencesofvariousoutcomes.Thenweconsiderreasonswhythese"i   nputs"to thedecisionprocessmaybebiased.Wealsodistinguishbetweenthreestagesofa dealingcareer:thedecisiontosellforthefirsttimeorfirstfewtimes,thedecisionto escalatetoregularselling,andthedecisiontocontinuesellingeven   afterbeing sanctioned.

TheInitialDecisiontoSellDrugs

Todiscusshowhumanfrailtiesmightplayhavocevenwithadata   -drivenattempt toweighcarefullythebenefitsandcostsofsellingdrugs,itishelpfultousespecific numbers.Thedecision   modeldescribedisbynomeansthemostsophisticatedor inclusiveonecoulddevise.Wekeepitsimpleforexpositionalpurposesandtrustthe readertoseethatthepointsmadearerobustwithrespecttosuchelaborations.

Mostapplicationsoftherisk   sandpricesframeworkhaveassumedthedecisionto dealcanbemodeledasifitismadeonanexpectedvaluebasis(e.g.,Rydell& Everingham,1994;Caulkinsetal.,1997).Thatis,themarginaldealerisperceivedas someoneforwhomtheexpectedvalue   ofthebenefitsofdealingequalstheexpected valueofthecosts,includingtheopportunitycostofnotdealing.

Reuter,MacCoun,andMurphy(1990,pp.102   -105)includeanexampleofthis approach.Theyestimatedthatsomeonewhosellsdrugsregularlyfo   rayear(atretail,in Washington,DC,inthe1980s)madeanaverageof$27,000peryear,netofthecostof buyingthedrugs. [5]Reuteretal.estimatedthatsuchanindividualfacesasevenpercent chanceofseriousinjury,a1.4%chanceofbeingkilled,   anda22%probabilityof

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[5]Regulardealersaredefinedasthosewhosold   "daily"orseveraldaysperweek.Itexcludesthosewho reportedonlysellingononedayperweek.

incarceration with an estimated average time served of 18 months. They hypothesize that these individuals might value a serious injury at $30,000, a 1% risk of death at $7,500, and a year in prison at the opportunity cost in terms of lost wages ($27,000 per year), and thus describe the average return to a year of regular dealing as:

$$\$27,000 - [0.07*\$30,000 + 0.014*\$7,500 + 0.22*1.5\text{years}*\$27,000/\text{year}]$$
$$= \$5,500\text{per year}$$

Assuming regular dealers spend an average of 15.9 hours per week selling, this works out to $6.65 per hour worked. [6] Ignoring taxes, that is close to the median hourly wage for legitimate work reported by subjects who had such work ($7 per hour). This rough equality between the opportunity cost of time spent dealing and the accounting profits net of the monetary value of expected non-dollar costs also held at the industry level in the mid to late 1990s (Caulkins and Reuter, 1998).

Even though these expected value calculations "add up" surprisingly well given the quality of the data, the expected value model may be too simple in important ways. For example, with expected value calculations it makes little difference whether the decision to sell is described in terms of payoffs per week, per month, or per year of selling. Monthly and annual calculations are convenient because various data are available in those time increments, but the choice is almost arbitrary. [7]

However, when the utility function being optimized is more complicated, e.g., because the individual is risk averse, expected monetary value is not a sufficient guide to choice. Non-linearity in utility as a function of payoffs can imply that it matters what time frame is contemplated, and for a variety of reasons the decision to sell for the first time is not likely to be perceived as a decision to sell for a year.

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[6] Reuter et al.'s sample included 67 daily sellers and 71 people who sold several times per week, and they use a figure of 4 hours worked per day of selling. We assume daily sellers sold five times per week, those who sold several times per week sold three times, and, therefore, that average number of hours worked per week by a regular seller is 15.9.

[7] Whether it is literally arbitrary depends on what happens when dealers are arrested or killed midway through a planned period of selling.

Someoftheseereasonsarepsychological.Withrespecttoprobabilityjudgment, peopleoftenfailtounderstandthatactivitieswithsmallper   -transactionriskscanhave verylarg ecumulativerisks(Doyle,1997).Withrespecttotheevaluationofoutcomes, peopletendtoframechoicesnarrowlyandlocallyratherthanbroadlyandglobally(see Kahneman&Tversky,2000).Anditislikelythatdrugdealing(likeothercrimes) disprportionatelyattractsthosehighinimpulsivityandlowinselfcontrol(Gottfredson &Hirschi,1990),implyingshorttimehorizons.

Therearealsostructuralfactorsthatdiscouragelong   -termplanning.Drugdealers havenoemploymentcontractsorun   ionrulesprohibitingpart -timeworknorminimum timecommitmentsasinthemilitary.Part   -timesellingor"moonlighting"asadrugseller iscommon(Reuteretal.,1990),andthemorenaturalunitofcommitmenttosellingisto carryoutonecycleofbuy   ingdrugsfromasupplier,dividingthepackagesintosmaller units,andsellingthosesmallerunitstocustomers.Suppliersgenerallytakeadimview ofeffortstoreturnmerchandise;theyoffernomoney   -backguarantees.Thismakesit costlytoabandon   dealingmid -cycle,butcyclesareshort,typicallyrangingfromafew hourstoafewdaysoraweek.Thereisnoyearlongobligation.

Thuswhensomeoneisconsideringwhethertoselldrugsforthefirsttimeitis probablymorerealistictodescribethe   masdecidingwhethertoexecuteonedrugselling cycle,notdecidingwhethertocommittosellforalongerperiodoftime,suchasayear. Consistentwiththisargument,Reuteretal.(1990,p.82)foundthatrelativelyfew adolescents(inasamplethat   includedquiteafewdrugdealers)thoughttheywouldsell drugsaftertheyleftschool,eventhoughdealingwasactuallymoreprevalentamong oldercohortsintheirneighborhoods.

Decisiontreesareausefultoolfordepictingchoices(Raiffa,1968).   Figures1a and1busedecisiontreestoillustratehowthe"commitforayear"and"commitfora cycle"perspectivesdiffer.Ineachcasethechoice,representedbyabox,istoselldrugs ornot,andineachcasetheresultofchoosingtoselldrugsisu   ncertain,representedby thearrowsemanatingfromthecircle,withoutcomesrangingfromverybad("death")to verygood("successfullysellingthedrugswhileincurringnosanction").Thespecific payoffsandprobabilitiesdiffer,however.Oneismore   likelytoevadesanctionwhile sellingonecycleasopposedtooneyear(99.3%chancevs.onlya64.1%chance),butthe
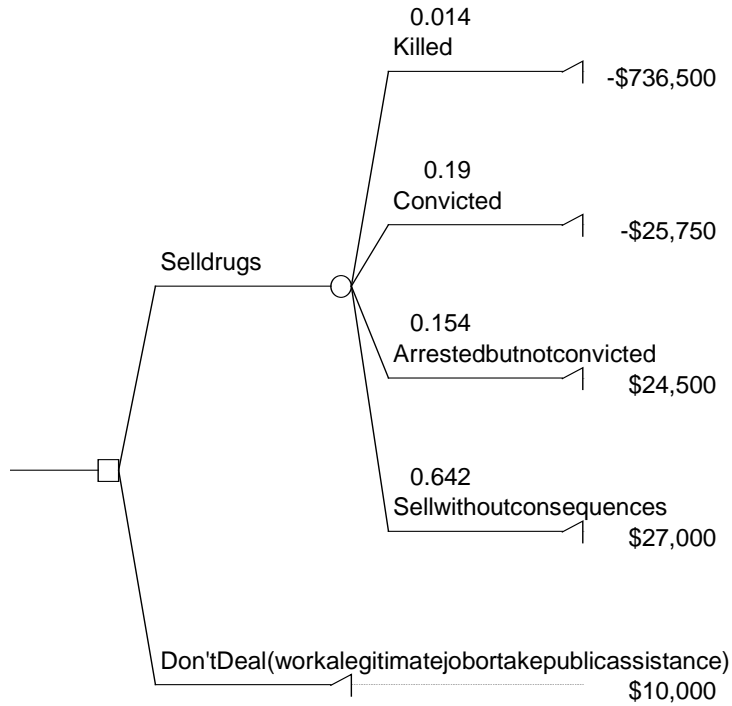
payofffordoingsoismoremodest($450vs.$27,000).

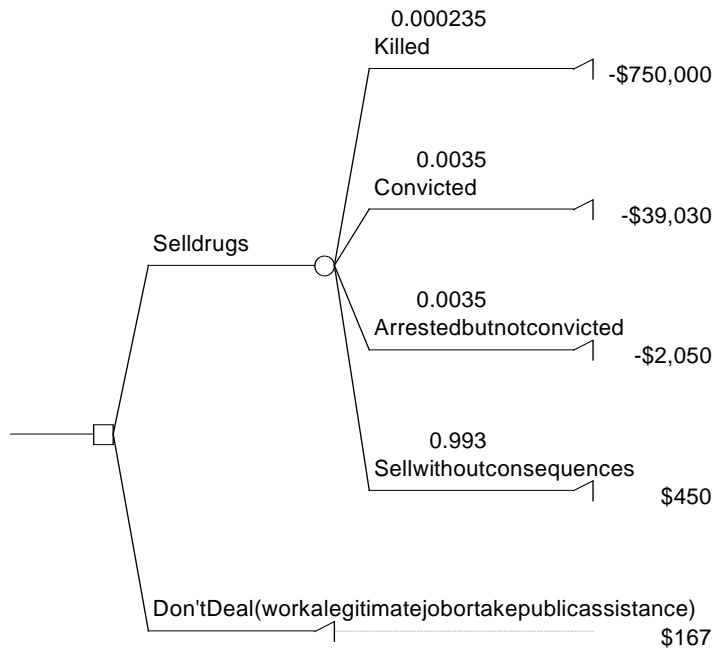**Figure1a:TreeforSellingforOne** *Year***withZeroPointBeingNotMakingAny Money**

Figure1b:TreeforSellingforOne *Cycle***withZeroPointBeingNotMaking AnyMoney**

The risks, valuations of outcomes, and definition of a cycle are specified in Appendix A. The arrest and conviction probabilities are derived from national data, but are quite similar to the Washington DC-based figures used above. We assume a regular dealer can complete 60 cycles per year. The relationship between the per-cycle and per-year probabilities of adverse outcomes is that implied by a "Bernoulli Process" or "coin toss" model. For example, if the probability of being killed during one cycle is p, we assume the probability of being killed while attempting to execute 60 cycles is $1 - (1 - p)^{60}$. We do not think the Bernoulli model is descriptively accurate, but we want to suppress issues such as discounting, diminishing returns, and skill increasing with experience in order to make the contrast between Figures 1a and 1b be a function only of the time horizon.

We suspect that more people find the "deal" option appealing in Figure 1b, which takes a per-cycle perspective, than prefer the "deal" option in Figure 1a. Agreeing to sell drugs for a year is agreeing to a one-third chance of criminal sanction and a one-in-five chance of being incarcerated. A one-in-three chance of failure is sobering. Recall the warning to freshmen in the past when university retention rates were lower. "Look left. Look right. One of the three of you will not graduate."

On the other hand, in Figure 1b there is a better than 99% chance of getting away without any adverse consequences. One does not have to be Don Quixote to "give it a go" when the chance of suffering any adverse consequence is less than one in a hundred.

Indeed, some well-known psychological tendencies might lead individuals to choose to deal when looking at Figure 1b even if they would not do so in Figure 1a. In particular, Prospect Theory (Kahneman & Tversky, 1979) suggests that people are risk-averse with respect to gains and risk-seeking with respect to losses, with gains and losses defined around some reference point (see Appendix B). The reference point can depend on the framing of the decision; in Figures 1a and 1b we describe the reference point as the status quo if he or she neither sells drugs nor works in the alternative employment. If one evaluates the choices in Figures 1a and 1b with utility functions of the form:

$U(x) = f(x)$ for $x > 0$

$\quad -f(-x)$ for $x < 0$

foravarietyoff(x),sellingispreferablewhencontemplatingasinglecycle,butnot

sellingispreferredwhencontemplatingayear   -longcommitment. [8]

Anotheraspectofprospecttheoryisthatlossesareperceivedmorepoignantly

thanaregains,sotheremaybea"lossaversionmultiplier"($\lambda>0$)suchthat

$U(x)=f(x)$forx>0

$-\lambda f(-x)$f orx<0.

When $\lambda=2.25$andf(x)=x $^{0.88}$(typicalvalues)dealingisnotthepreferredoptionfroma

percycleoraperyearperspective,becauselossesareweightedsoheavily.Butifone

adoptedmoreoptimisticparameters(e.g.,profitpercyclewere\$ 650insteadof\$450or

arrestandconvictionprobabilitieswereone   -thirdasgreat)thenthe"Deal"option

becomespreferredunderthepercycleperspectivebutnottheperyearperspective.Of

courseiftheparametersareoptimisticenough(e.g.,aprofi   tpercycleof\$1000)thenthe

"Deal"optionbecomespreferredwitheitherframing.Thepoint,though,isthata

tendencytoberisk -aversewithrespecttogainsandrisk   -seekingwithrespecttolosses

canmakethe"Deal"optionrelativelymoreappealing   withthepercycleperspective.

Anothercomponentofprospecttheory,however,pointsintheoppositedirection.

Thereisevidencethatpeopleweightoutcomesnotbytheirprobabilitiesbutbya

nonlinearfunctionofthoseprobabilities(AppendixB).In   particular,"diminishing

sensitivity"impliesthattheimpactofagivenchangeinprobabilitydiminishesasone

movesawayfromeitherextremeofcertainty(i.e.,foroutcomesthatoccurwith

probabilityzeroorone).Sincedecidingtodealforevenone   cyclemovestheprobability

ofarrest,incarceration,anddeathfromzerotoapositivenumberandtheselow

probabilitiesgetamplifiedbythedecisionweightingfunction,thisphenomenonwould

tendtodiscouragepeoplefromdecidingtodealwhenconside   ringthe"per -cycle"

perspective.Indeed,anactorapplyingprospecttheory'snonlineardecisionweighting

functionwouldnotchoosetodealdrugsgivenanyofthedecisiontreesweexaminein

thispaper,evenincaseswhereexpectedvaluetheorypredicts   drugdealing.

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[8]Functionsf(x)forwhichthisistrueincludef(x)=ln(x+1),sqrt(x),1   –exp(-x/R)forRlessthanabout

30,000,andx $^{\beta}$for βlessthanabout0.9.

Howthisnonlineardecisionweightingplaysoutinpracticeiscomplicatedbythe factthatinrealitythe"Don'tDeal"optioninvolvessomerisk.E.g.,foraproperty criminalwhohasabaselineannualarrestriskof0.2,thenonlineardec   isionweighting wouldtendto*reduce*   ratherthanincreasetheweightplacedonadditionalriskofarrest. Stillsuchargumentsareunlikelytoapplytotheincrementalriskofdeath.Veryfew peoplehaveabaselinedeathriskofmorethanafewpercento   vertheirrelevantplanning horizon.TverskyandKahneman(1992,p.303)arguethatthisnonlinearfunction"isnot well-behavedneartheendpoints,andverysmallprobabilitiescanbeeithergreatlyover   - weightedorneglectedaltogether."Perhapssomepe   oplearerepelledbythe"percycle" framing,e.g.becausenonlinearweightingamplifiesthedeathrisk,andtheyneversell, butothersviewtheprobabilitiesofdeathasessentiallyzeroandhavehighbaselinerisks ofarrest,sotheyproceed.Sincenot   everyonedecidestoselldrugs,weonlyneedto understandwhysomepeoplemightnotbedeterred,notwhynonearedeterred.

Atanyrate,thefundamentalobservationisthatunlikeexpectedvalue calculations,prospecttheorysuggeststhattheduration   ofdealingcontemplated(one cycleoroneyear)canaffectwhetherthe"Deal"or"Don'tDeal"optionseemsmore appealing.Ifthedurationisonecycleandthetendencytoberiskaversewithrespectto gainsandriskaversewithrespecttolossesswamps   thenonlinearweightingeffect,then someonewhowouldnotagreetosellforayear,mightstilldecidetosellforacycle.

TheDecisiontoContinueSellingDrugs

Themechanismjustdescribedmayhelpexplainwhysomepeopledecideto executeadrugse   llingcycleonceor,byextension,afewtimes,eveniftheywouldnot commitinitiallytosellingdrugsforanentireyear.Yetthephenomenonweseekto explainisnotwhysomepeopledabblewithdealingbutwhysomanybecomeregular dealersinthefac   eofstiffenforcement.Istheresomethingabouthavingsoldamoderate numberoftimesthatmakespeoplemorewillingtocommittosellingonanongoing basis?Inshort,theanswerisyes.

Akeyinsightisthatmostpeoplewhoexecuteafewsellingcyc   lesincurno sanctionforthatactivity.WiththeparametersinFigure1,fewerthanfourinahundred peoplewouldexperienceanyadverseoutcomeduringtheirfirstmonthofregularselling

(fivecyclesatapaceof60cyclesperyear).Nineoutoften   sellforthreemonthswithout incident.

   Figure1assumedthedecisionmakersassessedgainsandlossesrelativetowhat theyhadbeforedecidingtoselldrugs,namelynothing.Oncesomeonehassuccessfully solddrugsforafewcycles,thezeropointmigh   tchangetotheoutcomethenbeing experiencing,namelysellingdrugsandnotgettingcaughtmakestheper   -yearandper - cycledecisiontreesbecomethoseinFigures2aand2b.Thatpeople'sreferencepoints caneasilybeswayedinamannersuchasthisis   acentralfindingofprospecttheory.
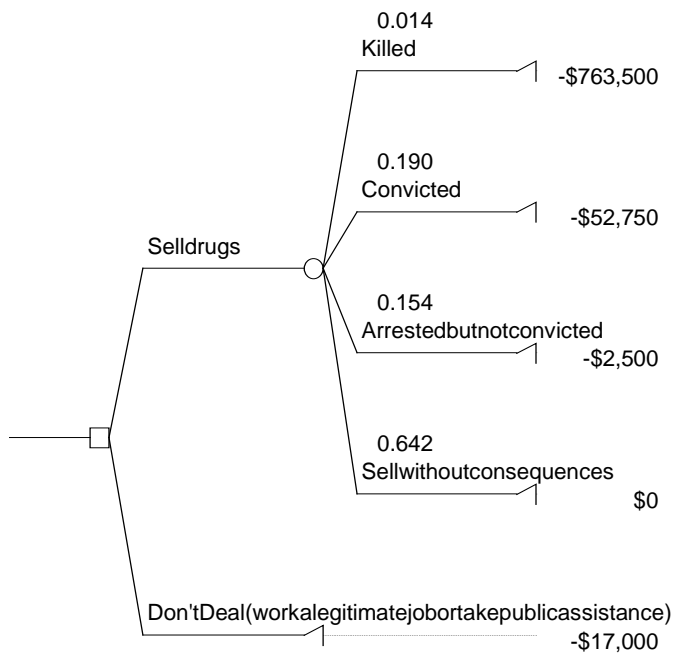

Figure2a:TreeforSellingforOne   *Year*withZeroPointBeingSellingSuccessfully

0.000235
Killed
-$750,450

0.0035
Convicted
-$39,480

Selldrugs

0.0035
Arrestedbutnotconvicted
-$2,500

0.993
Sellwithoutconsequences
$0

Don'tDeal(workalegitimatejobortakepublicassistance)
-$283

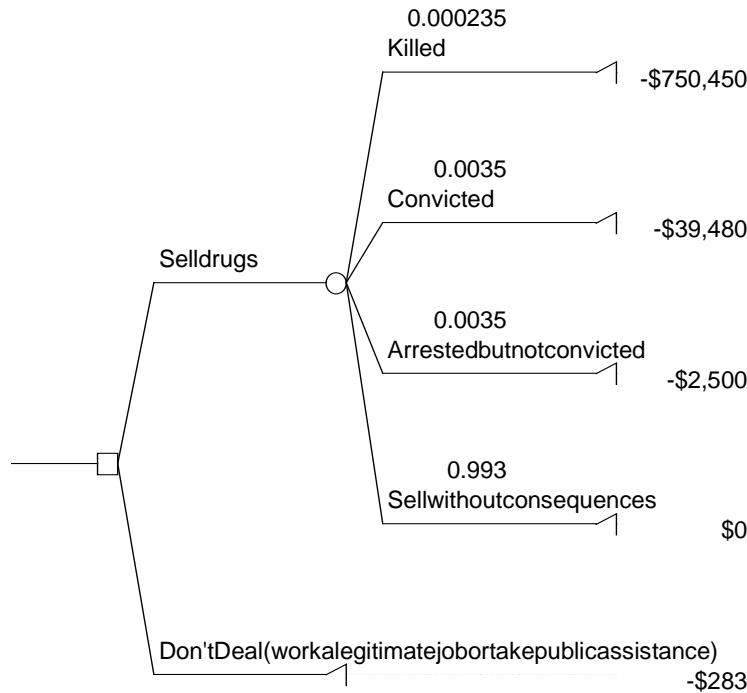**Figure2b:TreeforSellingforOne   *Cycle*withZeroPointBeingSellingSuccessfully**

Thisreframing,orshiftingofthe   zeropoint,couldmakedealingonanon   -going basisconsiderablymoreappealingrelativetothealternativebecause"riskseekingis prevalentwhenpeoplemustchoosebetweenasurelossandasubstantialprobabilityofa largerloss"(Tversky&Kahneman,   1992).AsFigure2shows,whensellingsuccessfully isthezeropoint,thedecisiontostopsellinggeneratesaguaranteedloss.Ifthistendency toberisk -seekingwithrespecttolossesisstrongenough,thenthere   -framingmakes sellingforayearmo   reappealingthanworkingforayearatanotherjobevenifsellingfor ayearwouldnotbepreferredinFigure1a.Indeed,thatisthecasewithallofthesimple utilityfunctionsmentionedabove.

JudgmentalErrorsandBiases

Evenifwearewrongand   dealersdointegrateriskandoutcomeinformationina completelyrationalmanner,itishighlyunlikelythattheycouldaccuratelyassemblethe relevant *inputs*tothechoiceprocess.Themostobviousproblemislackofrelevantdata. Drugpolicyanalyst slackgoodestimatesoftherisksandrewardsofdrugselling,and thereislittlereasontobelieveindividualcitizens,throughcasualinduction,couldeven

approximatetherelevantparameters.Furthermore,therearereasonswhyprospective
dealers'es timationerrorsmightnotonlybelargebutalsobesystematicallybiasedin
waysthatunderminetheabilityofenforcementtodeterdealing   .

AvailabilityHeuristic

      Prospectivesellersmightunderestimatetheaverageriskofsellingbecauseofthe
stru ctureandcomplexityofthedecisiontree.Sellingdrugsinvolvesalargenumberof
actions,anyoneofwhichcouldgowrongfromthedealer'sperspectiveandleadtoinjury
orarrest.Thesuppliermightdefraudtheprospectiveseller.Thesellermight   berobbed.
Anyofthesellers'customersmightturnouttobeaninformant.Asalemightbe
observedbyapoliceofficer.Peopletendtoignorethefullrangeofplausiblecausesof
failurewhenassessingacourseofaction,whichcanleadtosignifican   tunderestimation
ofthetotalprobabilityoffailure(Fischhoff,Slovic,&Lichtenstein,1978;Ofir,2000).

      Also,aspectsofthearrestandincarcerationprocesstendtodilutecasual
observers'estimatesofenforcementrisks.Thereisnodenyingthatar   restsareoftena
dramatic,salientevent.Atthesametime,arrestsarefairlyrareandrelativelyfew
citizenswitnessthem.Incarceration,bydefinition,reducesthevisibilityofthe
incarcerated.Thus,dealerswhoareincarceratedwillbelessvisi   blethandealerswho
aren't.Moreover,arrestsandincarcerationareclusteredbecausepolicetargetdealing
organizationsaswellasindividualsandtheyuseinformationfromarresteestolocateand
arrestotherdealers.Thusformostpeoplewhohaveno   tbeenarrested,thefractionof
drugsellingacquaintanceswhohavebeenarrestedwillbesmallerthanthefractionofall
sellerswhohavebeenarrested.Ifpeopleestimatetheprobabilityofarrestbasedonthe
fractionoftheirfriendswhohavebeena   rrested,theywillsystematicallyunder   -estimate
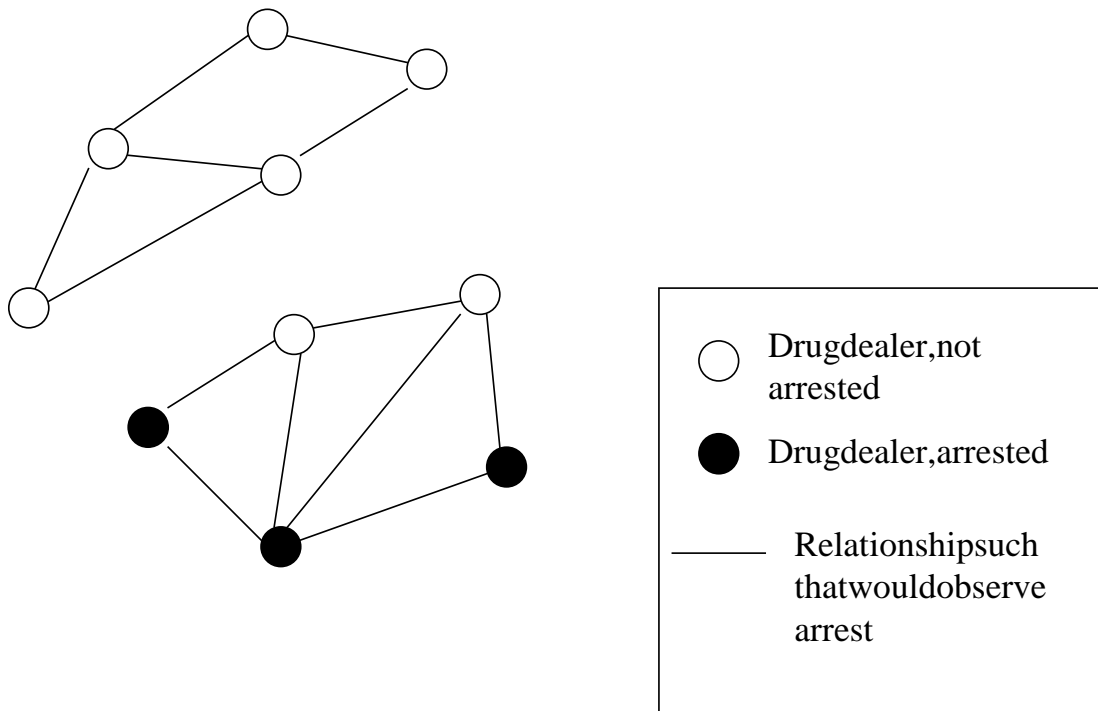theirarrestrisk.ThispointisillustratedinFigure3.

Figure3:EffectofClusteringofArrests

OptimismBias

Asecondfactorthatwilltendtopromotethedecisiontodealis"optimismbias,"
thegeneraltendencyofpeopletohaveunrealisticoptimismabouttheirpersonalriskof
experiencingnegativeevents,eveniftheyhaveanaccuratesenseoftherisksincurredby
peoplegenerally(seeWeinstein,1980;Weinstein&Klein,1996.)Afamiliarv   ariantis
thatthemajorityofdriversconsiderthemselvestobemoreskillfulthantheaverage
driver(Svenson,1981).MacCoun(1993)suggeststhatdrugusersanddrugsellersare
likelytosufferfromasimilarbias.

VicissitudesoftheMoment

Onereasonsomeonemightsellforacycle,eveniftheywouldn'tsellforayear,is
thattheyhaveverycompellingreasonsforneedingcashquickly.   T heremaybemoments
inthechaoticandcash   -constrainedlifeofayoungadultwhenthedesireforquickcash
seemsparticularlyurgent,whetherthereasonsaredramatic(e.g.,owingmoneyto
someonewhowillpunishnon-   paymentwithphysicalassault)orpedestrian(wantingto
impressadatebyspendinglavishly).

Intoxication

Perhapsthemostobvioussourceof   distortedjudgmentsisthatahighfractionof drugsellersareactivedrugusers.Thiswastrueevenattheheightofthecrackepidemic whendrugsellingwasarguablyatahistorichighpoint;evenabstainerswhobecame sellersoftenlatersuccumbedto   temptationandbecameheavyusers(Reuteretal.,1990). Streetdrugstendtoimpairthesamekindoffrontallobe"executivecognitivefunctions" thatarenecessaryforrationaldeliberationandplanning(Fishbein,2000).

Over-GeneralizationfromEarly   Successes

Supposethatforwhateverreason(per   -cycleframingeffects,intoxication,etc.) someonesellsforafewcycles.Asmentioned,mostlikelytheywouldnotsufferany adverseconsequences.Giventhatexperience,howshouldsuch"successful"selle   rsview therisksofcontinuingtosell?

InthespiritofBayesianstatistics,one'sposteriorprobabilityestimateshould combineone'spriorestimatewiththenewinformationobtainedbyhavingsoldwithout incident.Statistically,limitedexperiencesh   ouldprovidelimitedconfidence,butpeople arenotoriouslyinsensitivetosamplesizeandtendtogivemuchgreaterweighttosalient personalexperiencesthantomoreabstractbaseratestatistics(Kahneman&Tversky, 1974).Perceptualdeterrencestudie   sonpettycrimeslikemarijuanasmokingand shopliftingshowthatoffenderswhodonotgetarrestedtendtorevisedownwardtheir estimatesoftheprobabilityofcriminalsanctions(seeMacCoun,1993,Paternoster, 1987).Itseemsplausiblethatsimilar"   experientialeffects"wouldoccurfordrugselling.

Moreover,severalpsychologicalandsocialmechanismsmakesellingthefirst timelike"crossingtheRubicon."Psychologically,onehascrossedasymbolicmoral threshold;onceyouhavesolddrugsonce,   thepersonalshameofsellingasecondtimeis greatlydiminished(MacCoun,1993).Thereislikelytobeasimilarlydiminishing marginaleffectofthepublicstigmaassociatedwithbeingadrugseller,evenifoneisnot arrested.Indeed,thelabelingt   heorytraditioninsociologyandpsychologywouldpredict thatthisstigmawillpushtheoffenderfurtherfrommainstreamopportunitiesand relationshipsandfurthertowardcriminality.

ImplicationsforDeterringOtherTypesofActivities

Theforgoingsu ggeststhatvariouscognitivefactorscancombinewithframingto "enticeandtrap"peopleintochoosingtobecomeregulardrugsellers.Notethis"trap" stemsfromthefundamentalstructureofthisdecision,notitsdrug   -relatedcontext. Hence,ifthet   rapisanimportantcontributortotheprevalenceofdrugselling,itmayalso berelevantforotherhigh   -riskbehaviorssuchasspeeding,drivingwhileintoxicated, usingaddictivedrugs,engaginginunprotectedriskysex,andparticipatinginextreme sports.Conversely,insightsandintuitiondevelopedinthosecontextsmaybe informativewhenanalyzingdrugpolicies.

Thefundamentalstructureisthefollowing.Weobservethatmanypeople repeatedlyengageinriskybehaviorsforwhichtheprobabilityo   fseverelossper "transaction"ismodestbutforwhichthecumulativeprobabilityofseverelossfrom ongoingparticipationissubstantial.Inparticular,thisoccursevenwhenthecumulative risk,coupledwiththemagnitudeoftheloss,issolargethat   itisnoteasytoexplainwhy somanypeopleengageinthebehaviorsofrequently.

Inallthesecontexts,itiseasytoimaginethatthefirsttimepeopleundertakesuch anactivity,theyareonlydecidingto"takeachance""justthisonce".Theydo   not necessarilymakeaconsciousdecisiontoabandontheirpreviouspatternofprudent behavioraltogetherandcommittoparticipatingintheriskyactivityforsomenumberof years.Thatis,thedecisiontoengageintheriskyactivityisdoneatfirst   ona"per transaction"basis.

Thereareavarietyofreasonswhysomeonewhowouldnotcommittoarisky activityonanon   -goingbasismightdosoforatransactionortwo.Weintroducedone novel,structuralexplanationthatstemsfrombeingrisk   -aversewithrespecttogainsand risk seekingwithrespecttolossesrelativetothestatusquo,whichisthenatural referencepoint(intheprospecttheorysenseoftheword).Therearealsomathematically lessinterestingbutprobablymorecommonreasons(intoxication,peerpressure,extreme moodsorcircumstances,etc.).

Inalllikelihood,anindividualwhodecidestotakethegambleonahalfdozenor sooccasionsforwhateverreasonswillsuffernoadverseconsequencesbecausethe

probabilityoflosson   anyonetransaction,orevenanysixortentransactions,isnotgreat. Atthispointvariousbiasesdiscussedabovemaytakeeffect(e.g.,thesalienceofthe individual'sownrecent"success"relativetoabstractstatisticsdescribingfrequentfailure andthetendencytomovethereferencepointtobetakingthegambleandwinningas opposedtonotgambling).Atendencytoberiskseekinginthefaceoflossesmaythen maketheindividualdecidetopersistintheactivity.

TheDecisiontoContinueS   ellingDrugsEvenAfterReceivingaSanction

Thepprevioussectionssoughttoexplainwhyindividualsmightstartsellingdrugs eveniftheobjectiverisksofdoingsoarehigh.Butmostpeoplewhosellfulltimefora periodofyearswilleventuallyget   arrested.Theriskpercycleisnotveryhigh,butthe cumulativeriskoverhundredsofcyclesis.Whenenforcementintensityincreases,the numberofcyclesuntilthefirstarrestshouldgodownandtheconsequencesofarrest shouldgoup.Evenifenfo   rcementisnotveryeffectiveatpreventingpeoplefrom startingtoselldrugs,whydon'tpeoplestopsellingwhentheygetarrested?Empirically recidivismiscommon,andatfirstblushthatishardtounderstandinaneraofsevere sanctions.

Weoffer threeclassesofexplanations.First,wedescribedthechoicesavailable totheindividualassellingdrugsorworkingatanotherjob,perhapsinthelegitimate economy.Howeverappealingworkinginthelegitimateeconomywasbeforethe individualisarested,thatalternativeislikelytobelessappealingafter.Duringthe monthstheindividualwassellingsuccessfully,heorshewasprobablynotbuilding humancapitalinwaysthatarerewardedbythejobmarket.Furthermore,arrestand convictionca ndirectlyreducelabormarketopportunities(Freeman,1995).Tougher enforcementmightevenreducethereturnsconvicteddealerscanearnfromlegitimate workifitstigmatizesthem.

Second,theaveragesanctionfollowingarrestforadruglawviolation   isquite severe,butthemodeandmedianarenot.Arrestees,particularlyfirsttimearrestees,have arelativelylowprobabilityofbeingincarcerated,eventhoughiftheyareincarcerated, thesentencecanbequitesevere.

In particular, in Appendix A we estimate that only half of arrests for drug sale or manufacture lead to a conviction.[9] That implies that the modal and median sanction given arrest is nothing but the arrest itself. Of those who are convicted, only about half are sent to prison, with another quarter sentenced to jail. Furthermore, many drug-sentencing statutes have enhanced sanctions for repeat offenders. Since the overall averages pool outcomes for first-time and subsequent convictions, this implies that the sanction following the first conviction is even less likely to involve incarceration. In some sense the criminal justice system currently gives drug sellers one or two relatively free bites of the apple (Caulkins & Heymann, 2001). There are compelling arguments for being lenient with first time offenders. Enhancing deterrence is not one of them.

Most drug sellers may initially fear the consequences of arrest. If they then experience no substantial consequence from an arrest, that arrest might lead them to revise down not up their assessment of overall enforcement risk. That is, even if they revise upward their estimate of the probability of arrest, they might revise down their estimate of the severity of the consequences of arrest. This possibility is merely a conjecture, but there is evidence that the average person over-estimates the probability of arrest and the severity of sanction (see MacCoun, 1993 for a review) and Kim et al. (1993) find that drug offenders who were given only probation upon (second) conviction had a very high propensity to recidivate. So it is at least plausible that arrest and conviction can lead the seller to see the criminal justice system as a paper tiger – until the conviction that sends the individual away for many years, at which point perceptions and deterrence are irrelevant and incapacitation dominates.

Also, depending on their experiences behind bars, memories of an incarceration experience are likely to be less aversive than either the actor's original expectations, or the actual experience as it occurred (see Frederick & Loewenstein, 1999, for a theoretical analysis and review of relevant evidence; also see Petersilia, 1990). Due to both psychophysical adaptation and social coping, the early period of imprisonment is likely to

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[9] Drug sellers are also arrested for drug possession, but the conviction rate for possession arrests is probably even lower.

bethemos taversiveformostinmates.Butmemoriesoftheeventwillbestrongly
influencedbyarecencyeffect.

Finally,foravarietyofreasonsanadverseoutcomeafterastringofsuccesses
mightnotchangebehaviorasmuchasanaïvebehavioralmodelmight   suggest.Forone,
decision-makingexperimentationillustratesthatindividualsexhibitastrongstatusquo
bias,atendencytoremainwithaparticularalternativeeventhoughthatalternativemay
notbethebestchoice.Relatedisaconfirmationbiasth   atleadspeopletoreinterpret
informationthatappearstobecontrarytotheirpriorbeliefs,e.g.,aboutthelowlikelihood
ofgettingarrested.And,peoplefrequentlyshowaself   -servingtendencytoattributetheir
successestoskillandtheirfailures   tobadluck(Zuckerman,1979),sosellersmayview
thefailures(arrests)asanomalousevents.

WhyPricesMightFallWhenEnforcementIntensityIncreases

Theparadoxthatmotivatedthispaperwastheobservationthatdrugprices
declinedwhenenforcem entintensityincreased.Theforgoingdiscussiongavesomehints
astowhyincreasingenforcementmighthaveperverseeffects,butforthemostpartit
arguedsimplythatpricesmaynotbecloselyrelatedtoenforcementrisk.Thatmayhelp
explainanabs enceofapriceincrease,butitdoesnotinandofitselfexplainaprice
decline.

Recall,though,thatthereareotherfactorsthatwouldhavetendedtodriveprices
down(learningbydoing,pricesinitiallyhavingbeen"toohigh",etc.).Iftherisks   and
pricesmodelwereaccurate,onewouldhaveexpectedthesefactorstobetrumpedbythe
effectsofincreasingenforcementintensity.If,however,cognitiveandperceptual
limitationsvitiatetheprice   raisingeffectsofincreasedenforcementintensity,   thenthese
otherwisesecond -ordereffectsmightbecomedominant.

Thatis,theargumenthereisnotthatapsychologicallymoreplausiblemodelof
theresponsetoincreasedenforcementisthatenforcementhasaperverseeffectonprices.
Rather,theconj ectureisthatthesefactorssodilutetheimpactofenforcementonprices
thatotherfactorsbecomemoreprominentthanthe"risksandprices"calculationswould
suggest.

Thisisperhapsbestexpressedbyreturningtoandmodifyingtherisksandprices equation.DividingEquation(1)throughbyquantityandrearrangingyieldstheclassic risksandpricesequationforretailprices:

Retailprice=costofdrugstodealer+compensationforopportunitycostoftime +dollardenominatedproductionanddis   tributioncostsperunitsold +dollarvaluationofnon   -dollarrisksperunitsoldfromenforcement&violence.

Theconjectureraisedhereisthat(1)non   -dollarrisksmaynotbefully compensatedand(2)therecanbeadisjunctionbetweenthesellingp   riceandthetotal productioncosts,i.e.,therecanbeagapor"error"betweentheleftandrighthandsides ofthisequation.Thus,

Retailprice=sourceprice+compensationforopportunitycostoftime +dollardenominatedproductionanddistribut   ioncostsperunitsold + α*dollarvaluationofnon   -dollarrisks+ ε,

where αistheattenuationfactordescribingtheextenttowhichnon   -dollarrisksarenot fullycompensatedand εisthe"error"term.Inthelanguageofthisnewmodel,the centralconjectureofthispaperisthat $\alpha<1$.Theobservationthatmostoftheissues discussedaboveexplainwhyincreasingenforcementmighthaveadilutedbutnot perverseeffectofpricesisconsistentwithabeliefthat $\alpha>0$.Theoreticallytheactual valuecouldbemeasuredempiricallyfromdataseriesonpricesandthevariousright   - handsidevariablesoncetheerrorterm εisunderstood.

However,atpresentthereisnowaytomodelorquantifytheerrortermbecauseit isanatheoreticalresidual.The   "risksandprices"paradigmofferedconcretepredictions about $\alpha$and ε.Inanutshell,thattheorywas $\varepsilon=0$and $\alpha=1$.Ithasbeenapopular theorynotsomuchbecauseitisuniversallyheldtobeagoodmodel,butratherbecauseit isalmosttheonly   gameintown.Unfortunately,ifthattheoryiswrong,thereisnot anotherstrongcompetitorstandinginthewings.

Conclusion

The"risksandprices"frameworkgivesaclearandplausibleargumentforwhy enforcementintensityshouldbepositivelyrel   atedtodrugprices.Empirically,however, cocaineandheroinpriceshavefallensharplyoverthelast20yearseventhough enforcementintensitygrewsubstantially.Avarietyoffactorscouldhelpexplainthis. Hereweexploreonethathasnotreceived   muchattentiontodate.

Therisksandpricesimageofindividualsmovingintoandoutofdrugsellingina waythatbalancestheexpectedreturnfromsellingandalternativeactivitiesmakesstrong assumptionsabouthumandecisionmakinguveruncertain   ty.Inparticular,itassumes thatdrugsellersperceiveandestimatetherelevantprobabilitiesandconsequencesfairly accuratelyandthattheymakechoicesbasedonexpectedpayoffs.Researchonhuman decision-makingsuggeststhattheseconditionsare   notalwaysorperhapsevenoften satisfiedinpractice.Totheextentthatthesecognitivebiasesandheuristicsareprevalent amongprospectiveandactivedrugsellers,theycouldhelpexplainwhyenforcementhas notbeenamoreeffectivedeterrent.In   particular,iftheyaresufficientlyprevalent,there isnoreasonwhytheexpectedreturntodrugsellingneedbearanyparticularrelationship totheexpectedreturnfromalternativeactivities.Ifdecisionstoselldrugsarenotjust biasedversionso fcarefulcalculationsbutareactuallynotwellthoughtoutatall,then ourconclusionholdswithevengreaterforce.

Thisisnottosaythatenforcementiscompletelyunrelatedtoprice.Therecould stillbeastochasticrelationship.Allotherthings   equal,increasedenforcementmightstill bemorelikelytodriveupprice,butthelinkagemightbesoweakthatmaterially differentoutcomescanbeobserved.Also,enforcementgeneratestangiblecostsfordrug sellers,inadditiontothedeterrence   -basedmechanismofimposingtheriskofnon   - monetarycosts.Forexample,sellersparticipateinavarietyofcostlybehaviorstoavoid arrest.Theypostlook   -outs,refrainfromsellingtocustomerswholooksuspicious, minimizetheiruseoffixedlocations   andassets,etc.Inasmuchasthesecostsare tangible,immediate,and/ormonetary,theyarelesslikelytobeunder   -valuedforthe reasonsdiscussedhere.

Hence,wedonotarguethatdrugenforcementhasnovalue.Butthediscussion aboveraisesquestio ns,particularlyforhighlypunitiveapproachestosellersoperatingin

marketsthatarelargeenoughandefficientenoughtomakeitrelativelyeasytoidentify
potentialreplacementsforincarceratedsellers.Ifdeterrenceisunderminedbytheway
risksareperceived,thenpotentialreplacementsmayviewthedisappearanceoftheir
predecessorsasastrokeofgoodfortune,notasoberingwarning.

AppendixA:ModelingtheDec   isiontoSellDrugs

DescriptionofOneCycle

Thebasic"cycle"ofsellingdrugsinvolvesbuyingaquantityofdrugsfroma supplier(orobtainingthemonconsignment),breakingthemdownintosmallerunits,and sellingthosesmallerunits.The"Natural   HistoryofCrackDistribution/Abuse"project (Dunlap&Johnson1992,1996,1998)isalargeethnographicstudydesignedtodevelop systematicunderstandingofcracksellingcareers.Theprojectinvolvedinterviewing manyofthesedealers.Caulkins,Johns   on,Taylor,&Taylor(1999)describethecyclesof the45respondentsforwhomsufficientinformationwasavailabletofullycharacterize theircycle.Atypicalcycleforanindependentretailcocaineselleristhatof"Robert". Hereportedbuying\$300w   orthofcocainepowder,rockingitupintocrack,andmaking \$750(\$450accountingprofit)bysellingthecrackin\$20unitsizes(i.e.,37.5salesper cycle).WeuseRobert'scycleastheprototypicalcycleinourcalculations.

EnforcementRisk

Theret   ailvalueoftheUSillicitdrugmarketisalittleover\$60billionperyear (ONDCP,1999,p.113).Iftheaverageretailsaleis\$30(perhapsreasonableifaverage transactionsizesaresmallerforstreetsellerssuchasRobertthanforothersellers),t   hat meanstherearetwobillionretailcocainesalesperyear.

About1.5millionpeoplearearrestedfordruglawviolationseachyear,   with about375,000arrestedfordrugdistribution.   [10]Ofthosearrestedfordrugdistribution, abouthalfareconvicted.   [11]Thatsuggestsanaveragearrestriskpersaleofabout 375,000/2,000,000,000=0.0001875,andaconvictionriskofabout0.00009375.

Ofthoseconvicted,27%receiveprobation,22%aresentencedtojail,and51% aresentencedtoprison(Maguire&Pastore   ,1998,p.427).Forthosesentencedtoprison,

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[10]In1996,therewereanestimated1,506,200arrestsfordrugabuseviolations(Maguire&Pastore,1   998, p.324),ofwhichanestimated25%wereforsaleormanufacture(Maguire&Pastore,1998,p.363).

[11]In1994,therewere181,627convictionsfordrugtraffickinginUSDistrictCourtsandStateCourts combined,andtherewereabout365,000arrestsfors   aleormanufacture(27%ofthethen1,351,200arrests fordrugabuseviolations).(Maguire&Pastore,1996,p.432andMaguire&Pastore,1998,p.421)

theexpectedtimeservedis33months(p.431).Forthosesentencedtojail,theaverage maximumsentenceissevenmonths(p.430).If40%ofthattimeisserved(whichisjust aguess)thentheaveragetime   servedinjailbythosesentencedtojailis2.8monthsand theaveragetimeservedperconvictionisabout0.51*33+0.22*2.8=17.44months. (Thismeanstheexpectedtimeservedpersaleisabout1.2hours.)

Reuteretal.(1990,p.104)reportavera   genetincomeforaregularstreetdealeris $27,000peryear.Robertmakes$450percycle,sohewouldhavetoexecute60cycles peryeartomake$27,000.Thatisprobablytypicalofaregularstreetdealer. Respondentsinthecrackmarketsstudyrepor   tedcycletimesof"2   -3days","4 -5days",or "oneweek".

WeuseaBernoulliprocessmodeltoconvertbetweenprobabilitiesofoutcomes occurringpersaleorpercycleandprobabilitiesofobservingthatoutcomeoveralonger periodoftime.TheBernou   llimodelisalmostcertainlynotaccurate.Ontheonehand, individualsmaybecomemoreskillfulovertimeastheypersistindealing,sothe probabilitiesofadverseoutcomesperactmaydecline.Ontheotherhand,otherrisks mayaccumulateovertime.   Weignoresuchpossibilitiesbothbecausewedonothave morerefineddataandbecauseweareinterestedinillustratinggeneralpointswith stylizedexamples,notincomputingprecisenumericalresults.

WithaBernoullimodel,theprobabilityofbeingc   onvictedoveracyclethat consistsof37.5salesis1   –(1 –0.00009375)^37.5=0.0035.Theanalogousprobability ofarrestis0.007.

Likewise,theprobabilityofbeingconvictedoverayearthatconsistedof60 cyclesof37.5salespercycleis1   –(1 –0.00009375)^2250=19%.Recallthatthe expectedtimeservedperconvictionwasestimatedtobe17.44months.Thesefiguresare similartoReuteretal.'s(1990,p.104)estimatethatayearoffulltimesellingcariesa 22%probabilityofincarceration   withanaveragetimeservedof18months.   [12]The correspondingarrestprobabilityis34.5%,sotheprobabilityofbeingarrestedoneor moretimesbutneverbeingconvictedis34.5%   -19%=15.5%.

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[12]OurBernoullimodelbasedonnationaldatasuggestsonlya14%probabilityofincarceration,butatime servedgivenincarcerationof24months.Soexpressingourmodelintermsofconvictionsgivesacloser matchtotheReuteretal.figuresthandoesexpressingourmodelinper   -incarcerationterms.

WefollowReuteretal.inassumingacostperyearofin   carcerationof$27,000. Weassumebeingarrestedbutnotconvictedcarriesadisutilityof$2,500.Theresultsare notparticularlysensitivetothisparameter.

OtherParameters

Reuteretal.(1990)estimatethatayearofsellingcariesa1.4%riskof   deathand a7%riskofseriousinjury.Assigningdollarvaluestosuchoutcomesisdifficult,butto completetheircalculations,theyusevaluesof$7,500per1%increaseintheprobability ofdeathand$30,000perexpectedseriousinjury.Weusethese   figuresaswell.

ToconverttheseintoriskspercycleweemploytheBernoullimodel.Setting1   – (1 –deathriskpercycle)^60=0.014suggeststhattheprobabilityofdeathpercycleis 0.000235.Likewisetheriskofseriousinjurypercycleis0.001   21.

Weassumenotdealingpays$10,000peryearand,hence,$166.67percycle.

DecisionTreeDescribingDecisiontoDeal

Wecannowdrawadecisiontreedepictingtheprobabilitiesandconsequencesof thepossibleoutcomesofdecidingtoselldrugs.   Tokeepthetreefromgettingtoo complicated,wesimplysubtracttheexpectedcostduetoinjuriesfromallpayoffs. Likewise,althoughmultiplearrestsandconvictionsarepossible,wedistinguishonly betweentheoutcomesof"atleastoneconviction","   atleastonearrestbutnoconviction", and"noarrest"(inadditiontotheoutcomeof"death").Whentheoutcomeis"death"we ignorecriminaljusticesanctions.Whentheoutcomeiseitherdeathorconviction,we assumetheindividualmadeandbenefited   fromhalfofthesalestheywouldhave executedhadtheyneitherbeenarrestednorkilled.Weassumebeingarrestedbutnot convictedhasnoimpactonearningsfromdrugsales.

AppendixB:ProspectTheory

        Detailedpresentationsofprospecttheoryarea   vailableelsewhere(Kahneman& Tversky,1979,2000;Tversky&Kahneman,1992).Herewesimplypresentkeyfeatures oftheformalmodel.

ValueFunction

        Expectedutilitytheorypositsaconcaveutilityfunctiondefinedontotalwealth. Prospecttheorypo sitsanasymmetric *S*-shapedutilityfunctiondefinedintermsofgains andlossesrelativetoacurrentlysalientreferencepoint,often(butnotalways)thestatus quo.Specifically,

$$v(x) = \begin{cases} x^{\alpha} & \text{if } x \geq 0 \\ -\lambda(-x)^{\beta} & \text{if } x < 0 \end{cases}$$

Empiricalestimatessuggestthat $\alpha= \beta=0.88$,andthat $\lambda=2.25$.Thisvaluefunction suggeststhat, *ceterisparibus,* decisionmakerswillberiskaverseinthedomainofgains andriskseekinginthedomainoflosses.The λparameterrepresents *lossaversion* ,the empiricallywell -substantiatedfin dingthatdecisionmakerstendtoweighlossesover twiceasheavilyasequivalentgains.

DecisionWeightingFunction

        Expectedutilitytheoryweightsoutcomeutilitiesbythesubjectiveprobabilityof theiroccurrence.Prospecttheorypositsanon   -linearweightingfunction,roughlyan inverted *S*-shapedfunction.Asimpleone   -parameterversion(Prelec,2000)is:

$$w(p) = \exp[-\ln(p)^{\nu}]$$

Empiricalestimatessuggestthat $\gamma=.65$,withaninflectionpointof1/   *e*.

        Thecomplete,"cumulative"versionofpros   pecttheory(Tversky&Kahneman, 1992)nolongerappliesthisweightingfunctiontoeachoutcomeseparately.Instead, weightingofgainsinvolves"cumulativeprobabilities"   –afocusontheoutcomein

questionoranythingbetter.Theweightingoflosses   involves"decumulative probabilities" –afocusontheoutcomeinquestionoranythingworse.Thereis diminishingsensitivitytooutcomesinbetweenthelargestgainandthelargestloss.We describethisprocessbelow,butwenotethatinthesituation   sweanalyzehere,itdidnot qualitativelychangeanyoftheconclusionssuggestedbytheoriginalprospecttheory formulation.

Forlosses, $p_1= w(p_1)$Biggestloss

$p_i= w(p_1+...+ p_i) - w(p_1+... + p_{i-1})2<=i<=kAl$ lotherlosses

Forgains, $p_n= w(p_n)$Biggestgain

$p_i= w(p_i+...+ p_n) - w(p_{i+1}+... + p_n)k+1<=i<=n$ -1Allothergains

Thevaluefunctionanddecisionweightingfunction,takentogether,implyrisk seekingforver ylowprobabilitygains(p<.05),riskaversionforlargergains,risk aversionforverysmallprobabilitylosses(p<.05),andriskseekingforlargerlosses.

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