

New Economic Thinking on Addiction and Legalization

*Toward Sliding
Price Elasticities of Demand
for Addictive Substances
and their Implications
for Public Policy*

By Robert B. Charles

Commissioned by:

The National Alliance for Model State Drug Laws



July 2003

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About the National Alliance for Model State Drug Laws

The National Alliance for Model State Drug Laws (the Alliance) is a resource for governors, state legislators, attorneys general, drug and alcohol professionals, community leaders, the recovering community, and others striving for comprehensive and effective state drug and alcohol laws, policies, and programs. The Alliance is the successor of the President's Commission on Model State Drug Laws. Funded by Congressional appropriations since fiscal year 1995, the Alliance is a 501(c)(3) nonprofit organization.

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Forward from the National Alliance for Model State Drug Laws

The idea of commissioning *New Economic Thinking on Addiction and Legalization* came through the Alliance's work with people at the state and local levels to address alcohol and other drug problems. As elected officials, state agency staff, addiction treatment professionals, law enforcement officials, community members, and others worked to implement our model laws and related policy elements, they were frequently challenged to consider the option to legalize marijuana and/or other illegal drugs. They came to the Alliance for information that would help them to better understand legalization and its potential consequences for their states and communities.

In reviewing the current literature and accounts of legalization, we found that the majority of the materials appeared to be political, moral, philosophical, and/or emotional in their presentation of the related issues. While there were some references to supply and demand arguments, there seemed to be a scarcity of objective discussion of the complex economic dynamics related to the use of, abuse of, and addiction to alcohol and other drugs and the possible impact of legalizing an array of potentially addictive substances.

As this document goes to print, states are confronting one of their most difficult financial times in recent history. Decision makers are challenged to use limited - in many cases, diminishing - resources in the most efficient and effective ways possible. Therefore, efforts to address alcohol and other drug problems must speak both to the issues faced and to the fiscal "bottom line." On behalf of the Alliance, I hope that *New Economic Thinking on Addiction and Legalization* will provide useful information and fresh perspectives to everyone considering these important issues.

Sherry L. Green, Esq.
Executive Director
National Alliance for Model State Drug Laws
July 2003

About the Author

Robert B. Charles

Robert B. Charles is president of The Charles Group, a public policy consulting firm based in Gaithersburg, Maryland. A former litigator in New York and Washington, Mr. Charles worked at Weil Gotshal & Manges and Kramer Levin between 1988 and 1995. He also clerked on the U.S. Court of Appeals for the Ninth Circuit.

During the Reagan and first Bush White Houses, Mr. Charles held policy positions in these administrations. He was appointed Deputy Associate Director of the White House Office of Policy Development, where he served from 1992-1993. From 1995 to 1999, he was Chief of Staff and Chief Counsel to the United States Subcommittee on National Security, International Affairs, and Criminal Justice. He also served as chief staffer to the United States Speaker of the House Task Force on Counternarcotics. In these roles, Mr. Charles crafted major provisions of key bills, negotiated elements of omnibus appropriations bills on behalf of House Leadership with the White House Office of Management and Budget, and held hundreds of hearings, mark-ups and investigations from 1995 forward. Hearings and legislation ranged from the Department of Defense oversight and law enforcement issues to the Drug War and health care; from the Department of Justice and Waco hearings to NASA and State Department oversight; from the United States Coast Guard and Customs oversight to review of DEA, FBI and INS practices and budgets.

From 1998-2001, Mr. Charles taught both Government and Cyberlaw at Harvard University Extension School. In 2000, he was awarded the Petra T. Shattuck Award for Excellence in Teaching by Harvard University.

A native of Maine, Mr. Charles graduated magna cum laude from Dartmouth College with a Bachelor of Arts in government. He also holds a Master of Arts in politics, philosophy and economics from Oxford University (P. P. E., 1984) and a law degree from Columbia University School of Law (J. D., 1987). As a regular writer and commentator in print and broadcast media, Mr. Charles remains close to many top decision makers in Washington. He lives in Maryland with his wife and two children.



This economic study explores the idea that a sliding Price Elasticity of Demand (PED) may exist for any addictive substance; that this PED consistently slides from high to low over the cycle of addiction; that different addictive substances have different sliding PEDs; and that the existence of different sliding PEDs for addictive substances carries public policy implications. Specifically, the findings in this study suggest that, in practical and economic terms, the concept of a sliding Price Elasticity of Demand for addictive substances is important.

Policymakers can best reduce the costs associated with drug use and addiction in two ways:

- First, they can aggressively deter first time purchasers through policies that raise market prices and educate potential consumers just prior to market entry, taking advantage of the high Price Elasticity of Demand at that time.
- Second, policymakers can aggressively intervene to permanently end addiction through treatment regimes dedicated to stopping (not substituting) consumption of addictive substances, restoring rational economic decision making to consumers affected by addiction, and maintaining this rational economic behavior over time, in response to consistently low Price Elasticity of Demand for different drugs among addicted consumers.



Executive Summary

Any consumer of an addictive substance begins with a first use of that substance. That decision is informed by the costs of use, including price, risk of addiction and other adverse health effects, and perceived benefits of use. As the consumer migrates from treating the addictive substance (for example, cocaine or alcohol) as a “luxury” to treating that same substance as a “necessity,” substantial research indicates that the Price Elasticity of Demand (PED) for the drug shrinks – that is, the degree to which use is affected by price falls. Unlike the first time purchaser of drugs, who is assumed to have weighed the addicted substance’s putative effects against costs and risks, often based on information (accurate and inaccurate) collected from peers, media, parents and the community-at-large, an addicted person’s decision-making is defined by the state of addiction.

Predictable operation of the laws of supply and demand, requiring rational consumer behavior, seems not to work when applied to the addicted consumer. Price becomes less important to the addicted consumer. Consistent with the clinically proven elements of addiction, including dependence and tolerance, the market as applied to this consumer is no longer characterized by free and rational choice. The Price Elasticity of Demand has fallen to a low point. In other words, large changes in price do not affect the addicted person’s demand for the addictive substance or commodity, even if they do affect first time or non-addicted purchaser choices.¹

To be sure, there is a considerable body of writing that discusses the non-economic arguments for and against different methods of treating addiction, as well as a considerable body of opinion containing non-economic arguments for and against policies raising or lowering the price of various addictive substances, ranging from legalization of illegal substances to taxation of legal and addictive substances. There is also a body of writing propounding narrow-gauge analysis of economic factors which might come into play if different policy options were pursued, and another body of writing best described as pseudo-economic, in that these authors tend to reason from broad and unsubstantiated assertions to broad and unsubstantiated conclusions.

This study does not take any of these tactics. It explicitly does not address any of the (possibly quite valid) political, social, philosophical, moral or emotional arguments surrounding different types of drug use or addiction policy. It also does not pursue a narrow-gauge economic approach, isolating one variable and ignoring others in an effort to make pure the economic analysis. A number of variables are discussed, while the importance of recognizing sliding PEDs for different drugs and purchaser groups is viewed as central to future public policy. Finally, the pseudo-economic writers are addressed directly in several instances, without disparaging the merit that may attach to ideas raised.

Primary Findings

After reviewing, analyzing and discussing the relevant economic and medical literature, this study's primary findings are as follows:

- Policies that lower the price of addictive substances tend to increase first time use or initiation rates for these substances.
- Increased use or initiation rates tend to increase addiction rates, based on responsiveness of first time and casual purchasers to lower prices.
- Raising prices of an addictive substance generally appears to lower the rate of first time use or initiation for most addictive substances, although higher prices do not appear to have any substantial impact on consumption by the addicted population.
- Substitution of one addictive substance for another similar substance by the addicted population appears more likely at higher prices and in the event of lower availability.
- Substitution may include accessible, affordable treatment to end the addiction where available, but is less likely to occur where significant effort is required by an addicted population to obtain the treatment.
- Rational or free choice by the addicted population appears to be significantly impaired by a combination of the cognitive deficit produced by using certain addictive substances (i.e. cognitive changes in brain function created by use of the addictive substance) and what is generally described as compulsion, a combination of dependence and growing tolerance to the addictive substance.
- Addictive substances appear to be comparable to one another on several bases, including abusive potency, addictiveness based on time to dependence and rate of tolerance growth, severity of withdrawal symptoms, adverse collateral health, adverse brain function effects and overall physiological and psychological change induced by the addictive substance.
- A price versus time-used continuum appears to exist on which most addictive substances can be placed somewhere relative to one another.
- This price versus time-used continuum reflects the price sensitivity of purchasers at different times in the use cycle (from first use to addiction) for any given addictive substance relative to any other addictive substance, even if the absolute sensitivity to price by purchasers at a particular time for a particular addictive substance is elusive.

- *Most discussants of legalization or government distribution of addictive substances do not take account of predictable long-term growth in the population of addicted persons and/or the long-term addiction costs associated with this policy choice.*
- No discussant of legalization or government distribution of addictive substances takes account of the vast literature supporting a Price Elasticity of Demand for addictive substances that consistently slides from high PED to low PED, albeit at different rates for different addictive substances, unless the addicted population becomes unable to act upon the low PED or substitutes treatment for addiction.
- No discussant of legalization or government distribution of additive substances takes account of the implications associated with a Price Elasticity of Demand that consistently slides, at varying rates for different addictive substances, from high to low for all measured addictive substances, unless the addicted population becomes unable to act upon the low PED or substitutes treatment for addiction.
- Much of the literature on economics and addiction, as well as economics and drug abuse, focuses on a single variable to the exclusion of other variables materially affecting conclusions drawn (i.e. assuming away difficult questions) or is unsubstantiated or opinionated in nature.
- Insufficient economic data and insufficient stratification of purchaser groups exists to confidently measure or estimate the absolute prices (or price ranges) at which different purchaser cohorts (e.g. first time, occasional, frequent and addicted purchasers)² will choose to purchase or not to purchase different addictive substances.
- Insufficient economic research has been done on the efficacy of generally applying traditional supply and demand principles to the use of addictive substances by different purchaser cohorts (e.g. first time purchase, occasional, frequent and addicted purchasers).

Key Conclusions

This study yields two basic, but important, conclusions:

First, the existence of a high Price Elasticity of Demand for addictive substances at the time when consumers evaluate whether to initiate use of an addictive substance, paired with the high potential costs of addiction to both the individual and society, strongly reinforce policies that have: 1) the effect of creating and maintaining high prices in order to deter first use, and 2) the effect of educating potential first time purchasers about the risk of, and costs associated with, possible addiction.

Since the ability to influence consumer decision making is at an apex just prior to the consumer's decision to purchase, or when the potential first time purchaser is deciding whether or not to enter the market, policies targeting price and education at this time – even marginally – are most likely to reduce use and addiction. On the other hand, policies seeking to significantly deter consumption among *people with addictions* through changes in price are not likely to be cost-effective.

Second, the existence of consistently low Price Elasticity of Demand among addicted consumers or frequent purchasers of addictive substances, paired with the adverse economic effects of this consumer group's behavior on individual consumers and society at large, strongly reinforce policies that have: 1) the effect of restoring rational consumer decision making, 2) the effect of reducing consumer dependence on and tolerance for these addictive substances, and 3) the effect of restoring this group of consumers to a position of involvement in the economic system based on predictable interplay of supply and demand, namely a position maintained prior to first use of the addictive substance.

While there are points after first use and prior to addiction in which price and education may influence consumer behavior, and there are cognitive elements of the decision-making process which may never be restored even after intervention, the most cost-effective way for any society to reduce the cost of addiction is to intervene with effective treatment for one purpose: to end consumption of the addictive substance.

A consumer caught in the economic trap of addiction to a substance with a low Price Elasticity of Demand is not freed by replacing one addictive substance with another. While this policy might be able to reduce the adverse effects of the first addictive substance and replace them with the adverse effects of the second addictive substance, such substitution does not reduce either the costs or the opportunity costs associated with addiction. Moreover, policies that seek to substitute one addiction for another in the name of cost savings tend to be highly expensive and offer no measurable cost-benefit over time, other than accelerating the progress of adverse health effects and death, which reduces the cost to society of health care and addiction maintenance for that consumer.

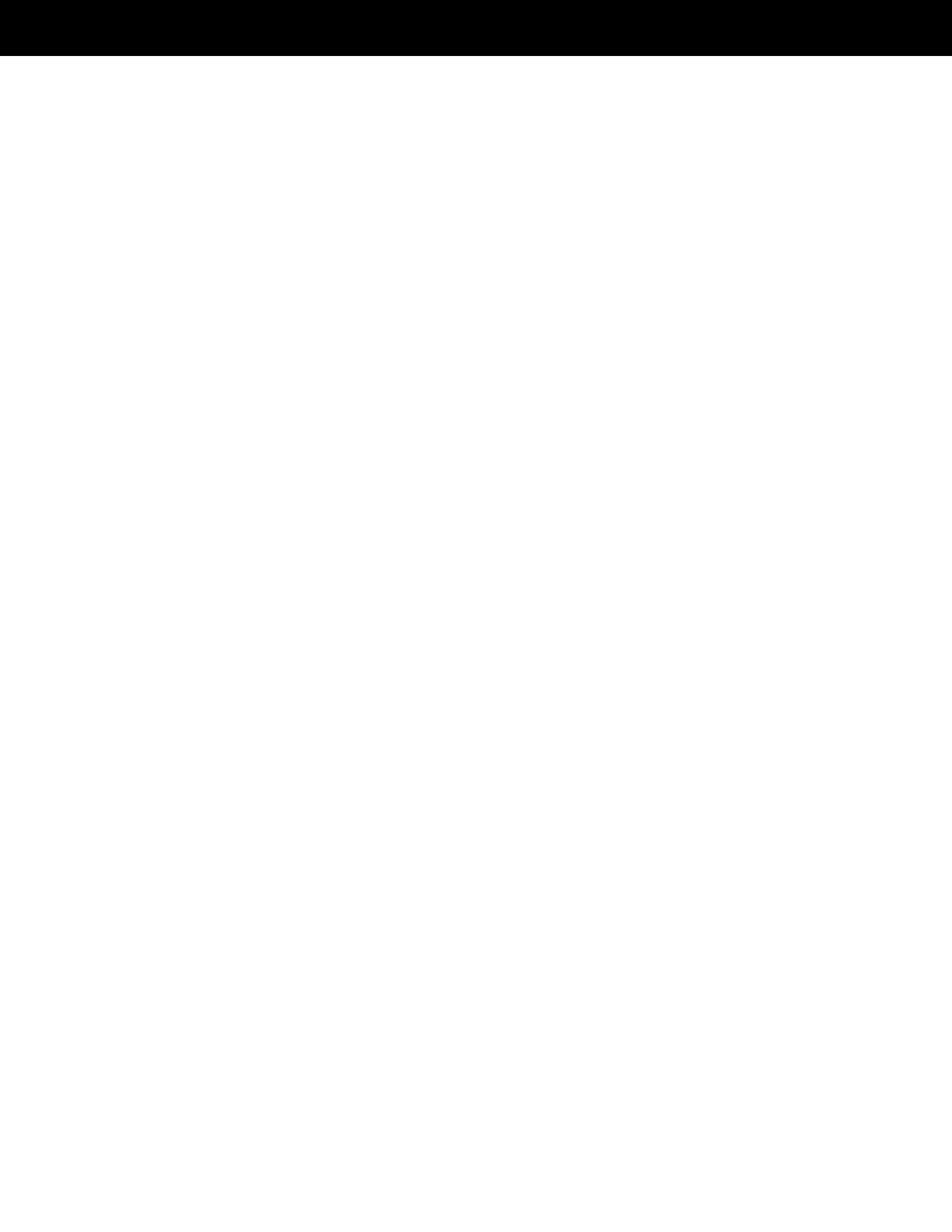
Substitution of addiction-ending treatment for addiction is only cost-effective when sustained over time; thus, policies that actively intervene to end addiction must be coupled with policies which educate the formerly addicted consumer to maintain his or her economic position. While price may then play a modest role in governing the consumer's behavior, other factors beyond price are likely to be equally important, as the consumer may never be as sensitive to price as he or she was prior to first use.

Core Recommendation

The study's core recommendation is simply put:

In practical and economic terms, the concept of a sliding Price Elasticity of Demand for addictive substances is important. Policymakers can best reduce the costs associated with drug use and addiction in two ways:

- First, by aggressively deterring first time purchases through policies that raise prices and educate potential consumers just prior to market entry, taking advantage of the high Price Elasticity of Demand at that time
- Second, by aggressively intervening to permanently end addiction through treatment regimes dedicated to stopping (not substituting) consumption of addictive substances, restoring rational economic decision making to consumers affected by addiction, and maintaining this rational economic behavior over time in response to consistently low Price Elasticity of Demand for different drugs among addicted consumers.



Introduction and Overview: Rolling Out a New Idea

The purpose of this study is several-fold. It provides an overview of economic research on a critical slice of public policy, namely whether, how, to what degree and when the price of an addictive substance affects consumption.

Stepping beyond current research, a new - and potentially explosive - argument is presented. The argument deserves more research and discussion: while higher prices may negatively affect initiation rates for *new* consumers of drugs and alcohol and lower prices may naturally increase the likelihood of wider *initiation* of use, the supply and demand model breaks down when discussing *prolonged* use of addictive substances.

Simply put, price becomes less important for purchasers as they become more addicted. The new element contained in this assertion is that there are more than one or two points at which Price Elasticity of Demand (PED)³ can be measured and matter. Rather than assuming a static PED for certain drugs used by first time and addicted purchasers, this study explores the possibility that Price Elasticity of Demand for any addictive substance is dynamic, changing continuously over time, and is different from drug to drug.⁴

As a given purchaser migrates from treating a drug (e.g. cocaine, alcohol) as a "luxury" to treating that same drug as a "necessity," price elasticity of the drug shrinks – that is, the degree to which use is affected by price falls. Unlike the first time purchaser, who is assumed to have weighed a drug's putative effects against perceived risks and costs, often based on information (accurate and inaccurate) collected from peers, media, parents and the community-at-large, an addicted person is typically caught in the cycle of addiction. This individual is often not in a frame of mind to weigh choices rationally.⁵

Ironically, both current "rational addict" research and application of the supply and demand model presume a degree of free will in the decision-making process.⁶ To the extent that they address the issue at all, they assume that the price elasticity of a particular drug will – for any given purchaser, whether first time, occasional or prolonged – be constant.

The kernel of this study, which should trigger further research for those who grasp the argument's significance, is a careful presentation of data suggesting that this core assumption may be wrong.

If the prevailing assumption – that the PED remains constant – is wrong, then increased availability of any drug will increase use,⁷ which predictably increases the cohort of those becoming addicted, and the measurable health costs associated directly and indirectly with addiction.⁸ This is a sobering connection of previously ac-

cepted and well-documented economic and statistical “dots,” creating a picture that mitigates both *against* the widening availability of drugs through legalization or any other means, and *in favor* of more proactive efforts to retrieve a society’s addicted population from what is an economic trap.

In economic terms, *this study argues that Price Elasticity of Demand* (that is, how demand “bounces” or changes in response to changes in price) *does not remain constant for an addictive substance*, even though *price and quantity are typically constant for most non-narcotic and non-addictive substances*. Why this matters will become more apparent in this study.

Before exploring the implications of this largely unexplored idea, a *corollary* is also worth mentioning. Just as ordinary market assumptions about purchasing behavior may not apply to addictive substances, particularly at the highly addictive end of a yet-to-be-established *addiction spectrum*, there is every reason to believe that *the more addictive a narcotic, the less price will matter to those who are addicted*.

The nature of addiction is both central to – and beyond the scope of – this paper. That said, the notion that addictions come in various types, affected both by the type of addictive substance being consumed and the person consuming, is commonly accepted. For example, while heroin, methamphetamine, Ecstasy and PCP ingestion, at the currently high purity levels, will often lead to a high proportion of first time emergency room incidents and deaths,⁹ other addictive substances take a longer period to produce death and organic damage.¹⁰ Based on the type of drug, consumer disposition and environment, addiction may occur rapidly or more gradually. One factor in assessing the likely rate of addiction is the drug being consumed. Thus, for opiates, addiction may be swift,¹¹ while for alcohol it may be more gradual.¹²

As with any product, there may be *substitution* of one addiction for another if wide price differentials exist and the drug-induced effects are viewed as similar (e.g. swapping methamphetamine addiction for cocaine addiction, or OxyContin addiction for heroin addiction), but *the corollary is not altered by substitution*.¹³

Addiction to a non-narcotic is, by definition, less likely than addiction to a narcotic. Addiction to a *highly* addictive narcotic is, by definition, more difficult to break than addiction to a *less* addictive narcotic. Thus, the Price Elasticity of Demand for milk may be constant over time, while the price elasticity for alcohol or cigarettes may be expected to slide less rapidly than for heroin from high to low.¹⁴

This corollary, like the rule before it, has a common sense kicker: Price Elasticity of Demand (how much a change in price affects consumption) may not only slide, but slide at different speeds, based on the drug to which the Price Elasticity of Demand is attached. The slide is likely to be steeper for highly addictive substances than for less highly addictive substances.¹⁵

In short, the speed at which certain Price Elasticities of Demand slide from high to low may be *measurably* different. One may be able, for example, to organize in ascending or descending order a variety of addictive drugs based on the speed with which they induce addiction. With this comes the corollary that some drugs can be described as having “swiftly sliding” Price Elasticities of Demand (from high to low), while other drugs trigger a “slowly sliding” Price Elasticity of Demand. Cocaine, heroin, Ecstasy, methamphetamine, OxyContin and marijuana might fit into the first category while nicotine, alcohol, weak prescription medications or over-the-counter drugs might fit into the latter.¹⁶

In everyday terms, which economists often eschew, both ideas can be simply illustrated. The first rule that drugs of any type slide down the so-called price elasticity scale - starting as a luxury and ending up a necessity – is illustrated best by analogy. Marijuana, cocaine and heroin are highly addictive substances, while baseball games, carnival rides and cotton candy are not. If prices rise on baseball tickets, carnival rides or cotton candy – especially if the price rise is substantial – buyers pass on the opportunity to buy (i.e. decide not to buy). Similarly, if prices are high for drugs, first time purchasers act the same way as a non-addicted buyer would act for any non-addictive commodity, such as baseball, carnival tickets, or cotton candy: they do not buy.

On the other hand, if drug prices rise for the addicted person, freedom to avoid buying is limited, if viewed as existing at all. Physiological and psychological dependencies dictate that higher prices will be met. Both addictive science and criminal justice data support this conclusion. Accordingly, drug addicted persons do not choose *not* to buy drugs as prices rise, since that is not typically viewed as an option.

While lower prices appear to spur buying of drugs by non-addicted persons¹⁷ and higher prices appear to reduce first time buying by non-addicts,¹⁸ there is evidence that higher prices may not reduce the buying of drugs by addicted persons. The wider policy implications of this argument are explored in this study.

In the same vein, again by example, if tetrahydrocannabinol (THC)¹⁹ levels in modern marijuana are more addictive than less addictive substances (e.g. caffeine, nicotine)²⁰ and cocaine is more immediately addictive than THC,²¹ it may be possible to establish a schematic charting the progression of addiction, associating certain outcomes with particular drugs or the “abusive potency” of these drugs.²² There is even a chance that consensus could be created around the levels or degrees of addiction that follow particular drugs, such that greater and lesser initial price elasticities could be attached to each drug (paired with the speed or steepness at which a purchaser slides toward addictive dependence after a first use).

In the end, all drugs end up near zero price elasticity, since this is the economic definition of a seemingly inescapable addiction. That said, some drugs (e.g. heroin) clearly force a user toward addiction on a compressed timetable. The user is forced

toward the “necessity” end of the price elasticity scale faster than the user of a less addictive substance (e.g. tobacco).²³

Among non-addictive substances, there is little to illustrate the effect of more and less addictive behaviors since there is a common assumption: it is assumed that price elasticities for a non-addictive substance not only stay unchanged when all else is held constant, but also that price elasticities for non-addictive substances seldom end up at zero. The substitution effect is constantly in play in the market for non-addictive substances. There is a common assumption that even such necessities as toilet paper or food staples would be replaced by other non-addictive commodities if prices on desired commodities soared. In short, no matter how much a consumer likes bananas or eggs, a consumer would turn to apples or other sources of nutrients if the first choice items became too expensive.

While there is a raft of literature suggesting outcomes that associate or correlate with particular drugs, *one project not evident in the literature is defining a universe of behavioral types which attach more quickly or more severely to particular drug types and putting the various drugs abused into some ordinal chart or order.* A scouring of the literature, and review by treatment and medical experts, would then allow these addictive behaviors and drugs *to be assigned particular price elasticities, each of which shifts from high (e.g. at first time use) to low (e.g. after psychological or physical addiction begins).* *Given differing drug effects, the assigned price elasticities would also likely shift at different speeds.*

Why does all this matter? Who cares whether drugs actually have – and are recognized to have – sliding price elasticities, and whether they differ from one another in important ways? If the two principles spelled out above are true, *there are major policy implications.*

These implications are not related to or compelled by state or federal politics, public morality, perceived criminal justice imperatives, treatment preferences, or the viability of competing or complementary prevention modalities. *They are purely economic.*

The conclusion toward which this argument tends is significant. Price elasticity varies according to the different drugs, reflecting the degree of addiction triggered and speed at which addiction occurs. Further - as a new and general rule – Price Elasticity of Demand does not remain constant for any given drug.

Recognition that a sliding Price Elasticity of Demand exists for every drug (price elasticity is not constant for an addictive substance), that some price elasticities slide faster than others, and that all tend toward zero, are important realizations for public policy in a number of ways.

First, this argument casts a shadow over broad and unquestioned reliance – for public policy – on so-called “rational addict” research and so-called supply and demand model research. *The addicted person does not act rationally as the price elasticity falls, and this should be taken in to account when formulating policy.*²⁴ Likewise, *the market for addictive substances may behave very differently – especially for those addicted – than rationally clearing markets for non-addictive or less addictive substances.*

The “rational addict” notion attributes rational economic decision making to persons who are addicted to drugs, overlooking unavoidable effects on rational-actor decision making imposed by the dependence on drugs. Missing is the empirical fact that *addicted* persons, unable to freely choose *not* to use drugs, may not respond to price increases by lowering use.²⁵

Similarly, the supply and demand models often do not take into account the one way effect of supply and demand for drugs on an addicted population; price and policies affecting price may deter first time or casual purchasers, but likely have little effect on addicted persons who are unable to exercise the option of not using, even when prices are high.

In summary, previous research on the relationship between prices and consumption, or between the price of an illegal drug (e.g. cocaine, heroin, marijuana) and the likelihood that it will be consumed, have missed a key element of that relationship. *The element missed is the non-applicability of market forces to narcotics and an addicted population.* Specifically, the behavior of addicted persons toward the market for drugs is tied to the effects of addiction upon their decision making. An expected change in consumption patterns, in response to changes in price may not materialize. Expected downward shifts in drug use based on higher prices may occur among first time purchasers, but be minimal or nonexistent among an addicted population. In short, the Price Elasticity of Demand does not stay the same for those who are first time purchasers and those who are addicted purchasers, and the slide from one to the other gradually sends the PED toward zero in virtually all cases.

Since the addicted person is caught in the downward spiral of addiction, public policies that are intended to discourage drug use by raising prices may have a dramatic positive effect on first time drug purchases, discouraging such use, while having little or no effect on use by the addicted population. *There would appear to be a significant need to complement such policy choices with sufficient accountable treatment to meet the needs of the addicted population untouched by the advantages of higher prices.*

Moreover, public policy decisions that encourage wider casual use – such as the reported eight percent or greater increase in casual use that might result from state or federal legalization of marijuana – would be likely to have a significant negative effect on the overall cost of state and federal health care (and related addiction costs), since

the fluctuating price elasticities associated with first time or casual (“luxury”) use would quickly be replaced by the low elasticity of demand that attends use by an addicted population (as the drug creates dependencies that make it a “necessity”).

The ordinary market demand and supply model and the so-called “rational addict” models are inadequate to explain the complex relationship, a sliding effect, between price and addiction. *The implications of this anomaly are significant. They mitigate against both legalization and decriminalization, since first time or non-addicted drug purchasers likely respond to higher prices by not initiating use and to lower prices by initiating use, but addicted persons do not respond in the same way.*

Among a larger addicted population, the lowering of prices would neither much increase nor much decrease drug use. Similarly, an increase in prices would neither much increase nor much decrease their use. The only deterrent with traction remains the incentive of effective treatment, to the extent that drug addicted persons retain an evaluative function and can be credited with a degree of rational decision making in response to this incentive, paired with the larger disincentive of serious, predictable and swift penalties, to the extent that major deterrents affect the decision making of addicted persons.

These are the tenets and conclusions discussed in this study. This paper is not intended to be either exhaustive or dispositive. The aim is to trigger further research and discussion of a fundamental – and commonly missed – element of the public policy debate surrounding both the need for treatment and the efficacy of attempts to lower the criminal penalties surrounding use of narcotics, based on the role of a sliding Price Elasticity of Demand for addictive substances.

Price Elasticity of Demand: What Is It and Why Does It Matter?

While an in-depth understanding of Price Elasticity of Demand is not required in order to grasp the importance of this concept in guiding public policy, a technical understanding is helpful. That having been said, a simple description is also the only starting point.

Price Elasticity of Demand is no more or less than the responsiveness of quantity of anything demanded (i.e., is more demanded or less?) to a change in price.²⁶ Typically, in order to make this tool useful, PED is used to measure a change in quantity demanded in response to an incremental up or down price change *in a given market during a given period of time.*²⁷

The Technical Definition and Illustration

Price Elasticity of Demand is the “ratio of a proportional change in the quantity demanded of the good to the proportional change in price that brought it about [i.e., the change in demand].” More generally, “elasticity” is any “measure of the percentage change in one variable in respect of a percentage change in another variable ... Measures of elasticity tend to be carried out for very small changes in the variable causing the response – e.g., a percentage change in quantity due to a very small change in price.”²⁸

Another technical definition of Price Elasticity of Demand is “responsiveness of the quantity demanded of a good to its own price,”²⁹ thus “elasticity of demand is expressed as the percentage change in demand that occurs in response to a percentage change in price.” The equation, where $Q = \text{Quantity}$ and $P = \text{Price}$, is:

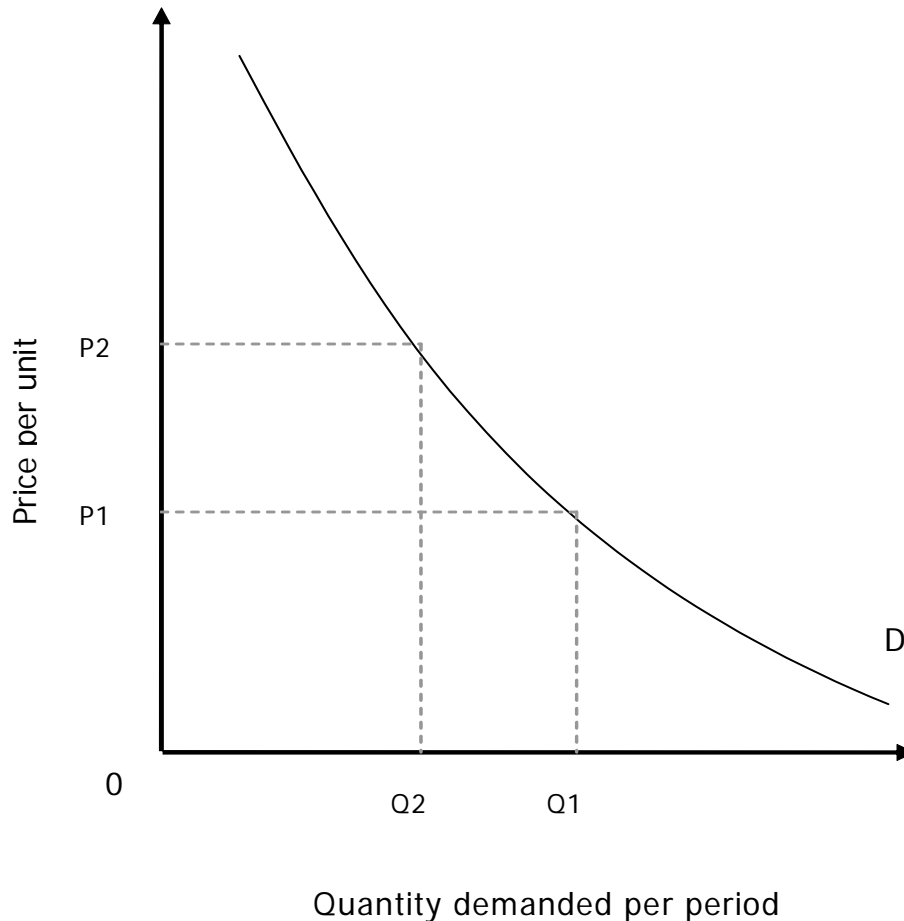
Price Elasticity of Demand =

$$\frac{(\text{Change in } Q / Q)}{(\text{Change in } P / P)} \cdot \frac{100}{100} \quad (\text{OR}) \quad \frac{\text{Change in } Q}{Q} \cdot \frac{P}{\text{Change in } P}$$

Demand is said to be *elastic* if Price Elasticity of Demand (often represented by e , as the coefficient of Price Elasticity of Demand, but represented here as PED) is greater than 1, *inelastic* if less than 1 and *unitary* if equal to 1. The point being conveyed is that change is either greater or less than one, and “if the absolute value of the price elasticity of demand for a good is equal to one, then expenditure on the good does not change as its price changes.”³⁰

Several other economic terms may help explain progression of purchasers of addictive substances from first use to addiction. One concept is “preference,” a term used by economists to mean that a consumer may “prefer” one good to another good

The Basic PED Graph



Price elasticity of demand (PED)*

The responsiveness of the quantity demanded to a change in price in a given market during a given time period, *ceteris paribus*. It is measured by the percentage change in quantity demanded divided by the percentage change in the good's own price. In the diagram the PED for a price rise from OP1 to OP2 would be measured as:
 $(OQ2 - OQ1)/OQ1 + (OP2 - OP1)/OP1$

The resulting value will be negative since when price rises, the quantity demanded falls (i.e. the demand curve slopes downwards from left to right). This method is known as arc elasticity because it measures the responsiveness over the range of prices between OP1 and OP2. By reducing the change in price to an infinitesimal amount, the PED at one point on the demand curve can be calculated. Point elasticity demonstrates clearly that PED depends not only on the ratio of the original price and quantity. Thus, in all but exceptional cases, the PED is different at every point along the demand curve.

* Daitithith, J. (Ed.), *Letts Dictionary of Economics* (London, 1983): 140.

or good(s), allowing a *preference function* to establish an *ordering* of such preferences. Notably, there is an assumption that the consumer is exercising rational choice when making his preference known by consuming one good over another. In other words, if an individual prefers X to Y, one can say that the utility the individual derives from X is greater than from Y.

“Utility,” in turn, is a term “widely construed in economics to be synonymous with ‘welfare.’ ... although understood by some economists to mean benefit.” The difference of opinion is important. An addicted person perceives that his addiction at the time of consumption is maximizing “utility,” where that term is defined as short-term benefit. Yet most observers would strenuously dispute the assertion that an addict’s dependence and tolerance for a drug – leading to greater consumption – is maximizing his welfare.

Referring to an individual’s “utility function” is one way of describing that a consumer’s perceived “utility is dependent upon the goods he consumes and their amounts.” By way of an equation, if $U = \text{Utility}$ and $X, Y,$ and Z are the types and amounts of goods in question, the individual’s utility function is $U = U(X, Y, Z \dots)$ For addicted purchasers, the utility function tends to minimize other commodities as it is increasingly defined by proportional and absolute increases in consumption of the addictive substance.

Several Common Sense Applications

Outside the world of drug policy, one might seek to prove that an upward price change constituting 50 percent of the baseline price (e.g. a jump in the price for all brands of disposable diapers from one dollar to one dollar and fifty cents per diaper) produces a net reduction in sales of only 10 percent. This would prove disposable diapers to be a relatively *inelastic* commodity, since the PED clearly indicates that diaper buyers just will not do without them, even when the commodity jumps in price. Low elasticities might also attach to such predictably necessary commodities as oil, gas, sugar, salt and toilet paper. The percentage change in amount demanded divided by the percentage change in price yields a number, describing the exact Price Elasticity of Demand. What matters most, however, is whether the changes in price upwards or downwards tend to alter, in similar or different ways, purchasing of the commodity.

By converse example, an upward price change of only five percent in the cost of one of a dozen similar breakfast cereals may yield an immediate switch by 80 percent of the buyers of that cereal to one of the other nearly identical, equally available, but cheaper brands.³¹ This commodity would be described as having a high elasticity of demand.

Several Basic Clarifications

Before applying this concept to drug policy and reviewing current literature on the topic, a few clarifications may be helpful. There are several types of elasticity, including point elasticity of demand, arc elasticity of demand, cross elasticity of demand, elasticity of income and elasticity of supply. There are also limitations on the value of price elasticity, where other factors matter more to the consumer than price.

In general, price elasticity measures the effect of price change on changes in quantity consumed. To do this, economists hold all other factors equal or unchanged, as they seek to isolate the impact of a price change alone on the quantity purchased. In reality, this is nearly impossible. Many factors can affect the quantity consumed, and price may yield a very small effect.

"Point elasticity" is essentially the quantity change at a new price where the change is very small.³² More specifically, it is the "coefficient of price elasticity of demand at a particular point on a demand curve."³³ "Arc elasticity" is an estimate of elasticity over an arc between two points on the demand curve. Specifically, arc elasticity is the "coefficient of price elasticity of demand between two points on a demand curve" (creating an arc on the graph).³⁴ It is an estimate based on significant change over a period of time, the accuracy of which improves as the arc becomes smaller. Notably, the basic "demand curve" plots price (Y-axis) against quantity demanded (X-axis). "By varying the price of the commodity under consideration, while keeping constant the individual's money income and tastes and the prices of other commodities ... [one gets] the individual's demand schedule for the commodity." A graph of an individual's demand schedule is the "demand curve," typically running from upper left to lower right.

"Cross elasticity of demand" refers to the effect of changes in price of one product on the quantity purchased of a second product in a set time, taking into account substitutes and complements. Thus, cross elasticity is the "ratio of the percentage change in the amount of commodity X purchased per unit of time to the percentage change in the price of commodity Y."³⁵ In other words, if the price of one manufacturer's cars increases markedly in a short period of time, how does that affect the quantity of cars purchased from other manufacturers (i.e. substitutes)? At the same time, how does the price increase affect the complementary products that are dependent on that manufacturer's model for their own sales (i.e. complements)? In the world of narcotics, if heroin becomes highly expensive or hard to acquire, what impact does this have on sales of a drug with parallel effects, such as OxyContin? What effect does a price increase for heroin have on sellers of needles?

"Income elasticity of demand" is the "ratio of the percentage change in the amount of a commodity purchased per unit of time to the percentage change in the consumer's income."³⁶ If the economy dips into recession and, holding other factors

constant, potential first time purchasers have less disposable income, how does this affect the rates of initiation? If potential first time purchasers experience marked increases in disposable income, what effect does this have on first time use?

Finally, “price elasticity of supply” refers to the “ratio of the percentage change in the quantity of a commodity supplied per unit of time to the percentage change in the price of the commodity.”³⁷ Thus, in the context of narcotics, if Western states have a substantial supply of Mexican methamphetamines and Eastern states have a substantial supply of Colombian heroin, what effect does that have on prices for these drugs, respectively, in those states? What effect does the lower quantity of the same drug on the opposite coast have on price? What effect would a substantial reduction in supply of either drug have on the prices in the states where it now is prevalent?

Over an extended period, there is often the assumption that price elasticity of a given product remains relatively constant, even as price changes are large and quantity consumed varies with the price changes. Often, the consumer of the product is assumed not to change the degree of need for that product over the period between measurement of two “point elasticities,” and is further assumed to exercise rational decision making in a consistent way over time to explain the changing amount purchased at two different prices. This may not be true, and certainly appears unlikely in the case of first time purchasers of addictive drugs who subsequently become addicted. No model of continuously shifting or sliding price elasticities for different drugs has been offered, and none has been studied by reference to any longitudinal data set.

Similarly, there is less overall importance attached to the actual price elasticity than to the “relative” elasticity of commodities. Thus an “ordinal” approach to measuring a product’s price elasticity may be most valuable. Gordon Hewitt, in his classic *Economics of the Market*, describes the importance of “relative elasticities” this way:

The concept of Price Elasticity of Demand is used to compare the response in quantity demanded of a good to different price changes, or alternatively to compare the response in quantity demanded of different products to a specific proportionate change in price ... When a variation in price leads to a greater than proportionate change in quantity, demand is said to be relatively elastic ... In such cases, the price elasticity will be greater than one ... Hence if the price of [any commodity] changed from 5 [dollars] to 4 [dollars], the demand for [that product] would be *relatively elastic*.³⁸

The same could be said by flipping the example. “Alternatively, when the proportionate change in quantity demanded is less than the proportionate change in price, demand is said to be *relatively inelastic* (emphasis added).”³⁹

Many traditional economic texts treat price elasticity as a set quantity change for a given price change in a product or commodity. They do not review longitudinal data for a purchaser group to see if there is a changing or "sliding" price elasticity for the same substance by the same consumer group over time, and thus do not address the concept. Thus, Hewitt concludes, "when demand is relatively elastic, a fall in price will lead to an increase in total revenue [for whoever the seller is], and a rise in price will lead to a fall in total revenue [for the seller]."⁴⁰ At the same time, his work holds that "when demand is relatively inelastic, a fall in price results in a fall in total revenue, and a rise in price results in a rise in total revenue."⁴¹

As accurate as these statements are for non-addictive goods or products, missing from this analysis is the notion that a commodity may begin at a high price elasticity and slide rapidly from "luxury" status to "necessity" status, bringing with it a sudden drop toward a lower PED.

The Idea of Sliding PEDs and Addiction

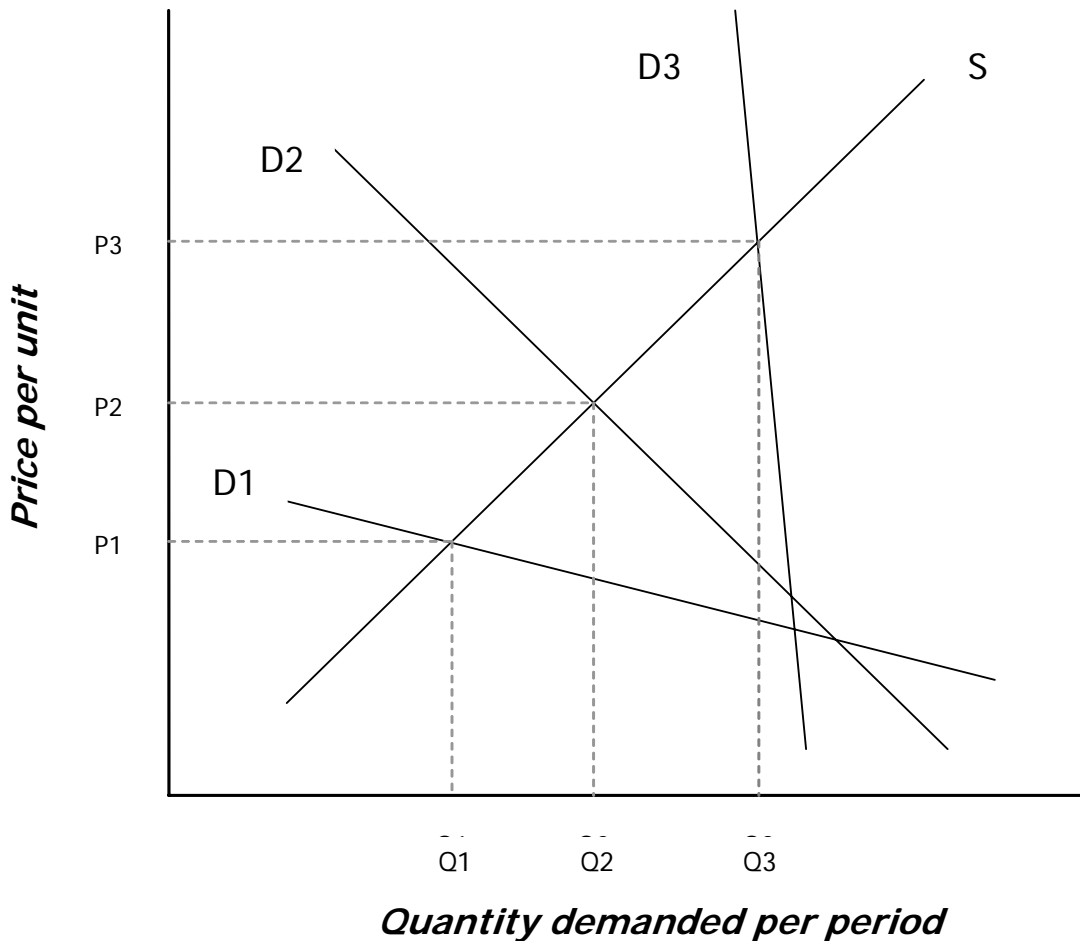
Turning to drug policy, if one assumes that addiction represents an unchanging or rising demand for the commodity at issue, namely a narcotic, the evolution from a highly *elastic* quality to a highly *inelastic* quality is represented by another principle of price elasticities. *A vertical line on a chart plotting changes in price (vertical axis) against change in quantity (horizontal axis) would represent what is called "perfect inelasticity." This is the ultimate state that describes drug addiction, and the state toward which casual users often drift as they become psychologically or physically addicted to a drug.*

Why is this so? The reason, in economic terms, is simple. "By inspecting [a vertical] demand curve, it can be seen that quantity demanded always remains the same ... at all price levels. [That is,] if we computed the value of Price Elasticity of Demand for *any price change*, the numerator in our formula would always be zero since *no change in quantity demanded takes place*. Hence the value of Price Elasticity of Demand would be zero over all parts of the demand curve. When a price change results in no change in quantity demanded, demand is said to be perfectly inelastic (emphasis added)."⁴²

Bingo! The evolution of an illicit drug user from first time experimentation to hardened addiction can be aptly represented by the shift from a responsive or price elastic product to a highly inelastic product. What the literature on non-addictive substances does not account for is the central fact behind addiction: it is not the product that has changed, but the consumer's behavior toward that particular product. Specifically, what has changed is the increasingly addicted consumer's unwillingness to reduce demand for that particular narcotic, even when price rises.⁴³

As the price elasticity has gone from high to low, the curve (plotting vertical

Progressive Drop in Price Elasticity of Demand Over Time Associated with Narcotics Use



- Demand is highly elastic (shallow slope) at first use of a narcotic ($D1$): a slight increase in price has substantial impact on demand, *ceteris paribus*.
- Demand becomes less elastic (increased slope) with casual use of a narcotic ($D2$): a price increase has less effect on demand, *ceteris paribus*. Note also that as narcotic use increases, the addictive characteristics of the narcotic increase the demand for the narcotic at all prices, thus shifting the demand curve to the right ($D1$ to $D2$).
- Demand becomes highly inelastic (steep slope) with addiction to a narcotic ($D3$): a price change has very little or no impact on demand, *ceteris paribus*. Again, as use increases, demand for the narcotic increases at all prices, shifting the demand curve further to the right ($D2$ to $D3$).
- Over time, from first use ($Q1$) to addiction ($Q3$), the quantity of an addictive narcotic demanded by an addict increases at all prices, and the demand for the narcotic becomes less elastic.

price against horizontal quantity) has gone from one that reflected *sensitivity to price* to one that *ignores price*, from a more horizontal line (left downward toward the right) to a vertical line, representing the inescapable clutches of a perfectly inelastic product. The purchaser is no longer able to choose not to purchase when the price rises infinitely, but rather is compelled to find the resources to obtain the drug to which he or she has become addicted.⁴⁴

In economic terms, the slide toward perfectly inelastic demand is significant. It confirms that, for narcotics or any highly addictive commodity, intervention to restore rational decision making is *essential*, since without a means for ending the addictive behavior which keeps PED inelastic, only death of the addicted person or complete absence of both the addictive commodity *and* any substitute will end the addiction.

Applying the Sliding PED to Legalization: A First Look

Equally poignant is the other application of PED to drug policy. If addiction can be explained in economic terms as a vertical line on the PED chart, or demand that is “perfectly inelastic” absent intervention, there is also a way to illustrate the economic effect of low price spurring theoretically infinite purchases.

A horizontal line at some very low price point on the same chart would indicate that there was a price level at which even first time drug buyers - presumably uninhibited by education, prevention, or knowledge of the risks incurred by the purchase - would feel inclined to “buy all they could possibly get [or at least use] at that price.”⁴⁵ This line represents “perfect elasticity” since, at any price above that price line, the consumer would be less inclined (or disinclined) to buy the narcotic. However, at a lower price, a first time purchaser is more inclined to purchase the commodity.

Why does any of this matter? The theory behind PED is that one can measure the impact of price on quantity purchased. While the literature has come up short on the measurement of an evolving or sliding PED for addictive substances (e.g., narcotics) and seems not yet to recognize a particular ordinal or relative ordering of the speed with which addiction occurs or speed with which PEDs change for different addictive substances, there is a genuine need for further research into what public policies follow from 1) the possibility of a sliding PED for an addictive substance, and 2) the speed with which different addictive substances shift from high price elasticity to low price elasticity.

This research and *mere recognition of sliding PEDs for various addictive substances* as an important element of the public policy debate is sufficient reason to study further the described phenomenon.

If narcotics or addictive substances generally are characterized by a sliding PED, then there is every economic reason to oppose policies such as decriminalization or

legalization of such substances, since they would tend to be rapidly purchased at lower prices, but would soon drive new purchasers of the addictive commodity toward "perfectly inelastic" demand, that is, addiction.

To the extent that addiction is a state of consumption carrying increased economic costs in medical response, reduced productivity, domestic violence response and related economic requirements on governments, policy movement in this direction is likely to increase the economic drain on any government that adopts a position of encouraging such consumption of substances characterized by a sliding PED.⁴⁶

In short, legalizing presently illegal and addictive commodities would predictably lower price and encourage wider first time use, triggering the onset of a larger number of consumers who are unable to avoid consumption at any price in the future. A policy that encouraged addiction, or a shift toward wider first time use and thus wider addictive consumption, would tend to cascade toward increasing addiction with all the concomitant costs of this widening within of addiction within society (see discussion in ***Notes and References***, #46).

While not all consumers would be expected to respond to the lower price of the addictive substance, and education and prevention might mitigate the effects of heightened availability, legalizing (i.e., lowering the cost of) that substance would likely lead to an increase in use, and the rate of slide for PED of each particular substance legalized would dictate how great the increase in economic cost would be to the government embracing that policy.

In short, additional research into the unique characteristics of a range of addictive substances in economic terms, including drug and alcohol-related PED research,⁴⁷ and in particular the concept of sliding PEDs and the rate at which they shift from high to low for each particular drug, would appear to be of considerable value for public policymakers.

Research Needed on Sliding PED Model

This point is driven home by one recent analysis of addiction and economics. In the 2001 study entitled ***Informing America's Policy on Illegal Drugs***, the National Research Council details weaknesses in "estimating demand functions and price elasticities" as they related to drug abuse.⁴⁸ While noting that "demand functions and price elasticities must be understood to formulate effective drug policies,"⁴⁹ the authors criticize existing studies in this area for nine reasons. These reasons are lack of reliable price data, price dispersion, other costs, lack of quantity data, addiction, heterogeneity of consumers, cross-elasticities, the dynamics of drug use, and heterogeneity of drugs.⁵⁰ While each of these criticisms of current economic research relating to PED may be valid, some stand out.

The notion that better data is needed to describe the actual prices at which drugs are purchased, actual costs incurred by consumers, how much of which drugs are purchased, what the purity of various drugs is and how often drugs are substituted for one another are all valid concerns. Generally, these criticisms point toward a need for better data collection. More importantly, however, are criticisms that dovetail well with this study's argument for measuring and charting different sliding PEDs for different drugs over the lifetime of a user population.

Specific criticisms lofted by the National Research Council reinforce points made in this study. First, too few longitudinal studies have been done on addiction, measuring the relationship between drug use, price and the effects of addiction over time for one user population. Second, different consumers of the same addictive drug may react differently to price. Thus, "cocaine consumers include casual and heavy users ... These two groups face similar prices (or distributions of prices) but have very different consumption patterns."⁵¹

The problem of not recognizing that casual and addicted purchasers consume in different ways is consistent with the argument that researchers should focus on the notion of a *sliding Price Elasticity of Demand* for different stages of drug consumption. As the National Research Council accurately points out: "Casual users may be more responsive to changes in prices [and in fact are] than heavy users ... If so, the high elasticities of participation [i.e., use of any kind] found in recent studies of demand may mainly reflect responses of casual users to price fluctuations ... In addition, the finding that frequency of use ... is less responsive to price ... may be strongly influenced by the behavior of heavy (high frequency) users who are relatively insensitive to price changes." Revealingly, the Council notes: "No demand model that the committee has seen allows for the possibility that casual and heavy users have different price sensitivities."

Likewise, this critique of economic literature points out what is missing. It notes that there is little research modeling "dynamic" drug use, explaining effectively the relationship between price, time and use of drugs by one addicted population, and there is no data to model this idea. "No existing empirical model of demand for drugs describes the process by which individuals initiate and make transitions among different levels of drug use (e.g. from nonuse to casual use, from casual use to nonuse or heavy use)," noting that "the data that are required for empirical study [of such a model] of drug use dynamics and their dependence on prices and other costs of drug use are not available to researchers ... Implementation of such a study would require a longitudinal data set that describes drug use by individuals over time."⁵² These points are well taken.

Even if the proper model is comparative "sliding Price Elasticities of Demand" for different drugs over time by one user population – the absence of data will remain a problem. Nevertheless, the need to articulate such a model and collect the data to

support it is becoming increasingly clear.

On balance, while a variety of studies have looked at narcotics as an economic commodity, most have sought to treat addictive substances in terms which apply to consumer behavior generally, such as imputing a static PED to a given commodity or applying a so-called "behavioral economic" approach to the question of drug consumption.

Generally, these studies seek to explain consumption by reference to a variety of factors, such as income level, socio-economic factors, work or cost of obtaining the drug, availability of the drug and availability of substitutes.⁵³

In summary, these studies see addictive substances as economic commodities that, in general, conform to traditional notions of price and income elasticity of demand, or "supply and demand." Even when the notion of Price Elasticity of Demand has been applied, and found for example to support a highly inelastic PED for cocaine among addicted persons, the idea has been premised on a constant – not sliding – variable, and recourse to a dynamic model or longitudinal data has been missing.⁵⁴



Survey of Literature on Economics of Addiction: Good, Bad and Ugly

A wide range of literature exists describing the economics – and putative economics – of human addiction, narcotics sales, incentives and disincentives, penalties and prohibitions, supply reduction, demand reduction, treatment modalities and prevention effects.

A substantial cross-section of this literature was collected and analyzed in an effort to synthesize and account for *the leading economic arguments and studies* in the field that might bear on this project. Reviewing all literature describing itself as economic or bearing on economics of these issues was beyond the scope of this project. In effect, there exists a set of repeating arguments which tend to surface under the rubric of economic analysis. These appear in journals as readable as *The Economist* and as arcane as the *Eastern Economic Journal*. A representative cross-section of this research is assessed in this paper.

Overview of Economic Literature on Addiction

Some articles and research presented in journals of higher learning are highly valuable pointers, rigorous in their methodology and deserving of special mention. Hundreds of others are thinly veiled excuses for unsubstantiated opinion and offer no new economic ideas upon which to make decisions or base future policies or research.

In an effort to fairly account for leading economic research surrounding the topic discussed in this paper, a description of several studies and research efforts of note is set forth in this document. These studies only buttress the notion *that sliding PEDs for drugs are important and their application to particular drugs is an unexplored avenue with significant policy and research implications*.

Less time is devoted to those studies which offer only cursory or unoriginal assessments of the economic factors at play in discussing the Price Elasticity of Demand for addictive substances. No time is allotted to discussions that range far outside the economics of PEDs for addictive substances, unless they materially address factors that might affect the PEDs of such substances.

Encouragingly, some studies of addictive substances have recognized that Price Elasticity of Demand may have valuable application to the science and policies surrounding substance abuse and addiction. Unfortunately, these studies have been largely dedicated to other matters, self-limited, incomplete and often conclude with such simplistic assessments as, for example, "there is a palpable demand curve for substances with a sizable price elasticity."⁵⁵

While this is a good starting place, such statements fail to pursue the best use

of that economic tool. They do not recognize, establish, track or make useful follow-up observations about the application of sliding PEDs to addictive substances. Missing is an understanding that the PED for a highly addictive substance does not remain constant, but is dynamic – invariably shifting for any given purchaser and for each type of drug. This understanding is central to effective public policy, since there will be a predictable attenuation of any effect that price has on quantity consumed based on the frequency of use and level of addiction.

On PED itself, as indicated earlier, existing research tends to suggest either that drug consumption is steady at one rate highly responsive to price or steady at one rate that is highly nonresponsive to price.⁵⁶ In only two studies are specific points or regions identified at which different Price Elasticities of Demand exist; both record a high sensitivity to price among “dabblers” and a low sensitivity to price among addicted persons.⁵⁷ *Missing are the notions that Price Elasticity of Demand invariably slides over time for purchasers of all drugs, that different drugs have different rates of slide or sliding price elasticities of demand, and that this dynamic reality directly affects a society's public policy choices.*

Reviewing “Rational Addict” Theory

Many studies on economics and addiction acknowledge that “prices are an important determinant of demand for addictive or psychoactive substances – whether they be alcohol, cigarettes, snuff, cocaine or valium”⁵⁸ Generally, these studies recognize that price is an effective tool for regulating demand only when purchasers are willing and able to respond *rationally* to changes in price. On the other hand, some studies suggest that addicted persons act *rationally*, calculating how to maximize utility over the long run by measured consumption and a thoughtful feeding of their addiction.

A review of leading economic arguments and recent addiction studies, suggests that the decision making by addicted persons is not rational, but compulsive. Reason and long-run calculations are replaced by growing dependence on, need for and tolerance of the addictive narcotic.

At the core of the PED discussion is the fact that addicted persons do not typically react to price changes in the same way as nonaddicted persons. While drugs are consumed by first time and casual purchasers *more often at lower prices (and less often at higher prices)*, these same drugs are consumed by addicted persons with *little change in quantity and low sensitivity to price*. Notwithstanding these observations and the science of addiction, some researchers propose that addicted persons calculate long-term utility as rational consumers – in short, they are “rational addicts.”

Persistent references to “rational addict” behavior invite a closer look at this idea and at *the nature of addiction*. In general, the notion that “rational addicts

should not require paternalistic rationing [by the government or anti-drug laws] of their [narcotic] consumption"⁵⁹ has little support in either the economic or addiction literature.

On its face, "rational" decision making is not a characteristic matching the compulsive and dependent nature of addiction.⁶⁰ On the contrary, a growing body of research supports the "cognitive deficits" model of addiction. This model sees a *departure from rational decision making* by those addicted to drugs.

Specifically, "[t]he cognitive deficits model of drug addiction proposes that individuals who develop addictive disorders have abnormalities in an area of the brain called the prefrontal cortex (PFC) ... The PFC is important for regulation of judgment, planning, and other executive functions ... [A]s a result, they have reduced ability to use judgment to restrain their impulses and are predisposed to compulsive drug-taking behaviors. Consistent with this model, stimulant drugs such as methamphetamine appear to damage the specific brain circuit – the frontostriatal loop – that carries inhibitory signals from the PFC to the mesolimbic reward system."⁶¹ In lay terms, "[d]rugs of abuse, such as cocaine, also appear to cause long-term physical alterations in the brain that may make it very difficult for [addicted persons] to merely change their minds about using drugs."⁶²

More to the point, although there are conflicts in the literature, a substantial body of research supports the bald assessment that "addiction is irrational in the sense that it is not curtailed by the aversive effects of drugs."⁶³

Another element of "rational addiction" theory requires a mention. To argue – as some do – that addicted persons should not have their supply of drugs curtailed by the government, but need help from the government to rationally "optimize" their "lifetime utility" as the addicted persons is, at best, "a circular argument."⁶⁴ As one observer put it, even if price had an effect on addicted outcomes, "at the end of the day, fairly large price elasticities [among a group of drug purchasers] does not constitute proof of rational addiction [within that group]."⁶⁵ While first time and occasional purchasers may demonstrate sensitivity to price, addicted persons are less likely to have their consumption change in response to price, reflecting a departure from rational decision making well documented by the cognitive deficits model.

One further study of interest in this area is a 1998 "rational addiction" study by Grossman, Chaloupka and Sirtalan, published in *Economic Inquiry* and entitled "An Empirical Analysis of Alcohol Addiction: Results from the *Monitoring the Future* Panels."⁶⁶ While the study assesses the "short-term" and "long-term" effects of price on consumption of alcohol, comparing these with those for cigarettes, the reference to PED is less valuable than hoped. As with other studies of this type, this study assumes rational decision-making by those already addicted. Moreover, the authors refer to "elasticity of consumption," a term not familiar or commonly recognized in leading eco-

conomic texts,⁶⁷ rather than price or cross elasticities of demand. To the extent that the authors intend to compare variations in Price Elasticity of Demand over a short-run period and a long-run period, the findings are unclear.

On the other hand, the rigor of the comparison is unusual, and one of the authors' findings may help in creating an ordinal system for comparing sliding PEDs for different drugs. Specifically, the authors find that "alcohol consumption is somewhat less addictive than cigarette smoking."⁶⁸

On balance, the "rational addiction" model seems to dispose too quickly of the mind altering nature and effects of addiction, while providing support for the relative addictiveness of different substances.

High Prices Have Limited Effect on Consumption by Addicted Persons

Another recent analysis illustrates that high prices may have less effect than frequently thought upon consumption by addicted persons. This 2001 study compares cigarette consumption in high-tax states with cigarette consumption in low-tax states.⁶⁹ The study notes that researchers attributing lower cigarette use in the high-tax states to the upward pressure on prices fail to account for the anti-cigarette bias pre-existing in many high-tax states. Thus, comparatively lower cigarette use numbers in such states do not imply that addiction can be reduced - even in the case of a milder addiction - by raising prices. In summary, the link between prices and behavior change for those who are already addicted is highly attenuated.

In the view of these researchers, antidrug education is far more compelling as an agent of behavioral change than price. Specifically, while many studies have corroborated that "anti-smoking regulations, anti-smoking education campaigns and less obviously formal education" have "often been found to reduce smoking, and more generally to increase healthy behavior," the same is not true for higher prices associated with an increase in cigarette taxes.

Without separating addicted persons from occasional purchasers, this study found that:

There is a potential bias in cross-sectional estimates of the effects of cigarette prices on cigarette consumption. States with the strongest antismoking sentiment will likely have the highest cigarette taxes, which result in the highest prices. Some of the lower consumption of cigarettes in high-tax states will result from such sentiments, rather than from higher taxes, so the estimated effect of cigarette taxes on consumption will be overstated. This study corrects for such bias, employing panel data ... from 1960 to 1990. *We find that controlling for this bias reduces the estimated consumer response to cigarette price change by 40 to 50 percent (emphasis added).*⁷⁰

In fact, if the overstatement is this high, the real effect of price on those addicted may be very low. The real impact of price, even on those addicted to cigarettes, may be closer to zero or characterized by an extremely low PED.

Note that there is a series of historical PED data cited in the foregoing study, but none of the studies cited addresses the issue of a sliding or shifting PED for specific drugs over an extended period. Instead, this data refers to a variety of different PEDs for different purchasers and the notion that “long run” PED is generally low for addictive substances. Missing are policy implications of a shift from a high to low PED, tracking an addict’s progression from first use to addiction. Moreover, decision making by individual addicted persons is not studied; only collective behavior of all users – nonaddicted and addicted – is studied.⁷¹ *What this study suggests is that price may be less significant for those who are addicted – even to nicotine – than originally thought, and also less important to decision making of addicted persons than education.*

This finding reinforces the thesis that sliding PEDs matter and that an addicted population may not respond to a price change the way a first time purchaser would respond to the same price change. One added voice for this thesis, while not addressing sliding PEDs for addictive substances, is an economic study published by *The Columbia Law Review* in 2000. In that study, the author argued that “[t]he concept of ‘elasticity of demand’ [citation omitted] is also important to the traditional law and economics argument ... When the elasticity of demand for a particular drug is low, increasing the price ... will have a relatively limited effect on consumption.”⁷² In short, if the PED for any drug is low among the addicted population, changes in price will have “a relatively limited effect on consumption.”

Again, this forces the conclusion that public policies intended to address addiction through a simple upward price change in the addictive substance will not succeed; while policies which would legalize a drug, lowering the price, might produce new first time purchasers and, over time, create a larger population of addicted persons.

Studies Fail to Separate Price Impacts on Nonpurchasers, Occasional Purchasers and Addicted Purchasers

Often studies with considerable economic depth miss the fine points of addiction. Thus, for example, one study published in 2001 mentions Price Elasticity of Demand and seeks to estimate the effect of state criminal justice and public health spending on deterring illicit drug use.⁷³ Unfortunately, the authors fail to separately analyze the behaviors of nonpurchasers, occasional purchasers and addicted purchasers. The effect of this omission is to minimize the impact of the findings.

As with other studies, these authors premise their work on the assumption that the laws of “supply and demand” work both for addictive and non-addictive substances.⁷⁴ Specifically, the study “assumes a demand function that is downward sloping

with respect to price and a supply function that is horizontal or upward sloping with respect to price." In short, changes in price are *assumed* to affect both "supply and demand" at any level and at any time, producing a traditional, proportional and predictable effect on one another. There is no attention to the possibility that price and supply changes may affect demand of a subgroup differently from the whole.

With partial accuracy, the study finds that "criminal justice spending directed at drug dealers may increase the cost of doing business, which would raise the price of illicit drugs and reduce drug use ... [Thus] [c]riminal justice spending directed at users may shift the demand curve to the left, which would reduce drug use and drug prices."⁷⁵

While increased costs do generally get passed to the consumer through higher prices, the notion that first time drug purchasers, occasional drug purchasers and addicted drug purchasers respond similarly – much less equally – to a rise in the price of an addictive substance is neither substantiated nor addressed.

The more likely conclusion is that first time and occasional purchasers, not yet addicted and therefore not yet unresponsive to price changes, will react to a rise in prices by reducing demand. On the other hand, addicted consumers will not respond swiftly – if at all – to a rise in prices, since to them the quantity needed (i.e., to be demanded) is unchanged.

The study also states that "the effect of a given expenditure on criminal justice or public health is dependent on the magnitude of the resulting shifts in the two functions and the supply and demand price elasticities." Subsequently, the study argues that "four recent empirical studies provide evidence that drug use is responsive to market forces."⁷⁶

Notably, not one of the four studies cited disaggregates the *addicted* persons and *nonaddicted* populations, or addresses the idea that a sliding Price Elasticity of Demand for addictive substances may exist – and may affect their findings. Instead, each study lumps together first time, occasional and addicted purchasers, and concludes generally that demand within this disaggregated market changes when prices change.⁷⁷

While there is wide acceptance of the idea that price increases reduce demand for those who are not addicted and price declines spur increases in demand,⁷⁸ there is no evidence offered – in this study or any of the four cited – to support the argument that addicted persons are similarly responsive to a rise in prices, that is, by reducing their demand. Further, there is not any evidence presented that demand remains similarly responsive to price when first time users migrate to occasional purchases and eventually to addictive purchasing, in effect producing the sliding Price Elasticity of Demand.

Perhaps most revealing is this study's confession that the data sets used, while large and thus likely to be more reliable, nevertheless aggregate all persons who come into contact with drugs; the authors recognize that the data sets do not separate responses of those who are *occasional* purchasers from those who are *addicted* purchasers. "Although there is no strict dichotomy between occasional and frequent drug users, these surveys are likely to be more representative of occasional drug users rather than frequent drug users...[and when measuring past year drug use, the dependent variable] does not differentiate between recreational and habitual drug users ... Because the [study's data sets] are more representative of recreational drug users [undefined], the effects may be strongest for this group."⁷⁹

Nevertheless, this study does reach at least one finding that crosses all purchaser populations. By reference to regression analysis, the authors conclude in general: "[m]arijuana decriminalization is ... found to increase drug use."⁸⁰ This finding is consistent with the view that first time drug use rises as availability increases, and that availability increases with legalization or decriminalization of an addictive substance.⁸¹

What would have been instructive is 1) an assessment of the changes in marijuana price as the decriminalization occurred, and 2) an assessment of the changes in addiction rate over an extended period in those states that decriminalized or legalized this (or any other) narcotic.

Still, this study stands for the propositions that 1) leading research often does not disaggregate first time purchasers, occasional purchasers and addicted purchasers when discussing the impact of price changes on consumption, and 2) at least for marijuana, decriminalization (presumably reducing price for all purchaser groups) increases overall use for the disaggregated purchaser population.

Changes in Price Affect Drug Initiation Rates

Another study of note was reported in the *American Journal of Public Health* in 1998. The key to this study was "trends in initiation of psychoactive drug use."⁸² *One essential conclusion drawn from this data analysis was that "changes in price can significantly affect initiation [of drug use]."*⁸³ *In other words, lower prices may increase initiation and higher prices may reduce initiation.*

Specifically addressing "marijuana, cocaine and hallucinogens," the study states that "demand does respond to price shifts in such markets."⁸⁴ The study does not identify whether this change in demand was among those "initiating" or among those who define themselves as frequent purchasers. Nevertheless, this study concludes that, "changes in price can significantly affect initiation [of drug use]."⁸⁵ The likely link between these two findings is that initiation rates – or rates of first use – for any drug are affected by price, while substantial price effects are not recognized for those already addicted. Other economic studies confirm the link between drug price and drug initiation rates.⁸⁶

Distinguishing between Decision Making by Addicted and Nonaddicted Persons: Price and Tax Hikes Offer Limited Utility for Reducing Consumption by Addicted Persons

A sixth recent study has special value for this analysis. Licari and Meier offer a 1997 study in the *Political Research Quarterly* entitled "Regulatory Policy When Behavior is Addictive: Smoking, Cigarette Taxes and Bootlegging."⁸⁷ Among the meaningful conclusions this study draws are the following:

First, while premising their research on the applicability of supply and demand principles in the addictive environment,⁸⁸ they acknowledge the significance of low Price Elasticity of Demand for the addictive commodity cigarettes. They state that: "Although the price elasticity of cigarettes may be sluggish because they [cigarettes] are an addictive commodity, at the margins higher prices should reduce demand." This statement is quite revealing. While cigarettes are a modestly addictive substance by comparison to substances with higher abusive potencies, such as heroin and methamphetamine, the study recognizes that the addicted consumer will behave differently from the non-addicted consumer. Additionally, the authors recognize that the value of high prices in an addictive market – even one that is relatively less addictive than commodities with higher abusive potencies – is limited as a tool of public policy for addressing addiction.

Second, the authors clearly articulate the dilemma presented by using *taxes* – that is, an artificial increase in price – as a tool of public policy for conflicting purposes, raising revenue and reducing consumption of the addictive substance:

Faced with an increase in taxes, a smoker [or other addict] has three options: (1) continue to smoke [or use] and pay the tax; (2) reduce consumption and pay less taxes; or (3) attempt to avoid the tax, possibly by bootlegging [i.e. illegal acquisition of the commodity at a lower price]. If the state government's goal is to raise revenue, it prefers the citizen select option (1) and not options (2) or (3). If the goal is to reduce consumption, then the government would like the smoker [or user] to select option (2) but not options (1) or (3). Whatever the state's goals, however, option (3) undercuts them.⁸⁹

The 1997 Licari study offers important points worth attention. The study suggests that price effects on an addict's demand for a drug may be accounted for by "a statistical model ... [that will] lag the dependent variable." In essence, this means that the authors believe – as do the other investigators who have explored this idea – that they can account for the "stickiness" of supply and demand in the addiction context by a statistical trick. They recognize that the addicted individual is less likely to respond to higher prices as he or she becomes more addicted, undercutting the normal operation of the laws of supply and demand.

To compensate for the obvious inapplicability of supply and demand, they offer to lag – or add back into the equation – past consumption of the addictive substance. That is, they will slow the responsiveness of the addicted individual to price changes in proportion to the number of years (or months) he or she has been addicted. In this way, they hope to prove that price still affects behavior, but to also acknowledge that price affects behavior of addicted consumers less and less each year.⁹⁰

There are several problems with this “lagged dependent variable” answer to the problem of addictive nonresponse to price. Lagging the dependent variable assumes a steady rate of addiction, requires speculation as to how much lag to permit (i.e., how addictive the drug is year to year), and fails to account for an end state often quickly – not gradually - reached, in which price no longer affects consumption patterns by an addicted person, since the need to consume is not reduced or rationally deflected by higher prices.

Nevertheless, one redeeming feature of the lagged dependent variable analysis in this study is the recognition it implies of the nonresponsiveness of addicted persons to price changes. Specifically, the study notes, but fails to quantify, the rising PED for drugs as purchaser addiction grows: “[s]ince the nicotine in tobacco is highly addictive, current consumption levels are highly dependent on prior consumption levels [citation omitted], and the responsiveness of demand to price (or tax) increases and policy changes should demonstrate some stickiness”⁹¹

Studying alcohol use at college age is instructive in other ways. One intriguing study is the 1996 analysis by Chaloupka and Wechsler, entitled “Binge Drinking in College: The Impact of Price, Availability, and Alcohol Control Policies,” in ***Contemporary Economic Policy***.⁹²

While the conclusions are limited for decision making by addicted persons, they suggest that alcohol use in the form of “binge drinking” by college age males may have a very low response to price, reflecting a low Price Elasticity of Demand. *In this way, “binge drinking” may be closely correlated with addictive behavior.* One problem with this study is that there is no data set uninfluenced by widespread availability of free, underpriced or unpriced alcohol, especially beer, on college campuses. Accordingly, the reference to prices in the community may be spurious.

On the other hand, the study suggests that a strong relationship exists between excessive alcohol use – with or without addiction – and price. As in the case of addiction, there is low responsiveness to price by college males engaged in “binge drinking.” On the other, in theory, “by raising prices, higher alcohol taxes could significantly reduce alcohol abuse among youths and young adults, as well as in other segments of the population.”⁹³ Note again, the study does not address the availability on college campuses of illegally acquired alcohol and illegal substitutes to legal alcohol. Refining their view, the authors find that “price rarely has a significant impact on the level of

drinking or drinking participation by young adult female students."⁹⁴ Perhaps due to "binge drinking" and the inability to account for free alcohol on college campuses, the authors conclude: "[g]iven the insignificance of price in most of the equations for male college students, these estimates [of marginal effects and price elasticities] suggest that sharp increases in beer taxes, if passed on in the form of higher prices, would have little impact on drinking and binge drinking among male college students."⁹⁵ In fact, they conclude that "male college students are virtually unresponsive to price."⁹⁶ For reasons that are not further explored, this low PED among these groups for this substance mimic the effects of longer term addiction. Consistent with the idea that alcohol prices are so low on college campuses that marginal price changes do not affect consumption, these authors note that "alcohol availability has a strong positive and significant impact on all measures of drinking and binge drinking..."⁹⁶ and that availability is apparently high among the sample groups.

***A Twist on Rational Addiction Theory:
Muddy Thinking about Treatment, Price Elasticity of Demand and the
Underpinnings of Rational Decision Making***

One study that offers controversial conclusions, but also refers to strong addiction research in doing so, was presented by Boyam and Kleiman in 1994.⁹⁸ While much of this study is unsubstantiated opinion relating to effects of possible drug legalization on crime, its analysis of past data sets is valuable. In many ways, this study represents the mindset of those who have bothered to examine the issue of PED in relationship to drug use. The cornerstone view of these authors and others who have examined PED seems to be that PED is a function of decision making by addicted persons (this much is true), *and that decision making by addicted persons is affected by price, since after a period of time, the addicted person rationally concludes the habit is not maximizing his or her long-run utility.* Thus, addicted persons will choose to stop their addiction, and will apparently be able to do so.

The evidence for such a long-run conversion by addicted persons to nonuse by higher prices and thus a lower PED over time for those addicted (unlike the natural tendency of non-users to avoid initiating use when prices are higher) is plagued with methodological problems.

A few of these problems are mentioned here, and affect this study and those which impute a *higher* PED to addicted persons over time, that is, a greater likelihood of addicted persons to stop use when prices are higher.

Consider the central questions raised – but not answered – by such studies:

- If higher prices affect addicted persons more dramatically than initial purchasers, how available to the addicted population being studied was effective treatment? If highly available, the results would be skewed by factors other than price.
- Similarly, how aggressive were the intervention modalities that were available? If highly aggressive within this study population, then again the impact of prices is masked by aggressive intervention.
- How many of the addicted persons stopped using because they were admitted to emergency room care? Since addiction raises the propensity for emergency room admission and many addictive drugs spur higher emergency room admissions, the effect of price may be altered by changes in the addicted population's access to these drugs.
- The same question may be asked for those addicted persons who stop consuming – and are thus credited with a lower PED – because they have died of their addiction.
- How did the study verify that addicted persons did not merely move geographic locations to gain access the same drugs at lower prices? If the drug prices were higher in a geographic area under study and the numbers of addicted persons went down, one explanation discrediting the notion of higher PED is that addicted persons simply moved in order to consume the same drug at a lower price in a neighboring, but unstudied, drug market.
- How did the study verify that the substitution effect was not in play, such that higher prices of one drug produced a shift in addictions – not a shift downward in drug use – for example, from heroin, to OxyContin or from crack cocaine to methamphetamine? If the substitution effect allowed continued addiction at the same rate, the idea that a reportedly higher PED for one of these drugs is not significant.
- Likewise, why would addiction rates fall faster than initiation rates in any drug market, other than the counterintuitive assertion that addicted persons evaluate long-run use and find it cost ineffective (an unlikely event given the nature of most drug addictions)?

In short, this study and others like it assume that an addicted person will abandon a habit at higher prices, just as higher prices negatively affect initiation rates by nonpurchasers. If this assumption is wrong, which appears at least as likely as not, then studies offering hope to policy makers by linking higher prices to shrinking popu-

lations of addicted persons are misguided, except to the extent that the higher prices reduce initiation, which reduces the pool of future addicted persons. Instead of offering real hope, they only point to the need to intervene early in the cycle of addiction and to avoid making addictive drugs more available at lower prices.

Examining carefully the fallacies that are embodied in the Boyam et al. study is worthwhile. The study holds that, "as far as empirical estimates of the elasticity of demand for illicit drugs goes, only two studies have been widely regarded as methodologically respectable. Both examined the link between heroin prices and crime in the early 1970s, and only indirectly looked at elasticity of demand."⁹⁹

While one might argue that neither study seriously studied the reasons for imputed changes in PED, the follow-on review in Boyam et al. is helpful in understanding the weakness in the field's examination of PED changes. Boyam et al note, for example, that "Brown and Silverman found, for New York City, a positive correlation between price of heroin and rates of different types of crime (such as robbery, burglary and auto theft) which addicted persons would commit to finance drug purchases" ¹⁰⁰ Similarly, Boyam et al. note that "Silverman and Spruill performed a similar, but more detailed, analysis ... [which] showed a strong association between heroin prices and crime, especially for property crimes."¹⁰¹

Notably, while the authors of both studies fail to point this out, that correlation – if higher than for nonaddicted purchasers – suggests that PED *does slide from high to low*, as addicted persons become less and less able to do without the drug, and thus more and more inclined to crime as a means of seeking money to buy the drug.

Ironically, this study does acknowledge that treatment is key to any reduction in use, presumably at any price, citing a well regarded study by Dupont and Greene, which found that higher prices of heroin in a community enjoying widely available treatment (without segregating addicted purchasers from nonaddicted purchasers) led to a decline in heroin use and lower reported crime.¹⁰² Perhaps the greatest common sense conclusion elicited is that, "[I]n effect, Dupont and Greene argue that the association between heroin and prices and crime is negative when treatment is available, positive when it is not."¹⁰³

The weakness in existing research on PED is further illustrated by another observation in this study. Boyam et al assert that: "[S]tudies [like these two] can only measure the elasticity of demand in the short run... . Thus their estimates are likely to understate the effect of price changes once users have the opportunity to discover and habituate themselves to substitute drugs, enter and complete treatment programs and so on."¹⁰⁴

With no data to support the observation, this is half right, half wrong. The PED will likely fall with increasing addiction, but will rise again as addicted persons substitute

one drug for another or enter treatment and thus – assuming availability of intervention – exit the market for that narcotic.

Unfortunately, the Boyam et al. study glosses over profound problems that lie within their discussion of PED. Meaningful treatment or intervention modalities are often unavailable, making the option of responding to higher prices by entering treatment (even if addicted persons tended toward this option) untenable. Similarly, substitutes exist for some drugs but not for others and the same drug substitutes are not available in all geographic areas. Moreover, the shift from one drug addiction to another, parallel addiction does not alter the population of addicted persons; it simply leads to a broader definition of that population. The PED for one drug may be higher, but the overall PED for addictive drugs in such a geographic area would remain the same.

Accordingly, it is *theoretically* possible for PED to become higher for a given drug in a given addicted population, but not likely. A higher PED could occur only where possible substitutes existed, where they are widely available at the same or lower prices, and where they are chosen by addicted persons over the primary drug. Likewise, it is *theoretically* possible for the PED for a drug to rise – that is, for the decision making of the addicted person to become more responsive to price – if treatment or intervention were universally available, effective and perceived by addicted persons as a viable, desirable, affordable and accessible option. In practice, a higher PED for drugs among addicted persons is unlikely, since many drugs are not perceived as having readily available one-for-one substitutes, and remain widely available (substitutes not being viewed as necessary). Moreover, treatment or effective intervention is often not an available option, nor is it perceived as desirable, affordable, accessible or viable as an alternative to the next purchase - at any price.

Thus, low PED more accurately describes the enduring nature of addiction to widely available and addictive drugs, where there is little likelihood of the addicted person seeking or finding viable treatment or intervention. Missed in these studies is the value of PED in describing the differing behavior of addicted consumers in a given market, not in assuming away the existence of the market by imputing other unlikely behaviors to the addict.

Notably, Boyam et al seem to acknowledge the enduring nature of addiction in discussing the market for any addictive drug. They note, “in the short run, demand is above all a function of consumption among current addicts ... [and] the demand is unlikely to respond quickly to a price increase... [since] not only is it difficult for [addicted persons] to immediately adjust their habits, but they know that most jumps in illicit drug prices reflect temporary interruptions in supply rather than lasting trends.”¹⁰⁵ Whether the latter point is true or not (no evidence is presented), the former seems undeniable.

Boyam et al. conclude “the higher price reduces both initiations *and* progressions from initiation or moderate use to heavy use (emphasis added).” In fact, the evidence of reduced *initiation* at higher prices for highly addictive substances is pervasive. The same simply cannot be said for addiction response. The authors acknowledge: “[i]n principle, the addictive nature of drugs may contribute to these effects [since] a rational person considering whether or not to take an addictive drug should be more strongly influenced by a change in its price than he would be if the drug were not addictive... .”¹⁰⁶ This much is both supportable and intuitive.

Falling back on rational addiction theory, Boyam et al. suggest that addicted persons will be induced to quit at higher prices “... because the effect of the drug’s price on his lifetime budget is greater.”¹⁰⁷ Somehow, the authors again assume away cognitive deficit issues associated with addiction by imputing nonaddictive behaviors to those experiencing, among other effects, extreme craving.¹⁰⁸ Thus, their conclusion merely scratches the surface of PED, its real calculation and meaning. In short, this study is also a missed opportunity as it relates to PED.

Economic Analysis of Legalization in the Context of Relative Initiation and Addiction Rates, Price Elasticity of Demand, and Predictable Changes in Consumption

A final study of significance – drawn from many which offer similar reasoning – is the seminal 1990 analysis by Avram, Goldstein, Harold and Kalant entitled “Drug Policy: Striking the Right Balance,” published in *Science*. These authors offer valuable insight into addiction, its economic consequences, and several suggested directions for future policy. Chief among their observations are these:

First, addiction is empirically a “compulsive” behavior characterized chiefly by physical dependence and tolerance. Supporting low PED among addicted drug purchasers, they offer:

People who become addicted usually believe, at the outset, that they will be able to maintain control. After the compulsion takes control, addicted persons persist in using high doses, often by dangerous routes of administration ... [T]here is an urgent need for more research to explain why they doggedly persists in a self-destructive activity despite full knowledge of its consequences.¹⁰⁹

Second, there is an empirical link between *availability of a drug at low prices* and *initiation rates*. While confirmed by other studies, these authors apply this observation to the notion of legalizing addictive substances and find that the *consumption rates would likely increase considerably*.

In fact, they find that “past experience suggests that the increase in use would be very large [By analogy], the history of alcohol provides some basis for predicting what might be expected from the removal of all drug prohibitions [and] [t]he key question is whether legalization of opiates and cocaine would result in levels of addiction comparable to those seen currently among users of alcohol and tobacco.”¹¹⁰ The authors point out: “[o]piates and cocaine are certainly not *less* addictive than alcohol or nicotine by any criterion [and] although the intravenous route [for administering the drugs] might never become widely popular, smoking (especially of crack) would be the route of choice for the millions.”¹¹¹ *The study's point is simple: increased availability at lower prices would increase use, which would increase addiction and the disproportionate costs of treating a nation of addicted persons.*¹¹²

Moreover, the economic trap set by legalizing a highly addictive substance is clearly stated: “[i]f the government were to attempt to prevent large increases in consumption by raising the prices for drugs sold through licit [legal] outlets Government would be in the unhappy position of having to choose between raising prices to discourage excessive use, thus allowing the illicit traffic to continue, and lowering prices enough to drive out the illicit trade, thus increasing consumption [citations omitted].”¹¹³ The depth and onset of the economic trap would vary by narcotic, but the effect would be the same.

Third, in purely medical terms, there are different levels of addictiveness identified for different types of drugs. While not formally catalogued or charted against one another by the authors, these relative levels of addictiveness are acknowledged by reference to medical science, opening the door to different types of comparative analysis.¹¹⁴

Notably, a first step in the direction of establishing comparative “sliding PEDs” for different drugs is arriving at relative levels of addictiveness, or the varying slopes measuring increased use (y-axis) against time (x-axis). While many factors affect the speed at which the average user becomes addicted to any given drug, and some users become addicted more rapidly than others, clinical studies offer useful guidance in establishing the relative rates of (or speed to) addiction.

These rates of (or speeds to) addiction offer a basis for further research on the relative slope of the different sliding PEDs for different drugs. Thus, the price sensitivity of purchasers to each drug could be studied at different times, namely 1) preceding first use, 2) during occasional use and 3) after addiction.

By charting estimated addiction rates (or speed to addiction) for each drug through use over time, we create a likely starting point for confirming the existence of different PEDs for different drugs at different times in the progression toward addiction from first use. This will open the door to a more thorough understanding of the relative prices at which different subgroups within the overall user population consume

addictive drugs, and the degree to which prices are likely to affect – and actually can or cannot affect – overall drug use.

Thus, with respect to cocaine, Avram et al. provide this starting point in comparing its objective addictiveness to other drugs:

Experiments [with various animal species] have shown that an animal fitted with an indwelling venous cannula, through which it can obtain an injection by pressing a lever, will establish a regular rhythm of lever-pressing if (and only if) the injection contains one of the known addicting drugs [citation omitted]. One measure of the addictiveness of a drug is how hard the animal will work (that is, how many lever-presses it will make) for each injection. Another measure is the extent to which the animal engages in drug self-administration to the exclusion of normal activities... Yet another measure is the rapidity of relapse after a period of enforced abstinence. *By these criteria, cocaine is the most addictive drug known* (emphasis added).¹¹⁵

The authors similarly note that:

[S]ingle-minded preoccupation of many cocaine, heroin, nicotine, and alcohol addicts with obtaining and using their respective drugs is disturbingly reminiscent of the animal experiment and reflects a major role of direct effects in driving addictive behavior ... [And] marijuana, which is less dangerous than cocaine or heroin [is] ... by no means harmless.¹¹⁶

Referring to THC¹¹⁷ or marijuana, the authors do not provide any comparative measure of this psychoactive drug's addictiveness, but note:

It is sometimes argued that as marijuana seems to be the least harmful of the psychoactive drugs ... it could be legalized safely. However, scientific evidence is still insufficient as to the potential magnitude of long-term harm, whereas the acute disturbance of psychomotor behavior is clearly dangerous under certain circumstances. It is not possible to predict with confidence what the result would be of vast expansion of the user pool, especially of heavy users.¹¹⁸

In this vein, the most recent information available on the addictive nature and relative health effects of THC and marijuana appeared in 2002 in a study published by the National Institutes of Health, National Institute on Drug Abuse (NIDA). NIDA found that "marijuana [in 2002] is far more potent than the marijuana of 30 years ago ... [and] the drug can produce a range of adverse physical and emotional effects, and – contrary to what many people believe – it can be addictive."

More specifically:

With high doses of marijuana, the user may suffer toxic psychosis, including hallucinations, delusions, and a loss of the sense of personal identity... . Marijuana has negative effects on memory and learning skills that are persistent but may not be permanent. Other effects of long-term abuse are cumulative and may last indefinitely...[including damage to the immune system]. A serious risk of long-term marijuana use is addiction – compulsive use of the drug... . Withdrawal symptoms and drug craving can make it hard for long-term marijuana users to stop the drug.¹¹⁹

While neither the 2002 NIDA study nor the Avram et al study offer a thoroughgoing comparison of addictions, they do offer support for the idea that levels of addiction (rates of or speeds to addiction) can be discussed in comparative terms.

In summary, the existing body of research on PED, as applied to drug use generally and drug addiction in particular, is limited. Most studies mentioning economic issues or making policy recommendations concerning either drug legalization or intervention to stop addiction do not address the issue at all, or refer to PED only in passing.

Where PED is mentioned or alluded to in the literature, it is chiefly to suggest that there is a static relationship between price and consumption of drugs - one that is either viewed as significant or insignificant, but applies across all drugs and with equal weight for both the first time purchaser population and the addicted population.

Where any disaggregation of these two populations is done at all, references are either fleeting or based on the spurious idea that addicted persons will act rationally, that is, in a way that will maximize their long-run utility when assessing when to buy drugs and at what price to stop buying drugs. Despite its prevalence in the literature, this “rational addict” concept is severely undermined by bodies of clinical and empirical evidence suggesting that addicted persons generally do not make decisions based on such long-term calculations and rationality.

Assessing the Popular Economic Argument for Legalization Offered by The Economist

One commonly heard voice on the topic is *The Economist* magazine.¹²⁰ Ironically, while an unabashed advocate of greater reliance on market forces to reduce drug use, *The Economist* has never seriously tackled the issue of a *sliding Price Elasticity of Demand for highly addictive drugs*. In fact, this issue is typically overlooked or dismissed in their regular analyses of drug policy. Thus, in June of 2002, *The Economist* argued for downgrading criminal penalties for cannabis, with “penalties for possession becoming nominal,” implied support for downgrading of “Ecstasy,” and argued for government “heroin prescribing” and “safe injecting houses” under the heading

“treatment” and “reform of Britain’s archaic drug laws.” The essential premise for this radical shift in policy is that drugs “have never been cheaper” and that “easy availability” now characterizes access to narcotics in Britain.¹²¹

Missing from their analysis are several critical elements of the economic discussion:

First, while prices may be at an historical low, a policy legalizing drugs of any kind would have to offer the same drugs at competitively low prices or risk quickly becoming irrelevant. In fact, until the government provided drugs in virtually unlimited quantities at the highest purity levels and at no appreciable cost to users, there would continue to be a secondary or black market for purchasers who wished to have more drugs than the government was offering, or a higher purity drug than the government was offering, or at a lower price than the government was offering. In short, given the twin characteristics of addiction - rising drug tolerance and rising dependence - it is hard to imagine the black market disappearing. To the extent that law enforcement resources were employed to address this black market, costs presumably saved by legalization would go uncollected.

Second, almost unmentioned is the enormous cost of either maintaining alive and addicted the population being accommodated in their addiction (particularly where a government assumes the substantial burden of health care) or the cost of effectively treating the addicted population to eliminate addiction, either one of which is likely to exceed the present cost of law enforcement and antidrug abuse education. Moreover, the inconsistency of a government both promoting or facilitating drug abuse and simultaneously seeking to stop drug abuse through expensive treatment is a formula for government outlays on a grand scale.

Third, separate from a persistent secondary market and the costs of treating addiction and addicted persons, any policy reducing penalties and widening availability through government distribution lowers the actual and perceived price associated with using drugs, in effect encouraging consumption. Estimates may range widely, but increases would be material.

As the number of annual users began to rise, so would the number of users becoming addicted. Even low estimates put the initiates-to-addicts ratio at 10 percent. As the pool of addicted users continued to grow, so would the government’s commitment to this pool’s addiction and medical costs.

Not calculated into this increasing government commitment are higher costs associated with predictably lower workforce productivity, higher domestic abuse, crimes committed under the influence of drugs, accidents, reduced educational achievement and the unquantifiable effects of government sponsorship for drug use.

Perhaps most pointedly, Price Elasticity of Demand plays two unacknowledged roles:

First, government sponsorship and low government prices would almost certainly encourage higher initiation rates, whether directly through government distribution or through recourse to the secondary or black market by those denied access to a government-approved habit. PED would be high for first time purchasers, but lower prices and government sponsorship would encourage increased first use *and* wider acceptance of long-term addiction as “normal” or “government-covered.” *The Economist* itself notes that “prescribing heroin to hard-core addicts could cost more than 363 million dollars a year,”¹²² not including the cost of new addictions and unrelated health care costs growing out of addiction.

The economic inconsistency of *The Economist's* position on drug legalization is only made more apparent by reference to their reasoning elsewhere. For example, on the proper approach to health care, *The Economist* regularly argues *against* government sponsorship of expensive treatment intervention and for reducing such interventions to lower priority whenever possible. Thus, *The Economist* has observed:

You can't put a price on human life. From this truism springs one of the most harmful delusions of the modern world – that when public money is spent on life-saving medical care, no account should be taken of cost. Given that demand for health care is almost infinite, while budgets are sadly finite, it makes sense to start by spending money on interventions that save lots of lives, cheaply. If good public health is the goal, treatments that save fewer lives at greater cost should receive lower priority.¹²³

Presumably, faced with the high cost and low success rate of drug addiction interventions cited by *The Economist* in June 2002, this component of their drug reform platform would, in fact, become a “lower priority” for the government.

Similarly, *The Economist* has argued persuasively elsewhere against increasing dependence on the government benefits, particularly benefits which might spur widening circles of dependence. Thus, in favoring welfare reform, *The Economist* noted the success of America's 1996 reforms, “requiring welfare recipients to work or get job training in exchange for benefits,” a law under which “the number of people on welfare has dropped from 14 million in 1994 to 5 million today [August 2002].”¹²⁴

Second, low PED for drugs sought by addicted persons will not change. Accordingly, they will continue to press the government for higher volumes of drugs, individually and as a group, in concert with the rise in tolerance and dependence that attach to all addictions. If the government cannot meet the rising need generated by higher tolerance among a wider population of addicted persons, the addicted population will again turn to the secondary market, and will commit crime to pay for drugs at the

prices demanded in that market. If the government chooses to meet the rising demand generated by higher tolerance among a wider number of users, and thus of addicted persons, the overall financial burden on the government will continue to rise in proportion, mitigated only by a rising number of deaths of addicted persons. As indicated above, this reality flies in the face of past reasoning by *The Economist* in other contexts.

In the July 28, 2001 issue of *The Economist*, the editors advocated broadly for “legalizing drugs,” unexpectedly revealing other economic weaknesses. At the outset, they admit that legalizing drugs “would lead to a rise in their use, and therefore to a rise in the number of people dependent upon them.”¹²⁵

Also, in direct contradistinction to the article from June 2002 which said drugs “have never been cheaper,” the article from less than one year earlier argued “drugs are expensive,” adding “a kilo of heroin sells in America for as much as a new Rolls Royce”¹²⁶ In fact, the July 2001 article observes: “[r]emove such constraints, make drugs accessible and very much cheaper, and more people will experiment with them ... [and] [a] rise in drug-taking will inevitably mean that more people will become dependent... .”¹²⁷

Somehow, also, the argument is pressed that a shift from free choice in the market to the absence of choice is not significant. Thus, *The Economist* acknowledges the argument that “once addicted, they [drug addicted persons] can no longer make rational choices about whether to continue to harm themselves.” This is disposed of by noting that both alcohol, which has less abusive potential over a short time frame, and nicotine, about which more is becoming known each year, are legal.¹²⁸ Somehow this argument fails to confront the cumulative economic cost associated with these substances,¹²⁹ both of which tend to produce less acute harm in a shorter period than heroin, cocaine, methamphetamine, PCP and even – based on some recent studies – high THC content marijuana.¹³⁰

The answer proposed is another conflicting policy, legalization paired with antidrug “health education.”¹³¹ This proposal for reducing demand – increasing the resistance to use while widening availability – seems fraught with economic contradictions. Considerable sums have already been spent on demand reduction for both alcohol and cigarettes, yet consumption rates remain high. While prevention is highly effective in reducing demand,¹³² this effectiveness has typically required consistency of message and collateral supply reduction efforts. In purely economic terms, and setting aside other externalities, government expenditures on antidrug “health education” together with government-sponsored distribution or legalization of currently illegal drugs are likely to create a counterproductive and wasteful cross-application of government resources.

Finally, *The Economist*, without reference to the changing nature of Price

Elasticity of Demand among drug consumers – the ebbing of rational choice in consumption patterns based on dependence and tolerance – and the economic trap represented by widening addiction, suggests governments should “proceed gradually” toward making drugs more available, allowing “*for conventions governing sensible drug-taking to develop.*” While this analysis might be useful for legalization of nonaddictive substances on other grounds or legalization of mildly addictive substances requiring prolonged use prior to addiction and carrying minimal adverse effects, the economic underpinning is missing for legalization of highly addictive drugs.

Specifically, there is no account taken of the impact that lower cost and wider availability would have on long-run rates and costs of addiction. While acknowledging that the primary economic effect of lower cost and wider availability is that “more people would experiment with them [narcotics],” *The Economist* does not then assess what this short-term consequence of legalization would mean, for example by reference to a sliding PED, for addiction.

A Final Comment on Animal Studies and their Application to Price Elasticity of Demand for Drugs among Humans

While somewhat far a field from the day-to-day interactions of the human market, one last set of “economic studies” deserves mention. Selected animal studies have sought to find a progressive PED, equating dollar cost to number of “responses required” or work done to acquire another dosage of the drug. While helpful, these few studies have been short-term sittings in which a nonaddicted animal is subjected to between four and twelve options for acquiring an addictive drug.

While they suggest that higher “price” (measured in work required of the animal) reduces the animal’s interest in acquiring more of the drug, they do not represent a meaningful study of addiction or even drug use over a long period (for animals or humans), dollar price changes in a free market, human behavior or the behavior of addicted humans over time. What they do suggest is nevertheless helpful: among certain animals, initiation rates are probably affected by the “cost” (work required for) of initiating consumption.¹³³ In addition, they may suggest that, after a certain level of dosing, animals may lose the strength required to continue dosing themselves.¹³⁴

Where does that leave us? At no point in the voluminous literature on addiction and economics (and the pseudo-economics) of addictive substance consumption is there mention of a sliding PED for addictive substances. Further, there is no recognition that this dynamic measure is significant as a research and policy tool, first for describing the differences between addicted and non-addicted decision-making over time, and second for reflecting on the evolving, day-in, day-out relationship between price, consumption and addiction for different drugs. Necessarily missing from the literature is any application of this tool - sliding PEDs for different addictive substances – to future policy.



Application of Price Elasticity of Demand to Drugs

Beyond the discussion in the previous section, there are several obvious ways that the “sliding PED” concept¹³⁵ and relative ordering of PEDs for various addictive substances over different timeframes could be useful. Several applications for this concept have been discussed previously in this document. Several others are offered in the following section.

Missing Data in Literature on Sliding PED for Addictive Substances

As indicated previously, *there is reason to believe that the notion of sliding PEDs for drugs and the relative ordering of such sliding slopes is both new and useful.*¹³⁶ At the very least, it warrants further exploration by both economists and policy-makers.

The aim of further study would be to better understand the character of drug use in various purchaser populations and to guide policymakers struggling with conflicting opinions on topics such as drug legalization and widening access to treatment for drug addictions. The primary element of “newness” is application of the language and framework of economic theory relating to PED – free of political, cultural or moral arguments for or against one or another policy options – to the field of addiction and drug policy formulation.

As indicated previously, there are practical reasons for applying the PED concept to drugs and rethinking how other models apply once this is done. Additionally, the absence of prior serious treatment of this concept is a strong basis upon which to advocate for the collection of new data to substantiate or disprove the theoretical premise offered.

One further argument supporting the unique nature of PEDs in the narcotics market, or market for any addictive substance, is that a drug is only replaceable by another drug if the market for the initial product disappears or the initial drug is made less available. The substitution principle is also circumscribed by the relative availability of exact substitutes for the drug being consumed by the addicted population. In other words, *substitution may be highly limited* and increases in price may therefore tend not to affect consumption, but to be reflected in a lower Price Elasticity of Demand for the commodity. When addicted persons need the product, they seek the product at whatever price is asked. If the range of alternatives is narrow and perceived need high, consumption will continue at pre-existing levels despite increases in price.

In economic terms:

The most important determinant of the value of price elasticity of de-

mand for a product is the degree to which it has available and acceptable substitutes. Goods which have many substitutes tend to have a relatively elastic demand, since a rise in their prices will induce consumers to switch to the available alternatives, resulting in a greater than proportionate fall in the quantity demanded. Goods which do not have ready substitutes tend to have a relatively inelastic demand. A given price change tends to lead to a less than proportionate change in the quantity demanded because consumers cannot easily buy goods which perform similar functions.¹³⁷

In fact, tying this concept to the addictive nature of cigarettes, Hewitt observes:

[W]e would not expect the demand for cigarettes to respond very much to a change in price; demand is very inelastic since acceptable substitutes (including abstention) are few.¹³⁸

Note that even this early application of the principle of PED to an addictive substance – a substance arguably less addictive and less immediately destructive on objective data than cocaine, heroin, marijuana, methamphetamine or Ecstasy – assumed that the addiction was present and affected PED.¹³⁹

Missing was any notion of a *sliding PED* for this or any drug, from higher elasticity at the early use stages of the product to lower elasticity after repeat or prolonged use. Also missing was the assessment and comparison of *different sliding PEDs*, or different rates at which the slide from higher to lower PED may occur for different addictive substances.

Sliding PEDs, Drug Legalization and Taxes

Application of this idea has been partially discussed earlier in this study. Still, other implications requiring in-depth examination stem from the relationship between the relatively inelastic demand for drugs by those who are addicted *and the economic effect of hypothetically taxing such a population*.

If narcotics of any kind were legalized, based on the addictive nature of the substances, several economic effects could be predicted from the low PEDs of these substances for addicted consumers.

Relatively lower prices would drive a wider number of initial purchasers to consume these substances.¹⁴⁰ Estimates by economists of note range upwards from eight percent of the population who would be included, on purely economic terms, to initiate use at the lower prices created by legalization.¹⁴¹

Even those economic thinkers advocating legalization (removal of all penalties and restrictions on sale of) addictive substances seem to concede that prices would fall

and availability would rise. *The Economist* concedes, for example, in July 2001 that legalizing narcotics “would increase the number of people who took them, whatever restrictions were applied,” on top of raising “difficult questions about who should distribute them and how.” Still, they seem unmoved by the argument that initiation rates would increase. There seems little concern that the PED for any one of countless drugs would rapidly slide from high to low as addiction spread.

In fact, *The Economist* accepts that:

The number of drug users would rise for three reasons. First, the price of legalized drugs would almost certainly be lower – probably much lower – than the present price of illegal ones ... Second, access to legalized drugs would be easier ... And third, the social stigma against the use of drugs – which the law today helps to reinforce – would diminish. Many more people might try drugs if they did not fear imprisonment or scandal.¹⁴²

Initially, this would amount to a new wave of freely made decisions, based on the information available from a variety of sources. The initial decision to purchase by these non-users would weigh costs and benefits and produce, in some percentage of the population, a decision to begin purchasing the drug.

One study recently estimated the price of legalized narcotics at one-twentieth current street prices. If the Price Elasticity of Demand for initiation is high, as this paper argues, one can assume a rate of initiation or first use that is proportional to the drop in price. Even if far less than 20 times the number of first time purchasers responded to legalization by experimentation, the increase in the pool of future addicted persons would be, based on conservative estimates of the percentage of first time purchasers likely to become addicted, enormous.

Put differently, a widely varying estimate of potential new addiction, while speculative, is possible. A drop in price to one-twentieth of the current street price for any given drug could produce an annual increase in teen addiction that ranged wildly *from modestly higher addiction to dramatically higher addiction* given the following conditions:

- if Price Elasticity of Demand for first time purchase of any drug is high (since non-addicted persons respond to higher prices by reducing demand and to lower prices by increasing demand)¹⁴³
- if prices dropped to one-twentieth current street levels under legalization,¹⁴⁴ producing a dramatic increase in new users at lower price
- if today's rate of first purchase is a substantial component of the 40 percent of teens who reported trying marijuana at least once in the year 2000¹⁴⁵ or the 10 percent who admitted to trying Ecstasy¹⁴⁶
- if the addiction rate for first time use to later addiction is just 10 percent¹⁴⁷

These estimates – while large – swing widely based on the assumptions surrounding 1) Price Elasticity of Demand for any given drug, 2) actual price change for any given drug if legalized, 3) actual percentage of first time purchasers who choose to purchase a drug after legalization but would not have otherwise chosen to do so (based on factors from lower price to diminished opprobrium),¹⁴⁸ and 4) percentage of first time purchasers that were likely to become addicted to any given drug. *Regardless of which estimates are accepted, the potential for increased addiction is substantial* and would give any policymaker pause.

Moreover, within a short period of time, depending on the addictive nature of each drug legalized and the susceptibility to addiction of the new users, many of the new initiates would slide down the PED spectrum toward a lower and lower PED, rapidly ending in addiction. One predictable result would therefore be an ever-widening number of addicted persons, or individuals trapped at the low PED end of the PED spectrum. Only after the dire consequences of this slowly growing, predictably young, population had become known across the potential new user population would the rise in addiction level off.

The relative economic costs of a sizable influx of new purchasers at a high PED, followed by movement of many to a lower PED and addiction, are illustrated – and likely underestimated – by Avram et al. They note that empirical evidence does not support any policy aimed at lowering PED for an addictive substance, since use and addiction climb, together with costs of treatment, which would overshadow any potential economic gain. “It has been argued that legalizing and taxing drugs would provide financial resources for treatment of those who become addicted, but in Canada in 1984 the total social costs of alcohol were double the revenues generated from alcohol at all levels of government... [and] in the United States in 1983, this ratio exceeded 10 to 1 [citations omitted].”¹⁴⁹

In view of the low PED for addictive substances after addiction occurs and highly time-lagged process of recovery (often unsuccessful at initial attempts) from narcotics addiction through treatment, *there are very few indications that the society-wide increase in addicted persons would shrink.* On the contrary, since the PED would be expected to remain low for all such addicted persons, there would be at best only modest shrinkage with widely available, highly effective and wholly appropriate treatment. Moreover, this potential shrinkage in the addicted population would come at great expense, resulting from the high cost of successful narcotics treatment.¹⁵⁰

Absent widespread and effective treatment regimes, factors that might accelerate a return by the growing pool of addicted persons to economic normalcy, or a position that allowed escape from the low PED for (i.e. dependence upon) addictive drugs, are difficult to identify.

The addicted population would, in a regime that legalized drugs of any kind,

bear the brunt of taxation on these substances. This is the population caught in the relatively inelastic position of needing the drug at any price. In other words, at a minimum, the addicted population already suffering from the physical deterioration associated with these addictions would nevertheless be the population, as a matter of necessity, paying taxes on a product they unavoidably needed. For this population, the PED would be so low that they would be unlikely to be dissuaded from use by even a substantial rise in price created by taxes. In economic terms, "the effect of the tax on a product whose demand curve is ... perfectly inelastic ... is to raise price ... by the full amount of the tax, with no change in quantity bought and sold."¹⁵¹ Moreover, as indicated earlier, "government would be in the unhappy position of having to choose between raising prices to discourage excessive use, thus allowing the illicit traffic to continue, and lowering prices enough to drive out the illicit trade, thus increasing consumption."¹⁵²

The nature of addiction cannot be overlooked. Just as the PED is low, approaching zero for addiction to many drugs, the notion that a self-sustaining tax base could be established, even with the growth of a larger addicted population, is undercut by several other ironclad economic realities. *Medical care, for example, is costly. Addicted persons who seek to stay alive, either to recover from or simply to sustain their addiction, will prove disproportionately more expensive to keep alive than revenues derived from the predicted increase in taxes from their dependence on government-taxed narcotics.*¹⁵³ *On a one-for-one basis, the cost of addiction would quickly outstrip tax revenues generated, even assuming that any given addicted person could somehow maintain tax payments in the debilitated state of addiction.*¹⁵⁴

The addicted population, while larger, would also tend toward self-limiting stabilization through death. Where the costs of successful treatment, even if available, were unable to be borne by the society or addicted person, many addicted persons would consume a sufficient quantity of narcotics (untreated, albeit in a regime that made self-terminating consumption legal) that they would die. *Theoretically reducing the burden on hospitals and medical care providers, this rise in addiction deaths would substantially reduce the foreseeable increase in tax revenues from an initially expanded population of addicted persons.*

To the extent that addiction cascades any addicted population into other health problems, imposing widening circles of cost on an afflicted society, *the rise in health-related addiction costs may predictably include treatment of collateral ailments, such as psychological impairment, a variety of types of organ damage, HIV and AIDS contraction, as well as a range of predictable drug-related accidents and victimizations which encompass both those addicted and those affected by the addicted population.*

Beyond these economic effects, *the low PED for narcotics would drive addicted persons who craved particular drugs to cheaper alternatives on an emerging black market, since the black market could offer – at a minimum – the same drug for a price*

equal to the drug's production and transshipment costs minus the tax levied by the government. To the extent that any given drug was not offered by the government at high purity and at low cost, the black market would compensate for this economic burden on the narcotics by presenting more pure and cheaper alternatives.

On balance, it is hard to see any sustainable economic advantage, putting aside all other arguments, which might justify drug legalization. In purely economic terms, substantial costs are foreseeable and appear almost inevitable from a decision to legalize narcotics, even on conservative economic estimates of collateral costs and even assuming a sequenced or gradual legalization of various drug regimes.

Other Applications of the Sliding PED Concept to Drug Policy

One obvious application of this sliding PED concept to policy is the economic argument for widely accessible and proactive intervention in order to rescue economically trapped consumers (i.e. addicted purchasers) from an economic position that, in practice, presents few substitutes or alternatives. In short, there is an economic imperative for effective treatment regimes born of the recognition that addicted persons suffer from long-term consumption of a commodity with a very low PED.

Without intervention in a market that no longer allows the laws of supply and demand to properly work, this unique population of consumers (i.e. addicted purchasers) will remain trapped by the low PED of these uniquely addictive commodities (i.e. narcotics) until the adverse health effects of addiction overtake them.

To the extent that the sliding PED concept describes the idea of an economic "black hole," swallowing the market's prime directive of free choice and that directive's resultant elasticity, the economic justification for a compensating economic force – at least as applied to this population – becomes stronger.

From a microeconomic point of view, the addicted person appears to have no exit strategy (other than consumption of a substitute narcotic) from a consumption role that ends in an ever-increasing rate of consumption at either steady or rising prices. Since the addictive commodity is both eroding the addicted consumer's health at a generally rapid rate and this individual is unable to resist consumption even at higher prices, the end state for this consumer is either accelerated death or a substitution of the addiction (or role of addicted consumer) for effective treatment, ending the economic trap of addiction at a low Price Elasticity of Demand. To the extent that the addicted person cannot create the treatment option, this is an option that government should be prepared to create for such trapped consumers.

Also, by inference, there may be a need to prevent others from sliding down the PED spectrum toward addiction, in order to stem the higher costs incurred by addiction. There may also be a need to rapidly and effectively respond to the apparent en-

trapment of addicted purchasers in the economic "black hole" of low PED. For policy purposes, further research is advisable on the question of whether the costs of low PED warrant a significant increase in the measures, however described, that would *prevent* the slide of narcotics consumers down the PED spectrum, while more actively retrieving those from low PED who have already migrated to that nearly inescapable economic position.

Preliminary Conclusions and Recommendations

The conclusions offered are preliminary, since new data sets were not gathered for this literature review and preliminary discussion of the economics surrounding “sliding PEDs for narcotic substances” and “different sliding PEDs for different narcotic substances [i.e. drugs].”

The overarching theme that emerges is the need for real and hard-hitting research and analysis on the economics of several related fields, including the cost-benefit of making effective treatment more widely available in light of the “perfectly inelastic” nature of addiction and the potential impact of policies encouraging lower prices for highly addictive substances, including legalization.

The first theme is associated with lower PED of addictive substances after prolonged use, while the latter is associated with higher PED at the time of initiation for any perceived luxury, including potentially addictive substances. The slide from higher to lower PED is imputed after a thorough review of the relevant literature in both economics and addiction science.

If higher drug prices cannot wean an addicted person off the drug to which he or she is addicted, there will need to be wider promotion of policy alternatives that will reach this population, in tandem with efforts to reduce the inflow of first time, casual or occasional purchasers to the population of addicted purchasers.

Similarly, policies that increase the availability of addictive substances at lower prices, such as proposed drug legalization, cannot find economic support in a predictable and sliding PED for these substances, since they are likely to increase use, increase addiction and disproportionately increase the economic costs to government of addressing the higher addiction rate.

More specifically, this study confirms several economic findings dominant in the literature on economics and addiction. Applying the concept of sliding Price Elasticities of Demand to these findings, several economic policy recommendations emerge. This study does not seek to incorporate or integrate collateral arguments – political, social, moral or emotional – into the recommendations. How these recommendations apply in any particular political, social, moral or emotional context is left to future research and discussion.

Key Findings

- Policies that lower the price of addictive substances tend to increase first time use or initiation rates for these substances.
- Increased use or initiation rates tend to increase addiction rates, based on responsiveness of first time and casual purchasers to lower prices.
- Raising prices of an addictive substance generally appears to lower the rate of first time use or initiation for most addictive substances, although higher prices do not appear to have any substantial impact on consumption by the addicted population.
- Substitution of one addictive substance for another similar substance by the addicted population appears more likely at higher prices and in the event of lower availability.
- Substitution may include accessible, affordable treatment to end the addiction where available, but seems less likely to be chosen where significant effort is required by an addicted population to obtain the treatment.
- Rational or free choice by the addicted population appears to be significantly impaired by a combination of the cognitive deficit produced by using certain addictive substances (i.e. cognitive changes in brain function created by use of the addictive substance) and what is generally described as compulsion, a combination of dependence and growing tolerance to the addictive substance.
- Addictive substances appear to be comparable to one another on several bases, including abusive potency, addictiveness based on time to dependence and rate of tolerance growth, severity of withdrawal symptoms, adverse collateral health, adverse brain function effects and overall physiological and psychological change induced by the addictive substance.
- A price versus time-used continuum appears to exist on which most addictive substances can be placed somewhere relative to one another other.
- This price versus time-used continuum reflects the price sensitivity of purchasers at different times in the use cycle (from first use to addiction) for any given addictive substance relative to any other addictive substance, even if the absolute sensitivity to price by purchasers at a particular time for a particular addictive substance is elusive.
- Most discussants of legalization or government distribution of addictive substances do not take account of predictable long-term growth in the addicted population or the long-term addiction costs associated with this policy choice.

- No discussion of legalization or government distribution of addictive substances takes account of the vast literature supporting a Price Elasticity of Demand for addictive substances that consistently slides from high PED to low PED, albeit at different rates for different addictive substances, unless the addicted population becomes unable to act upon the low PED or substitutes treatment for addiction.
- No discussion of legalization or government distribution of addictive substances takes account of the implications associated with a Price Elasticity of Demand that consistently slides, at varying rates for different addictive substances, from high to low for all measured addictive substances, unless the addicted population becomes unable to act upon the low PED or substitutes treatment for addiction.
- Much of the literature on economics and addiction, as well as economics and drug abuse, focuses on a single variable to the exclusion of other variables materially affecting conclusions drawn (i.e. assuming away difficult questions) or is unsubstantiated or opinionated in nature.
- Insufficient economic data and insufficient stratification of purchaser groups exists to confidently measure or estimate the absolute prices (or price ranges) at which different purchaser cohorts (e.g. first time purchasers, occasional, frequent, and addicted purchasers) will choose to purchase or not to purchase different addictive substances.
- Insufficient economic research has been done on the efficacy of generally applying traditional supply and demand principles to the use of addictive substances by different purchaser cohorts (e.g. first time, occasional, frequent and addicted purchasers).

Two primary conclusions grow out of the prevailing economic and addiction literature, the findings in this paper, and the concept of sliding Price Elasticities of Demand for addictive substances:

First, the existence of a high Price Elasticity of Demand for addictive substances at the time when consumers evaluate whether to initiate use of an addictive substance, paired with the high potential costs of addiction to both the individual and society, strongly reinforce policies that have 1) the effect of creating and maintaining high prices in order to deter first use, and 2) the effect of educating potential first time purchasers about the risk of, and costs associated with, possible addiction.

Since the ability to influence consumer decision making is at an apex just prior to the consumer's decision to purchase, or when the potential first time purchaser is deciding whether or not to enter the market, policies targeting price and education at this time – even marginally – are most likely to reduce use and addiction. On the other hand, policies seeking to significantly deter consumption among *addicted per-*

sons through changes in price are not likely to be cost-effective.

Second, the existence of consistently low Price Elasticity of Demand among addicted consumers or frequent purchasers of addictive substances, paired with the adverse economic effects of this consumer group's behavior on individual consumers and society at large, strongly reinforce policies that have 1) the effect of restoring rational consumer decision making, 2) the effect of reducing consumer dependence on and tolerance for these addictive substances, and 3) the effect of restoring this group of consumers to a position of involvement in the economic system based on predictable interplay of supply and demand, namely a position maintained prior to first use of the addictive substance.

While there are points after first purchase and prior to addiction in which price and education may influence consumer behavior, and there are cognitive elements of the decision-making process which may never be restored even after intervention, the most cost-effective way for any society to reduce the cost of addiction is to intervene with effective treatment for one purpose: to end consumption of the addictive substance. Notably, a consumer caught in the economic trap of addiction to a substance with a low Price Elasticity of Demand is not freed by replacing one addictive substance with another. While this policy might be able to reduce the adverse effects of the first addictive substance and replace them with the adverse effects of the second addictive substance, such substitution does not reduce either the costs or the opportunity costs associated with addiction. Moreover, policies that seek to substitute one addiction for another in the name of cost savings tend to be highly expensive and offer no measurable cost-benefit over time, other than accelerating the progress of adverse health effects and death, which reduces the cost to society of health care and addiction maintenance for that consumer.

Additionally, note that substitution of addiction-ending treatment for addiction is only cost-effective when sustained over time. Thus, policies that actively intervene to end addiction must be coupled with policies which educate the formerly addicted consumer to maintain the individual's economic position. While price may then play a modest role in governing the consumer's behavior, other factors beyond price are likely to be equally important, as the consumer may never be as sensitive to price as the individual was prior to first use.

Core Recommendation

In practical and economic terms, the concept of a sliding Price Elasticity of Demand for addictive substances is important. Policymakers can best reduce the costs associated with drug use and addiction in two ways:

- First, by aggressively deterring first time purchases through policies that raise prices and educate potential consumers just prior to market entry, taking advantage of the high Price Elasticity of Demand at that time.
- Second, by aggressively intervening to permanently end addiction through treatment regimes dedicated to stopping (not substituting) consumption of addictive substances, restoring rational economic decision making to consumers affected by addiction, and maintaining this rational economic behavior over time, in response to consistently low Price Elasticity of Demand for different drugs among addicted consumers.

Notes and References

¹Note, application of these economic principles may appear intuitive for highly addictive substances, such as heroin, cocaine and methamphetamine, but apply with equal force to less addictive substances, including alcohol. See, e.g., Wagenaar, A., and Holder, H., "Changes in Alcohol Consumption Resulting from the Elimination of Retail Wine Monopolies: Results from Five U.S. States," *Journal of Studies on Alcohol* **56** no. 5 (1995): 566-572; Watts, R., and Rabor, J., "Alcohol Availability and Alcohol-Related Problems in 213 California Cities," *Alcoholism: Clinical and Experimental Research* **7** (1983):47-58; Gruenewald, P.; Ponicki, W.; and Holder, H., "The Relationship of Outlet Densities to Alcohol Consumption: A Time Series Cross-sectional Analysis," *Alcoholism: Clinical and Experimental Research* **17** no. 1 (1993): 38-47; Smart, R., "The Impact on Consumption of Selling Wine in Grocery Stores," *Alcohol and Alcoholism* **21** (1986): 233-236; Rush, B.; Steinberg, M.; and Brook, R., "The Relationships among Alcohol Availability, Alcohol Consumption, and Alcohol-Related Damage in the Province of Ontario and the State of Michigan, 1955-1982," *Advances in Alcohol and Substance Abuse* **5** no. 4 (1986): 33-45; Wagenaar, A., and Holder, H., "A Change from Public to Private Sales of Wine: Results from Natural Experiments in Iowa and West Virginia," *Journal of Studies on Alcohol* **52** (1991): 162-173. Studies applying these economic principles to highly addictive substances are set forth elsewhere.

²Throughout this document, references to first time use and first time users are intended to implicate first time purchase and purchasers, since first time use itself may not, in fact, involve a purchase.

³The basic definition of PED is "the responsiveness of the quantity demanded of a good to its own price" (Pearce, D. W. ((Ed.)) *The MIT Dictionary of Economics* ((Cambridge, MA: MIT Press, 1992)): 342). Another economic study offers: " 'Elasticity of demand' is a phrase used to describe the response of consumer demand to changes in price for a particular good. Typically elasticity is expressed as [percentage] decrease in use [divided by percentage] increase in price, so that a 10 [percent] price increase leading to a 20 [percent] decrease in use would be expressed as an elasticity of demand equal to two. Elasticities with a value less than one are referred to as 'inelastic,' elasticities of one are 'unit elastic,' and elasticities with a value of greater than one are 'elastic' or 'highly elastic' depending on their magnitude." LaGrange, J. *Law, Economics, and Drugs: Problems with Legalization under a Federal System*, 100 COLUM. L. REV. 505, 509-10, no. 18 (2000).

⁴While detailed further below, existing research tends to suggest either that narcotics consumption is steady at one rate highly responsive to price or at one rate that is highly non-responsive to price. See, e.g., studies arguing that Price Elasticity of Demand is highly inelastic, such as Silverman L. P., and Spruill, "Urban Crime and Price of Heroin," *Journal of Urban Economics* **4** (1977): 80-103; Roumasset, J., and Hadreas, J., "Addicts, Fences, and the Market for Stolen Goods," *Public Finance Quarterly* **5** (1977): 247-272; Nisbet T.C., and Vakil, F., "Some Estimates of Price and Expenditure Elasticities among UCLA Students," *Review of Economics and Statistics* **54** (1972): 474-475, 1972. In two studies, specific points or regions are identified in which different price elasticities of demand exist, namely a high initial rate of sensitivity and a low addicted rate of sensitivity. See White, M. D., and Luksetich, W. A., "Heroin: Price Elasticity and Enforcement Strategies," *Economic Inquiry* **21** (1983): 557-564; Moore, M., "Supply Reduction Policy and Drug Law Enforcement," in *Drugs and Crime*, ed. by Tonry, Michael and Wilson, James Q., Chicago, IL: Univ. of Chicago Press, 1990. Missing is the notion that Price Elasticity of Demand invariably changes or slides over time for any narcotic, that different narcotics have different sliding price elasticities of demand and that this reality has direct implications for public policy.

⁵A significant, if contradictory, body of research has suggested the existence of a "rational addict," giving rise to "rational addiction theory" or "rational addictive behavior." Assumptions underlying this theory, which tends to discourage government intervention, seem dubious. For example, one leading study

notes that “rational addictive behavior” would “emphasize the interdependency of past, current and future consumption of an addictive good” such that addicted persons would calculate future “utility” of present levels of consumption. Putting aside questions surrounding how the addicted person defines “utility” (e.g. does the addicted person seek to maximize future states of euphoria, putting off overdoses until physically beyond euphoria maximization, in some rational way? can we realistically refer to rational, euphoria-maximizing addicted persons?), the notion that rationality attends addiction is questionable at best. Likewise, this study suggests that, “if [addicted] consumers take into account the future costs that they impose upon themselves by abusing alcohol [or narcotics such as marijuana, cocaine or heroin], then the case for higher taxes or other policies to curtail abuse must be based solely on the harm that abusers do to third parties” (Grossman, M.; Chaloupka, F. J.; and Sirtalian, I., “An Empirical Analysis of Alcohol Addiction: Results from the *Monitoring The Future* Panels,” *Economic Inquiry* **36**, no. 1 ((Jan. 1, 1998)): 13). The questions presented include: Do addicted persons process information that is available about the impact their addiction is having upon them and their future in a rational way? Do well-documented and enduring brain changes that affect addicted persons typically allow for a rational choice by an addict, in the absence of intervention, as to whether an addiction should be continued or terminated? Has economics gone too far when it imposes the assumption of rational decision-making on irrational acts of craving, or the ability of the addicted human mind and body, unaided by others, to choose to continue or arrest addictive behavior? Do decisions by cigarette smokers and alcohol drinkers allow inferences about behaviors of narcotics with greater addictive potency, such as heroin? Finally, is it wrong for public policy to be based, in substantial part, on the “harm that abusers do to third parties”? See also Becker, G. S., and Murphy, K. M., “An Empirical Analysis of Cigarette Addiction,” *American Economic Review* (June 1994): 396-418; “A Theory of Rational Addiction,” *Journal of Political Economy* (August 1988): 675-700; and Chaloupka, F. J., “Rational Addictive Behavior and Cigarette Smoking,” *Journal of Political Economy* (August 1991): 722-42.

⁶See references to “rational addict” theory, *supra*, and the laws of supply and demand, *infra*.

⁷Strong statistical data support the argument that higher availability of a highly addictive narcotic leads to a higher rate of use across the studied population, which in turn produces a higher rate of addiction and negative health consequences. One of the more persuasive sets of data is offered by examining heroin availability, purity, use and health consequences in the United States during the 1980s and 1990s. For example: “The rise in average purity recorded by the [Drug Enforcement Agency’s Domestic Monitor Program, or DMP] during the 1980s and early 1990s corresponded directly to an increased availability of high-purity Southeast Asian heroin, South American heroin and, to a lesser extent, increases in the purity of Mexican heroin. In 1998, the average purity of South American samples obtained through the DMP was higher than that from any other source, averaging 53.0 percent.” At the same time, while highly pure South American heroin accounted for 75 percent of the total net weight of heroin analyzed in the DEA’s Heroin Signature Program in 1997, use was climbing. Specifically, by 1997, data from the National Household Survey on Drug Abuse indicated “that heroin use has increased steadily since 1992” and that “the number of Americans who used heroin in the past month increased from 68,000 ... in 1993 to 325,000 ... in 1997.” As availability and purity of heroin have increased, triggering increased use and addiction, the rise in negative health effects has also been reliably recorded. For example, over the same period, the annual *Drug Abuse Warning Network (DAWN)*, chronicling emergency room incidents in hospitals across the United States, revealed that “the annual number of heroin-related emergency room (ER) mentions [associated with heroin] increased from 42,000 in 1989 to 76,000 in 1995 – an 80-percent increase” (*The National Narcotics Intelligence Consumers Committee Report 1997*, Drug Enforcement Administration, Publication no. DEA-98036 ((November 1998)): 39-40). See also *Drug Abuse Warning Network: 1995 Preliminary Estimates of Drug-Related Emergency Department Episodes* (Rockville, MD: Substance Abuse and Mental Health Services Administration, U. S. Department of Health and Human Services, 1996).

⁸*Id.* at 39-40.

⁹See, e.g., the *Drug Abuse Warning Network: 1995 Preliminary Estimates of Drug-Related Emergency Department Episodes* (Rockville, MD: Substance Abuse and Mental Health Services Administration, U. S. Department of Health and Human Services, 1996), compiled annually from hospitals across the United States. Likewise, recent research indicates that beyond addictive properties, “[a]cute myocardial infarction is the most commonly reported consequence of cocaine misuse, usually occurring in men who are young, fit and healthy and who have minimal, if any, risk factors for cardiovascular disease” (“Cocaine Use and Cardiovascular Complications,” *Medical Journal of Australia* ((September 2, 2002)): Clinical Update Section).

¹⁰For example, widely accepted medical research supports the relationship between use of alcohol in varying degrees, addiction and health impairment, such as severe loss of cognitive function. Accordingly, such research indicates that cognitive ability declines in direct proportion to the severity and duration of alcoholism. See Parsons, O. A., “Neurocognitive Deficits in Alcoholics and Social Drinkers: A Continuum?,” *Alcohol Clinical Experimentation Research* **22**, no. 4(1998): 954-961. Note that the concept of a continuum of use leading to addiction comports with the idea of a slowly sliding PED for alcohol, leading toward the straight-line PED, in which the addicted person’s decision-making does not change in response to price. See also Beatty, W. W.; Tivis, R.; Stott, H. D.; Nixon, S. J.; and Parsons, O.A., “Neuropsychological Deficits in Sober Alcoholics: Influences of Chronicity and Recent Alcohol Consumption,” *Alcohol Clinical Experimentation Research* **24** no. 2 (2000): 149-154. Such studies also confirm that casual consumers of alcohol who ingest more than 21 drinks per week suffer measurable *long-term* cognitive impairment. Parallel research suggests that the period of time required to detect this damage is *10 years or more*. See Parsons, O. A., and Nixon, S. J., “Cognitive Functioning in Sober Social Drinkers: A Review of Research since 1986,” *Journal of Study of Alcohol* **59** no. 2 (1998): 180-190; see also, e.g., Eckardt, M. J.; File, S. E.; Gessa, G. L.; et al., “Effects of Moderate Alcohol Consumption on the Central Nervous System,” *Alcohol Clinical Experimentation Research* **22** no.5 (1998): 998-1040.

¹¹Even minimal repeated exposures to opioid drugs “induces the brain mechanisms of dependence, which leads to daily drug use to avert the unpleasant symptoms of drug withdraw,” after which “prolonged use produces more long-lasting changes in the brain that may underlie the compulsive drug-seeking process of decision-making, and related adverse consequences that are the hallmarks of addiction” (Kosten, T. R., M.D., and George, T. P., M.D., “The Neurobiology of Opioid Dependence: Implications for Treatment,” *National Institute on Drug Abuse Science and Practice Perspectives* **1**, no. 1 ((July 2002)): 15). See also, note 5 *supra*.

¹²One 1998 study asserts, for example, that based on a comparison of long-run and short-run consumption patterns at various prices, “alcohol consumption is somewhat less addictive than cigarette smoking” (Grossman, M.; Chaloupka, F. J.; and Sirtalian, I., “An Empirical Analysis of Alcohol Addiction: Results from the *Monitoring The Future* Panels,” *Economic Inquiry* **36** no. 1 ((Jan. 1, 1998)): 12).

¹³In economic terms, product substitution or the “substitution effect” is defined as “the effect on the quantity demanded of a good resulting from a change in price relative to the prices of other goods when the consumer’s real income is held constant and other things being equal” (Daitith, J. ((Ed.)), *Letts Dictionary of Economics* ((London, 1983)): 178). Note that substitution theory depends upon a substitute being available.

¹⁴Grossman, M.; Chaloupka, F. J.; and Sirtalian, I., “An Empirical Analysis of Alcohol Addiction: Results from the *Monitoring The Future* Panels,” *Economic Inquiry* **36** no. 1 (Jan. 1, 1998): 12-14.

¹⁵Indicia of higher and lower addiction rates, based on speed of addiction, severity, observable effects of one time use, occasional and regular use are available which support this proposition. However, additional research would be required to create a generally accepted ordinal (if not absolute) scale of sliding PEDs. Once agreed rates of addiction speed and severity were placed in context, that is measured

against one another, a reliable sliding scale of PEDs for all drugs could be created and used to describe the varying economic costs of different types of addiction. For example, the economic costs to a given society of a widening population of heroin-addicted persons, growing at a rate of “x” persons per “y” population over “z” time period would differ from the economic costs of a widening population of marijuana-addicted persons growing at a rate of “x-n” persons per “y” population over the same “z” time period, assuming a slower migration from first time use to addiction for marijuana users than for high-purity heroin users. If speed of addiction is high in both cases, then the significance of the scale turns on the severity of the addiction and the costs imposed by the addiction severity. In either case, the costs to society would then need to be measured by taking speed of addiction and multiplying it by quantifiable costs of addiction to the specific drug over a set period of time. While difficult, this could be done by access to archival or survey data on “first use to addiction” and by reviewing medical and non-medical costs associated with various addiction types. For example, there are plentiful studies showing the highly addictive nature of heroin, crack-cocaine, cocaine, amphetamines, PCP, high-purity marijuana and nicotine. There are also studies indicating that addiction rates are slower, and Price Elasticity of Demand remains higher over a longer period of time, for alcohol. See, e.g., Babor, T. F.; Mendelson, J. H.; Greenberg, I.; and Kuehne, J., “Experimental Analysis of the Happy Hour: Effects of Purchase Price on Alcohol Consumption,” *Psychopharmacology* **58** (1978): 35-41. Ultimately, one could create an ordinal scale of addiction speeds and severities that allowed economists to assess and assign a sliding PED – reflecting various speeds to addiction, severities of addiction, and costs of addiction – to each drug studied. While subject to criticism as incomplete, overly narrow, or merely unduly subjective (as the study of human decision-making invariably tends to be), such a sliding PED scale would allow policymakers to understand more clearly the impact of their decisions upon both individuals and society at large. Opening the way to wider addiction or failing to accurately assess the value of intervening to retrieve consumers from costly addictions, in varying degrees, would be a policy failure; if the sliding PED scale assists policymakers in seeing how narcotics addictions function in economic terms, producing such a scale would be worth the exercise. Unfortunately the creation of such a scale, based on a thorough-going review of archival data or drawing new survey data from the addicted population, is beyond the scope of this paper.

¹⁶Note, reference to a time between first use of any addictive substance and addiction to that same substance is not intended to minimize or discount other factors affecting addiction. For any addictive substance, the number of times used and period over which use occurs are central determinants of long-term addiction. However, the individual nature of addiction should not be underestimated; certain individuals are more susceptible than others to addiction, regardless of the substance under consideration. While the majority of consumers may predictably fall within a time window (from first use to addiction) for a given addictive substance, all consumers are susceptible to genetic or environmental factors that speed or slow the rate at which addiction occurs, and some are highly sensitive to these factors. See, generally, Friel, J., and Friel, L., *Adult Children: The Secrets of Dysfunctional Families* (Deerfield, Florida: Health Communications Inc., 1988) ; Jampolsky, L., *Healing the Addictive Mind* (Berkeley, California: Celestial Arts, 1991); Gravitz, H. L., and Bowden, J. D., *Recovery: A Guide for Adult Children of Alcoholics* (New York: Simon & Schuster, 1985); Nakken, C., *Reclaim Your Family from Addiction* (Center City, MN: Hazelden Foundation, 2000). In summary, the proposition advanced is not that genetic and other factors are unimportant, but that addiction to certain substances generally occurs more rapidly.

¹⁷Driven chiefly by first time users, in 2000, national statistics indicated that “[d]rug related deaths have reached a record level in America, while users have been able to buy cocaine and heroin at some of the lowest prices in decades ...” (“Drug Deaths Reach A Peak As Prices Fall,” *Boston Globe* ((March 22, 2000))).

¹⁸Notably, from the mid-1980s through 1992, prices for many narcotics were driven up by coordinated supply interdiction and law enforcement efforts. At the same time, prevention messages for youth were pervasive. Attributable to these two factors were markedly lower initiation rates. “Monthly cocaine use

dropped from nearly 3 million users in 1998 to 1.3 million in 1990 ... [and] [b]etween 1991 and 1992, overall drug abuse dropped from 14.5 million users to 11.4 million." Looked at from another perspective, while prices rose "[o]verall casual drug use by Americans dropped by more than half [between 1977 and 1992] ... [and] [b]etween 1985 and 1992 alone, monthly cocaine use declined by 78 percent." (Walters, J. P., *Effectiveness of the National Drug Control Strategy and the Status of the Drug War: Hearings before the National Security, International Affairs and Criminal Justice Subcomm. of the Comm. on Gov' t Reform and Oversight*, 104th Cong., 1st Sess. ((1995)): 14, 18 [hereinafter *Effectiveness Hearings*]). Another expert noted that "crack-cocaine use sharply declined from nearly half a million in 1990 to just over 300,000 two years later in 1992," and "in virtually every category of illegal drug, we saw sharp declines from the mid-1980s through 1992, including "an astonishing 61 percent decline" of regular marijuana users between 1985 and 1992 (Bonner, R. C., *Effectiveness Hearings*, 104th Cong., 1st Sess. ((1995)): 42-43).

¹⁹Tetrahydrocannabinol (THC) is the psychoactive component found in marijuana. While marijuana is often paired with other narcotics, such as being soaked in PCP, the purity levels of THC in marijuana itself reportedly ranges up to 40 percent in 2002, a significant increase from one to ten percent levels found in the 1960s.

²⁰While an exhaustive medical analysis is beyond the scope of this paper, there is mounting evidence that the shared effects of tobacco and marijuana smoke on the human body – including carbon monoxide, tar and carcinogens – can be separated from the "psychoactive drug effects" of THC in marijuana. Among leading studies on this topic are Gardner, E. L., "Cannabinoid Interaction with Brain," In *Marihuana and Medicine*. Edited by Nahas, G. G., et al., (New Jersey: Humana Press, 1999). Gardner states: "Although marihuana and other cannabinoids have clear addictive potential, they have been considered by some to be anomalous drugs of abuse, lacking interaction with brain reward substrates. That position is absolutely untenable, in view of more than 10 years of research that shows clearly that marihuana and other cannabinoids have potent augmenting effects on brain reward mechanisms." *Id.* at 189, citing dozens of recent studies on topic. Similarly, a recent study by Hiroi, N., "Dependence, Tolerance and Alteration in Gene Expression," In *Marihuana and Medicine*. Edited by Nahas, G. G., et al., (New Jersey: Humana Press, 1999) concludes: "Recent studies have included cannabinoids in a class of drugs that act on the mesolimbic dopamine system. [THC], the psychoactive component of cannabinoids, increases dopamine release in the midbrain and in the nucleus accumbens, as do most drugs of abuse." Additionally, THC's psychoactive physical impairments are many, as illustrated by Sutin, K. M., and Nahas, G. G., "Physiological and Pharmacological Interactions of Marihuana (THC) with Drugs and Anesthetics," In *Marihuana and Medicine*. Edited by Nahas, G. G., et al., (New Jersey: Humana Press, 1999). This 1999 study finds: "THC produces bronchodilation ... causes a dose-dependent tachycardia ... [I]ncreases of blood pressure, but orthostatic hypotension is also observed. Marihuana exacerbates angina pectoris in patients with exercise-inducible myocardial ischemia. [Accounting for] ... psychoactive drug effects, marihuana smoking caused hyperalgesia [and] THC interacts with other drugs: it increases the depressant effects of sedatives and mitigates the effects of stimulants. In addition, severe adverse psychoactive side-effects have been observed when this agent is combined with barbiturates. In combination with opiates or ethanol, THC increases sedation and respiratory depression" While none of these studies offers a specific timeline for comparison to other addictive substances, the speed of addiction is suggestive of a rate greater than for tobacco and, for example, less than for opiates.

²¹While there may not be sufficient data to create a definitive "abusive potency" portrait for all narcotics – reflecting the average or mean time between first use and addiction for that drug – there are characteristics which typically attach to addiction for each drug type – and to the speed at which a typical user becomes addicted. Accordingly, one recent study noted: "In contrast to the behavioral effects associated with acute cocaine administration, addictive decision making develops gradually with repeated usage and persists long after the last administration of cocaine. The difference in time courses is important to understanding the mechanisms underlying them. Although the biochemical and cellular mechanisms underlying the acute effects of cocaine have been extensively studied, relatively little effort has

been made to understand the mechanisms underlying chronically induced alterations that appear to be more relevant to drug craving" (Hope, B. T., "Cocaine and a Mechanism for Long-Term Changes in Gene Expression," In *Marijuana and Medicine*. Edited by Nahas, G. G. et al., ((New Jersey: Humana Press, 1999))). Thus, an incomplete body of data suggests that the rate at which certain drugs are craved after first use differs from other drugs, and that drug potency may be the determinant. Another indication of how to order various rates of addiction is suggested by reference to what certain studies describe as a drug's "abusive potency." Thus, one study has noted that "behavioral activation and its sensitization have been hypothesized to predict a drug's abusive potency ..." (Hiroi, N., "Dependence, Tolerance and Alteration in Gene Expression," In *Marijuana and Medicine*. Edited by Nahas, G. G., et al., ((New Jersey: Humana Press, 1999)): 207). See also Robinson, T. E., and Berridge, K. C., "The Neural Basis of Drug Craving: An Incentive-sensitization Theory of Addiction," *Brain Research Reviews* **18** (1993): 247-291; Koob, G.F., "Drug Addiction: The Yin and Yang of Hedonic Homeostasis," *Neuron* **16** (1996): 893-896.

²² *Id.*

²³ Note that this discussion omits another stark fact surrounding the use of most illegal narcotics: addiction is a state of body or mind that assumes continued life of the addict. In many instances, with highly pure narcotics such as heroin, cocaine, methamphetamine, LSD and PCP-laced marijuana, or highly unpredictable purities such as Ecstasy, life may end on first use with cardiac arrest, accidental overdose or similarly fatal reaction or drug-induced fatal effect, ranging from lung edema to automobile accident. For example, non-injection use of heroin, while not spreading HIV and AIDS, carries a high risk of "untreatable brain damage, with death due to progression of brain damage occurring in about 20 percent of cases" ("`Chasing the Dragon' Heroin Use Can Damage Brain," *Reuters* ((November 9, 2001))). This analysis does not discount the frequency of first time use ending in fatality, but focuses instead on addiction as a continuing event.

²⁴ Substantial medical research supports the "cognitive deficits" model of addiction, documenting a departure from rational decision-making by the addicted person. Specifically: "The cognitive deficits model of drug addiction proposes that individuals who develop addictive disorders have abnormalities in an area of the brain called the prefrontal cortex (PFC). The PFC is important for regulation of judgment, planning, and other executive functions ... [A]s a result, they have reduced ability to use judgment to restrain their impulses and are predisposed to compulsive drug-taking behaviors. Consistent with this model, stimulant drugs such as methamphetamine appear to damage the specific brain circuit – the frontostriatal loop – that carries inhibitory signals from the PFC to the mesolimbic reward system" (Kosten, T. R., M.D., and George, T. P., M.D., "The Neurobiology of Opioid Dependence: Implications for Treatment," *National Institute on Drug Abuse Science and Practice Perspectives* **1**, no. 1 ((July 2002)): 15). In lay terms, "[d]rugs of abuse, such as cocaine, also appear to cause long-term physical alterations in the brain that may make it very difficult for [addicted persons] to merely change their minds about using drugs" (Hope, B. T., *Cocaine and a Mechanism for Long-Term Changes in Gene Expression, in Marijuana and Medicine* ((New Jersey: Humana Press, 1999)): 213). Despite conflicts in the literature, a substantial body of research supports the assessment, for example, that "addiction is irrational in the sense that it is not curtailed by the aversive effects of drugs" (Heyman, G. M., "Resolving the Contradictions of Addiction," *Behavioral and Brain Sciences* **19**, no. 4 ((1996)): 573).

²⁵ *Id.* at 15. For the proposition that rational thought and judgment are replaced by decisions defined by the addiction, see also, e.g. Nakken, C., *Reclaim Your Family from Addiction* (Center City, MN: Hazelden Foundation, 2000): 71-90; Jampolsky, L., *Healing the Addictive Mind* (Berkeley, California: Celestial Arts, 1991): 23-37. For the proposition that rising prices, while they may affect first time purchases, will not deter the addicted consumers from seeking the drug at any price, see e.g., Heyman, G. M., "Resolving the Contradictions of Addiction," *Behavioral and Brain Sciences* **19**, no. 4 (1996): 573.

²⁶More specifically: "Elasticity of demand" is a phrase used to describe the response of consumer demand to changes in price for a particular good. Typically elasticity is expressed as [percentage] decrease in use [divided by percentage] increase in price, so that a 10 [percent] price increase leading to a 20 [percent] decrease in use would be expressed as an elasticity of demand equal to two. Elasticities with a value less than one are referred to as 'inelastic,' elasticities of one are 'unit elastic,' and elasticities with a value of greater than one are 'elastic' or 'highly elastic' depending on their magnitude" (LaGrange, J. *Law, Economics, and Drugs: Problems with Legalization under a Federal System*, 100 COLUM. L. REV. 505, 509-10, no. 18 ((2000)).

²⁷See, e.g., Daithith, J. (Ed.), *Letts Dictionary of Economics* (London, 1983). Another description of PED in this context is: "The responsiveness of the quantity demanded to a change in price in a given market during a given time period, *ceteris paribus*. It is measured by the percentage change in quantity demanded divided by the percentage change in the good's own price ... The value of the PED depends on the availability of close substitutes and their relative prices, the proportion of income spent on the good, habit, alternative uses of the good" *Id.* at 140-41

²⁸Pearce, D. W. (Ed.), *The MIT Dictionary of Economics* (Cambridge, MA: MIT Press, 4th Edition, 1992): 125.

²⁹Pearce, D. W. (Ed.), *The MIT Dictionary of Economics* (Cambridge, MA: MIT Press, 4th Edition, 1992): 342.

³⁰Laidler, D. E. W., *Introduction to Microeconomics* (New York: Halsted Press, 2nd Edition, 1981): 26.

³¹While a bit beyond the current discussion, the essential principle can be illustrated in diagram and equation form. In a case such as the two given above, one of which is a relatively low price elasticity (for diapers) and the other relatively high price elasticity (for cereal), both values would be represented by a downward sloping (left to right) demand curve, where the vertical Y axis is price of a unit and the horizontal or X axis is the quantity demanded. As Letts describes the demand curve: "The resulting value [of any relationship in which higher prices generate lower quantity consumed, whether at lower or higher elasticity] will be negative, since when the price rises, the quantity demanded falls (i.e. the demand curve slopes downward from left to right). This method is known as arc elasticity because it measures the responsiveness over the range of prices between [two points]. By reducing the change in price to an infinitesimal amount, the PED at one point on the demand curve can be calculated. Point elasticity demonstrates clearly that PED depends not only on the slope of the demand curve but also on the ratio of the original price and quantity." *Id.* at 140.

³²"Point elasticity" is the measure of Price Elasticity of Demand where change in the price is extremely small, thus "if change is very small the resulting measure is known as price elasticity of demand." However, if change is very large over the same period of time, this is called "arc elasticity of demand." Accordingly, "if change is significantly large, the measure obtained is one of the responsiveness of demand to this change in price and is generally known as the arc elasticity of demand" (Pearce, D. W. ((Ed.)), *The MIT Dictionary of Economics* ((Cambridge, MA: MIT Press, 4th Edition, 1992)): 342).

³³Salvatore, D., Ph.D., *Schaum's Outline of Theory and Problems of Microeconomic Theory* (New York: McGraw-Hill, 3rd Edition, 1992): 44.

³⁴Salvatore, D., Ph.D., *Schaum's Outline of Theory and Problems of Microeconomic Theory* (New York: McGraw-Hill, 3rd Edition, 1992): 44..

³⁵*Id.*

³⁶*Id.* at 38-44.

³⁷*Id.*

³⁸Hewitt, G., *Economics of the Market* (Great Britain: Fontana/Collins, 1976): 54.

³⁹*Id.* at 54.

⁴⁰*Id.* at 54.

⁴¹*Id.* at 55.

⁴²*Id.* at 57.

⁴³By way of reference, research describes cocaine as highly addictive, to the point of virtually locking out the choice not to use, even at higher prices. Experimentation under conditions of high PED swiftly turns to perpetual abuse at low PED. As one study explained: "Cocaine-driven humans will relegate all other drives and pleasures to a minor role in their lives ... If we were to design deliberately a chemical that would lock people into perpetual usage, it would probably resemble ... cocaine ..." (Peele, S., and De-Grandpre, R. J., "Cocaine and the Concept of Addiction: Environmental Factors in Drug Compulsions," *Addiction Research* 6, no. 3 ((1998)): 235-263, citing Cohen, S., "Reinforcement and Rapid Delivery Systems: Understanding Adverse Consequence of Cocaine," In Kozel, N. J. and Adams, E. H. ((Eds.)), *Cocaine Use in America: Epidemiologic Clinical Perspectives* (Washington, D. C.: Government Printing Office, DHHS Publication no. ADM 85-1414, 1984)): 151-153). The general nature of addiction, driving out choice and locking users into perpetual consumption patterns at any price occurs across drug types. Accordingly, researchers "identify cocaine (and amphetamines, which mimic the effects of cocaine) as addictive in the same sense and as a result of the same changes in 'molecular mechanisms' following chronic drug ingestion as heroin: 'Repeated doses of addictive drugs – opiates, cocaine, and amphetamine – cause drug dependence and, afterward, withdrawal' " (Peele et al., *supra*, citing Hyman, S., "Shaking Out the Cause of Addiction," *Science* 273 ((1996)): 611-612). See also, e.g., Fishman, M. W., "Behavioral Pharmacology of Cocaine," *Journal of Clinical Psychiatry* 49 (1988): 7, cited in Peele et al. ("Cocaine appears to be a most potent reinforcer, and the self-administering organism is resistant to any attempts to decrease drug-taking ... Indeed, the drug is so reinforcing that the organism self-administering it becomes totally preoccupied with drug acquisition").

⁴⁴Note that many researchers use the idea of compulsion to describe addictive behavior. See, e.g., Peele et al., *supra*.

⁴⁵Hewitt, G., *Economics of the Market* (Great Britain: Fontana/Collins, 1976): 57-58.

⁴⁶Policies that could encourage higher consumption of substances characterized by a PED that rapidly slides from high to low, encouraging addiction by a larger number of first time users, would prove to be highly costly. According to the Office of National Drug Control Policy, for example, 3.6 million chronic drug users disproportionately spread infectious diseases like hepatitis, tuberculosis and HIV. See McCaffrey, B., *Testimony by ONDCP Director Barry McCaffrey before Senate Comm. on Judiciary*, 105th Cong. (July 23, 1997) [hereinafter *McCaffrey Testimony*]. Infant mortality is much higher among children born to substance-abusing mothers and hospital charges – not to mention follow-up and lifetime care costs – for infants exposed to illicit drugs are four times greater than those for drug-free infants. See Califano, J. A., Jr., "Substance Abuse and Addiction – The Need to Know," *American Journal of Public Health* 88, no. 1, (Jan. 1998): 9. Drug-using employees experience higher absenteeism, use more health benefits, require more discipline, and turnover at higher rates than drug-free employees. See McCaffrey testimony *supra*. Likewise, to pick one recent year, child abuse, crime, welfare costs and mortality were all directly affected by addiction. Reputable studies indicate that between 25

and 90 percent of all child maltreatment involves substance abuse. See Barth, R. P., *Substance Abuse and Child Welfare: Problems and Proposals before the Subcomm. on Human Resources of the House Committee on Ways and Means*, 105th Cong. (Oct. 28, 1997). A majority of arrestees tested positive for drug use at the time of arrest and an estimated 12 million property crimes and two million violent crimes committed each year are drug-related. See, e.g., *McCaffrey Testimony supra*. In 1995, there were more than half a million drug-related hospital emergency room episodes and this number has continued to rise in a number of categories. See *Drug Abuse Warning Network: 1995 Preliminary Estimates of Drug-Related Emergency Department Episodes* (Rockville, MD: Substance Abuse and Mental Health Services Administration, U. S. Department of Health and Human Services, 1996), compiled annually from hospitals across the United States. Finally, 15 to 20 percent of welfare recipients have alcohol and drug addiction problems, and tend to remain on welfare for longer periods of time than those who are free of addiction. See *Making Welfare Reform Work: Tools for Confronting Alcohol and Drug Problems among Welfare Recipients* (Washington, D. C.: Legal Action Center, Sept. 1997). See also Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* **249**, no. 4976 (Sept. 28, 1990): 9 ("in Canada in 1984 the total social costs of alcohol were double the revenues generated from alcohol at all levels of government... [and] in the United States in 1983, this ratio exceeded 10 to 1 [citations omitted]").

⁴⁷See also, e.g., for cutting-edge alcohol research and the addictive nature of alcohol paired with discussion of tax policy, the National Institute on Alcohol Abuse and Alcoholism (NIAAA) as well as the National Center for Science and the Public Interest, particularly at their web site, www.cspinet.org/booze, with special attention to the "Alcohol Policies Project" and the "research" within that resource. Similarly, recent studies of note include: Wagenaar, A., and Holder, H., "Changes in Alcohol Consumption Resulting from the Elimination of Retail Wine Monopolies: Results from Five U.S. States," *Journal of Studies in Alcohol* **56**, no. 5 (1995): 566-572; Chaloupka, F.J.; Grossman, M.; and Saffer, H., "The Effects of Price on Alcohol Consumption and Alcohol-related Problems," *Alcohol Research and Health* **26**, no. 1 (2002): 22-34; Coate, D., and Grossman, M., "Effects of Alcoholic Beverage Prices and Legal Drinking Ages on Youth Alcohol Use," *Journal of Law and Economics* **43**, no. 1 (1988): 215-238; Cook, P. J., and Moore, M. J., "Environment and Persistence in Youthful Drinking Patterns" In Gruber, J. (Ed.) *Risky Behavior Among Youth: An Economic Perspective* (Chicago: University of Chicago Press, 2001): 375-437; Grossman, M., "The Economic Analysis of Addictive Behavior" In Hilton, M. E. and Bloss, G. (Eds.) *Economics and the Prevention of Alcohol-related Problems* (Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism, NIAAA Research Monograph No. 25, NIH Pub. No. 93-3513, 1993); Manning, W. G.; Blumberg, L.; and Moulton, L. H., "The Demand for Alcohol: The Differential Response to Price," *Journal of Health Economics* **14**, no. 2 (1995): 123-148; Markowitz, S., "The Price of Alcohol, Wife Abuse and Husband Abuse," *Southern Economic Journal* **67**, no. 2 (2000): 279-303; Markowitz, S., and Grossman, M., "Alcohol Regulation and Domestic Violence toward Children," *Contemporary Economic Policy* **16**, no. 3 (1998): 309-320; Markowitz, S., and Grossman, M., "The Effects of Beer Taxes on Physical Child Abuse," *Journal of Health Economics* **19** no. 2 (2000): 271-282; Mast, B. D.; Benson, B. L.; and Rasmussen, D. W., "Beer Taxation and Alcohol-related Traffic Fatalities," *Southern Economic Journal* **66**, no. 2 (1999): 214-249; Pogue, T. F., and Sgontz, L. G., "Taxing to Control Social Costs: The Case of Alcohol," *American Economic Review* **79**, no. 1 (1989): 235-243; Sloan, F. A.; Reilly, B. A.; and Schenzler, C., "Effects of Prices, Civil and Criminal Sanctions, and Law Enforcement on Alcohol-related Mortality," *Journal of Studies on Alcohol* **55** (1994): 454-465.

⁴⁸Manski, C. F.; Pepper, J. V.; and Petrie, C. V. (Eds.), *Informing America's Policy on Illegal Drugs: What We Don't Know Keeps Hurting Us* (Washington, D. C.: National Research Council, 2001): 42.

⁴⁹*Id.* at 43.

⁵⁰*Id.* at 43-46.

⁵¹*Id.* at 44-46.

⁵²*Id.* at 46.

⁵³See, e.g., Peele et al., *supra* at 9; Vuchinich, R. E., and Tucker, J. A., "Contributions from Behavioral Theories of Choice as a Framework to an Analysis of Alcohol Abuse," *Journal of Abnormal Psychology* **92** (1988): 408-416; DeGrandpre, R. J. and Bickel, W. K. "Drug Dependence in Consumer Demand" In Green, L. and Kagel, J., *Advances in Behavioral Economics* **3** (Westport, CT: Greenwood Publishing Group, 1996): 1-35; Carroll, M. E., "The Economic Context of Drug and Non-drug Reinforcers Affects Acquisition and Maintenance of Drug-reinforced Behavior and Withdrawal Effects," *Drug and Alcohol Dependence* **33** (1993): 201-210; Hursh, S. R., "Behavioral Economics of Drug Self-administration: An Introduction," *Drug and Alcohol Dependence* **33** (1993): 165-172.

⁵⁴See Peele, et al., citing Fishman, M. W., "Behavioral Pharmacology of Cocaine," *Journal of Clinical Psychiatry* **49** (1988): 7-10; see also Manski, C. F.; Pepper, J. V.; and Petrie, C. V. (Eds.), *Informing America's Policy on Illegal Drugs: What We Don't Know Keeps Hurting Us* (Washington, D. C.: National Research Council, 2001): 44-46.

⁵⁵Cameron, S. E., "Review of Chaloupka, F. J. et al. (Eds.) *The Economic Analysis of Substance Use and Abuse*," *Eastern Economic Journal* **27**, no. 2 (Spring 2001): 245-246. Cf. LaGrange, J. *Law, Economics, and Drugs: Problems with Legalization under a Federal System*, 100 COLUM. L. REV. 505, 509-10, no. 18 (2000): 4-6 (valuable references to PED confirming the value of law enforcement in raising non-dollar price of narcotics for all users). While many non-dollar costs or externalities could be integrated into this analysis, such as the environmental, criminal and social costs which contribute to higher and lower PEDs, this analysis will focus on the rise and fall of the dollar price of narcotics, since this is perceived to be a chief factor affecting the acquisition decisions and reflecting the availability of the narcotic. To some degree, this price is assumed to reflect the inclusion of other externalities, such as the likelihood distributor apprehension by law enforcement.

⁵⁶See, e.g., studies arguing that Price Elasticity of Demand is highly inelastic, such as Silverman, L. P., and Spruill, N. L., "Urban Crime and the Price of Heroin," *Journal of Urban Economics* **4** (1977): 80-103; Roumasset, J., and Hadreas, J., "Addicts, Fences, and the Market for Stolen Goods," *Public Finance Quarterly* **5** (1977): 247-272; Nisbet T. C., and Vakil, F., "Some Estimates of Price and Expenditure Elasticities among UCLA Students," *Review of Economics and Statistics* **54** (1972): 474-475.

⁵⁷See White, M. D., and Luksetich, W. A., "Heroin: Price Elasticity and Enforcement Strategies," *Economic Inquiry* **21** (1983): 557-564; Moore, M., "Supply Reduction Policy and Drug Law Enforcement," In Tonry, M., and Wilson, J. Q. (Eds.) *Drugs and Crime* (Chicago, IL: University of Chicago Press, 1990).

⁵⁸Cameron, S. E., "Review of Chaloupka, F. J. et al. (Eds.) *The Economic Analysis of Substance Use and Abuse*," *Eastern Economic Journal* **27**, no. 2 (Spring 2001): 245-246.

⁵⁹*Id.*

⁶⁰For the proposition that rational thought and judgment are replaced by decisions defined by the addiction, see, e.g. Nakken, C., *Reclaim Your Family from Addiction* (Center City, MN: Hazelden Foundation, 2000): 71-90; Jampolsky, L., *Healing the Addictive Mind* (Berkeley, California: Celestial Arts, 1991): 23-37.

⁶¹Kosten, T. R., M.D., and George, T. P., M.D., "The Neurobiology of Opioid Dependence: Implications for Treatment," *National Institute on Drug Abuse Science and Practice Perspectives* **1**, no. 1 (July 2002): 15.

⁶²Hope, B. T., "Cocaine and a Mechanism for Long-Term Changes in Gene Expression," In *Marihuana and Medicine*. Edited by Nahas, G. G., et al., (New Jersey: Humana Press, 1999): 213.

⁶³Heyman, G. M., "Resolving the Contradictions of Addiction," *Behavioral and Brain Sciences* **19**, no. 4 (1996): 573.

⁶⁴Cameron, S. E., "Review of Chaloupka, F. J. et al. (Eds.) *The Economic Analysis of Substance Use and Abuse*," *Eastern Economic Journal* **27**, no. 2 (Spring 2001): 245-246.

⁶⁵Cameron, S. E., "Review of Chaloupka, F. J. et al. (Eds.) *The Economic Analysis of Substance Use and Abuse*," *Eastern Economic Journal* **27**, no. 2 (Spring 2001): 245-246.

⁶⁶Grossman, M.; Chaloupka, F. J.; and Sirtalian, I., "An Empirical Analysis of Alcohol Addiction: Results from the *Monitoring The Future* Panels," *Economic Inquiry* **36**, no. 1 (Jan. 1, 1998).

⁶⁷Commonly recognized elasticities are the Price Elasticity of Demand, cross elasticity of demand, elasticity of supply, point elasticity, arc elasticity, income elasticity, elasticity of technical substitution, and often the relation of elasticity to total expenditures. See, e.g., Pearce, D. W. (Ed.), *The MIT Dictionary of Economics* (Cambridge, MA: MIT Press, 4th Edition, 1992); Salvatore, D., Ph.D., *Schaum's Outline of Theory and Problems of Microeconomic Theory* (New York: McGraw-Hill, 3rd Edition, 1992); Daithith, J. (Ed.), *Letts Dictionary of Economics* (London, 1983); Laidler, D. E. W., *Introduction to Microeconomics* (New York: Halsted Press, 2nd Edition, 1981); Sowell, T., *Basic Economics: A Citizen's Guide to the Economy* (New York: Basic Books, 2000); Slaviv, S., *Economics: A Self-Teaching Guide* (New York: Wiley, 1999).

⁶⁸Grossman, M.; Chaloupka, F. J.; and Sirtalian, I., "An Empirical Analysis of Alcohol Addiction: Results from the *Monitoring The Future* Panels," *Economic Inquiry* **36**, no. 1 (Jan. 1, 1998): 11-12.

⁶⁹Keeler, T. E.; Hu, T.; Manning, W. G.; and Sung, H. Y., "State Tobacco Taxation, Education and Smoking: Controlling for the Effects of Omitted Variables," *National Tax Journal* **54** (March 1, 2001).

⁷⁰*Id.* at 1.

⁷¹*Id.* at 4. In fact, the study acknowledges that "working with individual data (rather than state averages) would represent a superior way of analyzing the relationship between education and smoking, and definitive results await disaggregated studies on this topic." *Id.* at 9. The same may be said for the conclusions drawn concerning PEDs and the overall state population.

⁷²See, e.g., LaGrange, J. *Law, Economics, and Drugs: Problems with Legalization under a Federal System*, 100 COLUM. L. REV. 505, no. 18 (2000): 510.

⁷³Saffer, H.; Chaloupka, F. J.; and Dhaval, D., "State Drug Control Spending and Illicit Drug Participation," *Contemporary Economic Policy* **19**, iss. 2 (April 1, 2001).

⁷⁴The laws of supply and demand are almost intuitive, when applied to non-addictive substances. Thus, Thomas Sowell has written: "There is perhaps no more basic or more obvious principle of economics than the fact that people tend to buy more at a lower price and less at a higher price. By the same token, people who produce goods or supply services tend to supply more at a higher price and less at a lower price The fact that people demand more at a lower price and less at a higher price may be easy to understand, but is also easy to forget. Seldom, if ever, is there a fixed quantity demanded" (Sowell, T., *Basic Economics: A Citizen's Guide to the Economy* ((New York: Basic Books, 2000)):16). Note that Sowell does not address, and the laws of supply and demand are not fitted to explain, the case in which an addicted person or addicted population sees the quantity needed or

demanded as fixed. More formally, the demand function is "an equation expressing the mathematical relationship between the quantity demanded of a good or service and another variable (usually price), in a given market and specified time period" (Daitith, J. ((Ed.)), *Letts Dictionary of Economics* ((London, 1983)): 40). Typically, the demand curve is a line on a graph showing the quantity consumers will buy (x axis) plotted against the changes in price (y-axis), a line that is downward-sloping from left to right. Meanwhile, supply is the quantity produced for purchase at any given price. Thus, the supply curve is a different curve, upward-sloping from left to right, where quantity is on the x-axis and price is on the y-axis. The supply curve tends to show that more goods are offered for sale at higher prices, since there is a greater incentive to sell at higher prices, albeit with diminishing returns. *Id.* at 178-79.

⁷⁵Saffer, H.; Chaloupka, F. J.; and Dhaval, D., "State Drug Control Spending and Illicit Drug Participation," *Contemporary Economic Policy* 19, iss. 2 (April 1, 2001): 2.

⁷⁶*Id.*

⁷⁷*Id.* at 5.

⁷⁸See, e.g., "The Case for Legalization," *The Economist* (July 28, 2001): 11.

⁷⁹*Id.* at 5-6.

⁸⁰*Id.* at 10.

⁸¹See, e.g., "The Case for Legalization," *The Economist* (July 28, 2001): 11.

⁸²Johnson, R. A., and Gerstein, D. R., "Initiation of Use of Alcohol, Cigarettes, Marijuana, Cocaine, and Other Substances in U.S. Birth Cohorts since 1919," *American Journal of Public Health* 88, iss. 1, (Jan. 1, 1998).

⁸³*Id.* at 10.

⁸⁴*Id.*

⁸⁵*Id.*

⁸⁶See, e.g., LaGrange, J. *Law, Economics, and Drugs: Problems with Legalization under a Federal System*, 100 COLUM. L. REV. 505, no. 18 (2000); Licari, M. J., and Meier, K. J., "Regulatory Policy when Behavior is Addictive: Smoking, Cigarette Taxes and Bootlegging," *Political Research Quarterly*, (March 1, 1997).

⁸⁷Licari, M. J., and Meier, K. J., "Regulatory Policy When Behavior is Addictive: Smoking, Cigarette Taxes and Bootlegging," *Political Research Quarterly* 50 (March 1, 1997).

⁸⁸Note direct reference to reliance upon "a simple theory derived from the economics of supply and demand" *Id.* at 1.

⁸⁹*Id.* at 5.

⁹⁰In this particular study, the lagged dependent variable is added to the analysis as follows: "Focusing on the lagged model, a one-cent-per-pack real increase in taxes, is associated with a reduction in cigarette consumption of .813 packs per person for state taxes and .824 packs per person for federal taxes. With a lagged dependent variable, this is the impact for the first year increase. The impact for the second year is equal to these slopes times the regression coefficient for the lagged dependent variable; for

state taxes this is .813 x [times] .972, or about .79 packs per capita. Impacts for subsequent years can be calculated in a similar manner, producing a geometrically distributive lag [citations omitted]. Initial reductions in smoking continue into the future at a gradually declining rate." *Id.* at 10-11. While this presents a neatly distributed set of data, it may not comport with the average real speed of addiction or the relative speed at which addicted persons decide to ignore price in order to acquire a narcotic. Moreover, the more intense an addict's need to consume a given drug – that is, the higher the abusive potency of the drug -- the steeper the likely decline toward non-responsiveness to price. Thus, if heroin is more addictive in a shorter period of time than nicotine, then use of a lagged dependent variable will be of less value as a descriptor of real decision making by addicted persons over time.

⁹¹*Id.* at 8. This observation scratches the surface of the sliding PED, since the reference to "stickiness" of consumption in response to price is the result of the sliding PED for addictive nicotine. However, like other studies in the addiction and economics field, this study discounts the importance of such "stickiness" as an indicator of declining responsiveness that swiftly approaches zero. Instead, this study seeks to compensate for the perceived reduction in responsiveness to price among addicted purchasers by suggesting that addicted purchasers, like all drug purchasers, simply become marginally less responsive over time to incremental price changes. In fact, a more likely description of the nature of addiction, especially for drugs with a high abusive potency, is that addicted persons become *significantly* less responsive *rapidly*, even in the face of *major* price changes.

⁹²Chaloupka, F. J., and Wechsler, H., "Binge Drinking in College: The Impact of Price, Availability and Alcohol Control Policies," *Contemporary Economic Policy* (October 1, 1996).

⁹³*Id.* at 3. See also, e.g., Cook, P. J., and Moore, M. J., "Drinking and Schooling," *Journal of Health Economics*, (Dec. 1993): 411-429; Kenkel, D. S., and Ribar, D. C., "Alcohol Consumption and Young Adults' Socioeconomic Status," *Brookings Papers on Economic Activity: Microeconomics* (Washington, D.C.: The Brookings Institution, 1994).

⁹⁴Chaloupka, F. J. and Wechsler, H., "Binge Drinking in College: The Impact of Price, Availability and Alcohol Control Policies," *Contemporary Economic Policy* 14, no. 4 (October 1, 1996): 9.

⁹⁵*Id.* at 10.

⁹⁶*Id.* at 12.

⁹⁷*Id.* at 11.

⁹⁸Boyam, D., and Kleiman, M. A. R., "Drug Enforcement Challenge" In Wilson J. Q. et al. (Eds.) *Crime and Public Policy* (San Francisco: Institute for Contemporary Studies, 1994).

⁹⁹*Id.* at 21, citing to Brown, G. F., and Silverman, L. P., "The Retail Price of Heroin: Estimation and Applications," *Journal of the American Statistical Association* 69 (1974): 595-606; Silverman, L. P., and Spruill, N. L., "Urban Crime and the Price of Heroin," *Journal of Urban Economics* 4 (1977): 80-103.

¹⁰⁰Boyam, D., and Kleiman, M. A. R., "Drug Enforcement Challenge" In Wilson J. Q. et al. (Eds.) *Crime and Public Policy* (San Francisco: Institute for Contemporary Studies, 1994).

¹⁰¹*Id.* at 22.

¹⁰²Boyam et al., *supra*, at 22, citing to Dupont, R. L., and Greene, M. H., "The Dynamics of a Heroin Addiction Epidemic," *Science* 181 (1973): 716-722.

¹⁰³ *Id.* at 22.

¹⁰⁴ *Id.*

¹⁰⁵ *Id.*

¹⁰⁶ *Id.* at 23.

¹⁰⁷ *Id.*

¹⁰⁸ If not generally accepted, the notion of extreme craving for the addictive substance, together with a growing tolerance, is implicit in the commonly used definitions of addiction. "The behavioral and psychological markers of addiction were codified as pathologic withdrawal and craving in a deterministic model that replicated the alcoholism-as-disease notion of drug-induced loss of control" (Peele, S., and DeGrandpre, R. J., "Cocaine and the Concept of Addiction: Environmental Factors in Drug Compulsions," *Addiction Research* 6, no. 3 ((1998)): 1). See also Levine, H. G. "The Discovery of Addiction: Changing Conceptions of Habitual Drunkenness in America," *Journal of Studies on Alcohol* 39 (1978): 143-174; Peele, S., "Addiction as a Cultural Concept," *Annals of the New York Academy of Sciences* 602 (1990): 205-220. "The addicting drugs have two special characteristics with policy implications. First, repeated long-term administration produces a state of physical dependence, so that neurochemical brain function is disturbed (withdrawal syndrome) if the drug is suddenly discontinued Dependence accounts, in part, for the compulsion to continue use of an addicting drug The second special characteristic, tolerance, is typically associated with the development of physical dependence, [and] is manifested by a tendency to escalate dosage because the same dose is no longer as effective as it was before" (Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* 249, no. 4976 ((Sept. 28, 1990)): 4).

¹⁰⁹ Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* 249, no. 4976 (Sept. 28, 1990): 4.

¹¹⁰ *Id.* at 9.

¹¹¹ *Id.*

¹¹² The study states: "There is not reason to doubt that the increased costs to society would rival those now attributable to alcohol. In that case, the economic savings that might be achieved, even if it were possible to eliminate all the costs of drug law enforcement, might well be offset by the traditional costs resulting from the consequences of increased drug use." *Id.*

¹¹³ *Id.* at 9.

¹¹⁴ One reservation: This model may not fully capture the powerful effect of poly-drug addiction or "potentiation" between varying drugs of addiction, despite offering a graduated assessment of varying types of addiction related to differing drugs or differing abusive potencies, in turn associated with particular types of drugs.

¹¹⁵ *Id.* at 5.

¹¹⁶ *Id.* at 5, 11.

¹¹⁷ THC is the psychoactive component found in marijuana, and the acronym for tetrahydrocannabinol. While marijuana is often paired with other narcotics, such as being soaked in PCP, the purity levels of THC in marijuana itself reportedly ranges up to 40 percent in 2002, a significant increase from one to

ten percent levels found in the 1960s.

¹¹⁸ *Id.* at 13. Note that recent research has added a number of medical factors to the use of marijuana suggesting significant long-run health and addiction concerns. See **Research Report: Marijuana Abuse** (National Institute for Drug Abuse, National Institutes of Health, No. PHD940, 2002).

¹¹⁹ "New Research Report Presents Marijuana Facts," **NIDA Notes: National Institute on Drug Abuse 17**, no. 3 (2002): 15, citing **Research Report: Marijuana Abuse** (National Institute for Drug Abuse, National Institutes of Health, No. PHD940, 2002).

¹²⁰ See, e.g., "Drugs: It's All in the Price," **The Economist** (June 8, 2002): 52-53; "The Case for Legalization," **The Economist** (July 28, 2001): 11.

¹²¹ "Drugs: It's All in the Price," **The Economist** (June 8, 2002): 52-53.

¹²² *Id.* at 53.

¹²³ "Cheap Cures," **The Economist** (August 17, 2002): 13.

¹²⁴ "The Young and the Rested," **The Economist** (August 24, 2002): 24.

¹²⁵ "The Case for Legalization," **The Economist** (July 28, 2001): 11.

¹²⁶ *Id.*

¹²⁷ *Id.*

¹²⁸ *Id.*

¹²⁹ For example, in Canada in 1984 the total social costs of alcohol were double the revenues generated from alcohol at all levels of government... [and] in the United States in 1983, this ratio exceeded 10 to 1 [citations omitted]. See Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," **Science 249**, no. 4976 (Sept. 28, 1990): 9; "Statistics on Alcohol and Drug Use in Canada and Other Countries," In Adrian, M.; Jull, P.; and Williams, R. (Compiled) **Statistics on Alcohol Use, Data Available by 1988, Volume I** (Toronto: Addiction Research Foundation, 1989); **Alcohol and Health, Sixth Special Report to the U.S. Congress** (Rockville, MD: U.S. Department of Health and Human Services, NIDA, 1987).

¹³⁰ Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," **Science 249**, no. 4976 (Sept. 28, 1990): 9, noting: "It is sometimes argued that as marijuana seems to be the least harmful of the psychoactive drugs ... it could be legalized safely. However, scientific evidence is still insufficient as to the potential magnitude of long-term harm, whereas the acute disturbance of psychomotor behavior is clearly dangerous under certain circumstances. It is not possible to predict with confidence what the result would be of vast expansion of the user pool, especially of heavy users." Similarly, one recent study notes: "A serious risk of long-term marijuana use is addiction – compulsive use of the drug ... Withdrawal symptoms and drug craving can make it hard for long-term marijuana users to stop the drug" (**Research Report: Marijuana Abuse** ((National Institute for Drug Abuse, National Institutes of Health, No. PHD940, 2002))).

¹³¹ "The Case for Legalization," **The Economist** (July 28, 2001): 11.

¹³² Recent indicators are, for example, that media-based education and prevention programs, combined with current law enforcement regimes, reduce demand for targeted addictive substances. Thus, "[s]

tatistically significant changes in marijuana-related attitudes also occurred between 1998 and 2000 [in the United States], and coincide with the launch of a multi-million dollar, anti-drug media campaign, much of which has targeted teens with messages about marijuana" ("Teen Drug Use Down and Holding," *The News: Newsletter of the Partnership for a Drug Free America* ((Winter 2001)): 2). Similarly, then-President and CEO of the Partnership for a Drug Free America noted in 2001: "With so much deemed ineffective in the fight against drugs, here is a program that's working ... [and] may prove to be the most cost-effective drug-prevention program ever funded by the government." Notably, such messages are both consistent and unhampered by a government policy actually promoting distribution of the drugs toward which the prevention program is directed. *Id.*

¹³³See, e.g., Peele et al. at 9-11; Goldberg, S. R., and Kelleher, R. T., "Behavior Controlled by Scheduled Injections of Cocaine in Squirrel and Rhesus Monkeys," *Journal of Experimental Analysis of Behavior* **25** (1973): 93-104; Harrigan, S. E. and Downs, D. A., "Self-Administration of Heroin, Acetylnethadol, Morphine and Methadone in Rhesus Monkeys," *Life Sciences* **22** (1978): 619-624; Peden, B. F., and Timberlake, W., "Effects of Reward Magnitude on Key Pecking and Eating by Pigeons in a Closed Economy," *The Psychological Record* **34** (1984): 397-415.

¹³⁴See Peele et al., at 11. While Peele et al. seek to divine added meaning from these limited animal studies, suggesting that "as unit price increases, response rate first increases, reaches a maximum, and then decreases" – and that these drugs are thus *less* addictive over time – more likely is the conclusion that these animals simply dosed themselves to a point where future dosing required more "work" than they were willing to put forward. Unclear, too, is how quickly after experimentation the animals (squirrels and monkeys) died. Notably, also, there is considerable research suggesting that animals will become more addicted over time and are "resistant to attempts to decrease drug taking" (Fishman, M.W., "Behavioral Pharmacology of Cocaine," *Journal of Clinical Psychiatry* **49** ((1988)): 7-10. Errors inherent in drawing any significant conclusions from these highly limited animal studies have not prevented those who subscribe to the "harm reduction model" from citing them to support of the notion that addiction is self-limiting and that humans can "quit without treatment" (Peele et al., citing to Fiore, M. C.; Novotny, T. E.; Pierce, J. P.; Giovino, G. A.; Hatziaandreu, E. J.; Newcomb, P. A.; Surawicz, T. S.; and Davis, R. M., "Methods Used to Quit Smoking in the United States," *Journal of the American Medical Association* **263** ((1990)): 2760-2765). A substantial body of counter-veiling economic and addiction research suggests that this is a spurious conclusion when applied to human decision-making under the influence of addictive drugs.

¹³⁵Both in economic literature and in addiction literature, there appears to be no prior reference to the idea of a "sliding PED" by any name, or application of a "sliding PED" to consumption of differing types of addictive substances, including narcotics. Nor is there recognition that different addictive substances carry different sliding PEDs, describing the different characteristics of their user populations and producing different policy implications. Passing reference is made in both addiction literature and economic literature to the general PED concept in the context of addiction. These studies are discussed above. There is also casual awareness that a non-constant PED might apply to consumption of addictive substances or narcotics. However, this casual understanding is nowhere set forth as the basis for further study of the "sliding PED" concept and its application to various addictive substances.

¹³⁶As indicated in the foregoing note, no formal recognition has been made of the "sliding PED," particularly as applied to consumption of addictive substances and the impact that this concept on policy. The notion of differing PEDs, as well as the relative "stickiness" or "non-responsiveness" of different consumer goods to price in different populations is well understood, but application of a "sliding PED" to decision-making by consumers initially not addicted and thereafter becoming addicted, has not been explored. By metaphor, one might argue that the dots exist on the paper, but have yet to be connected, or the stars exist in the night sky, but the constellation they comprise has not yet been fully recognized. Expressed differently, researchers have archived substantial knowledge on the topics of addiction, the general utility and workings of Price Elasticity of Demand, of addicted decision-making, of con-

sumption by addicted persons and non-responsiveness to price change, of initiation rates for non-users and their responsiveness to price, and of the relationship between availability, price and general use. These are the various species of data which have been observed and chronicled over time. Missing has been a unifying way to explain that the PED for narcotics does not remain constant for any given addicted person or for a given user population migrating toward addiction to a particular drug. Nor has there been an easy way to express or describe the fact that users consume at different rates of responsiveness to price based on the type of drug being consumed. The notion of "sliding PEDs" specific to particular drugs, and generally applicable to narcotics or addictive substances, is a unifying concept of sorts, much as Darwin invented nothing new, but merely explained what he and many others before him had already seen clearly. In this case, the idea of sliding PEDs for addictive substances generally, and for various narcotics in particular, provides a better or different description – in the language of economics – for facts generally well understood by the prevailing literature and respective fields.

¹³⁷Hewitt at 59.

¹³⁸*Id* at 60.

¹³⁹See also Boyam et al., *supra*, at 22, citing to Dupont, R. L., and Greene, M. H., "The Dynamics of a Heroin Addiction Epidemic," *Science* **181** (1973): 22 ("in the short run, demand is above all a function of consumption among current addicts ... [and] the demand is unlikely to respond quickly to a price increase ..."); Licari, M. J., and Meier, K. J., "Regulatory Policy When Behavior is Addictive: Smoking, Cigarette Taxes and Bootlegging," *Political Research Quarterly* **50** (March 1, 1997): 5 ("Since the nicotine in tobacco is highly addictive, current consumption levels are highly dependent on prior consumption levels [citation omitted], and the responsiveness of demand to price (or tax) increases and policy changes should demonstrate some stickiness").

¹⁴⁰See, e.g., Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* **249**, no. 4976 (Sept. 28, 1990):4, 9 (legalizing could affect "millions" of new users).

¹⁴¹See Grossman, M., and Chaloupka, F., "The Demand for Cocaine by Young Adults: A Rational Addiction Approach," *Journal of Health Economics* **17**, no. 4 (1998): 427-474; see also Chaloupka, F. J.; Grossman, M.; and Tauras, J. A., "The Demand for Cocaine and Marijuana by Youth," *Economic Analysis of Substance Use and Abuse* (University of Chicago, 1999); Saffer, H.; Chaloupka, F. J.; and Dhaval, D., "State Drug Control Spending and Illicit Drug Participation," *Contemporary Economic Policy* **19**, iss. 2 (April 1, 2001): 5.

¹⁴²"Set It Free," *The Economist* (July 28, 2001): 15-16.

¹⁴³Regardless of actual numbers, even *The Economist* estimates that lower price would dramatically increase the number of users. See "Set It Free," *The Economist*, (July 28, 2001): 15.

¹⁴⁴"Set It Free," *The Economist*, (July 28, 2001): 15, citing to "Mark Kleinman, a drug policy expert at the University of California in Los Angeles."

¹⁴⁵*The News: Newsletter of the Partnership for a Drug Free America* (Winter 2001): 2, citing to the 2000 Partnership Attitude Tracking Study (PATS).

¹⁴⁶*Id.* at 2.

¹⁴⁷Many estimates are higher than 10 percent based on the abusive potency of the narcotic being legalized.

¹⁴⁸One economic study suggested: "Removal of the legal restrictions would risk conveying the message

that drug use is not really as harmful as the students had come to believe and thus would weaken an important influence tending to keep consumption levels low" (Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* **249**, no. 4976 ((Sept. 28, 1990)): 9).

¹⁴⁹Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* **249**, no. 4976 (Sept. 28, 1990): 9.

¹⁵⁰*Id.* at 9. See also, e.g., "Statistics on Alcohol and Drug Use in Canada and Other Countries," In Adrian, M.; Jull, P.; and Williams, R. (Compiled) *Statistics on Alcohol Use, Data Available by 1988, Volume I* (Toronto: Addiction Research Foundation, 1989); *Alcohol and Health, Sixth Special Report to the U.S. Congress* (Rockville, MD: U.S. Department of Health and Human Services, NIDA, 1987).

¹⁵¹Hewitt, G., *Economics of the Market* (Great Britain: Fontana/Collins, 1976): 62-63.

¹⁵²Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* **249**, no. 4976 (Sept. 28, 1990): 9.

¹⁵³See reference notes 90, 91 and the accompanying text.

¹⁵⁴In addition to previously described costs, note that – by analogy – "the role of alcohol and other drugs in highway accidents is well documented" (Goldstein, A., and Kalant, H., "Drug Policy: Striking the Right Balance," *Science* **249**, no. 4976 ((Sept. 28, 1990)): 13); see also Moskowitz, H., and Robinson, C. D., *Effects of Low Doses of Ethanol on Driving-Related Skills: A Review of the Evidence* (Washington, D. C.: Department of Commerce, National Technical Information Service, 1988); Yesavage, J. A.; Leirer, V. O.; Denari, M.; and Hollister, L. E., "Carryover Effects of Marijuana Intoxication on Aircraft Pilot Performance," *American Journal of Psychiatry* **142** (1985): 1325-1329. (referring to same effects with marijuana); Kalant, O. J., *The Amphetamines: Toxicity and Addiction* (Toronto: University of Toronto Press, 1973); Johnson, E. D., "Thompson Family Feels the Impact of Marijuana," *Las Vegas Sun* (Oct. 28, 2002) (example death from driver under influence of marijuana).



The research conducted for and referenced in *New Economic Thinking on Addiction and Legalization* is current through December 2002.