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### Research Spotlight

## Including Illegal Market Activity in the U.S. National Economic Accounts

By Rachel Soloveichik

The Bureau of Economic Analysis (BEA) follows carefully documented methodologies to ensure the National Income and Product Accounts (NIPAs) are calculated consistently over time. As part of that documentation, BEA researchers have published articles in the *Survey of Current Business* discussing potential changes to BEA's methodologies. This month, as part of our centennial coverage, we feature here a two-part article, "The Underground Economy: An Introduction," which was written by former BEA Director Carol S. Carson and published in the [May](#) and [July](#) 1984 issues of the *Survey*. At the time Carson's article was published, illegal drugs, illegal prostitution, and illegal gambling were considered out of scope for gross domestic product (GDP) and were therefore not included in the NIPAs. Since then, the internationally agreed and official guidelines for national accounts, the *System of National Accounts 2008* (SNA 2008), has recommended that countries track illegal market activity in their published economic statistics. Many countries have already changed their published economic statistics to follow this recommendation (Eurostat 2018). This *Research Spotlight* updates and extends Carson's article to study how tracking illegal market activity might change measured economic statistics in the United States.

This *Spotlight* studies three categories of illegal activity: drugs, prostitution, and gambling. These three categories are not equal in their recent economic impact. Consumer spending on illegal drugs was \$153 billion in 2017, compared to \$4 billion on illegal prostitution and \$11 billion on illegal gambling in the same year. Furthermore, tracking illegal drugs raises the average real GDP growth rate between 2010 and 2017 by 0.05 percentage point per year and raises the average private-sector productivity growth rate between 2010 and 2016 by 0.11 percentage point per year. In contrast, neither tracking illegal prostitution nor tracking illegal gambling has much influence on recent growth rates.

This *Research Spotlight* is divided into four sections. Section 1 presents nominal spending data on illegal drugs, illegal prostitution, and illegal gambling, respectively. Section 2 presents price statistics for each illegal activity category. Section 3 presents nominal import data on illegal drugs, illegal prostitution, and illegal gambling, respectively. Finally, section 4 presents the impact of tracking illegal market activity on aggregate economic statistics. The numbers and methodologies in this *Spotlight* are largely taken from a previously published BEA working paper ([Soloveichik 2019](#)), but a few time series have been updated or smoothed. A future working paper will focus on marijuana and provide recent details for that category.

As part of BEA's commemoration of the centennial of the *Survey of Current Business*, we are honored to present this *Research Spotlight* by Rachel Soloveichik. Ms. Soloveichik is a research economist at the U.S. Bureau of Economic Analysis (BEA). She may be contacted at [rachel.soloveichik@bea.gov](mailto:rachel.soloveichik@bea.gov).

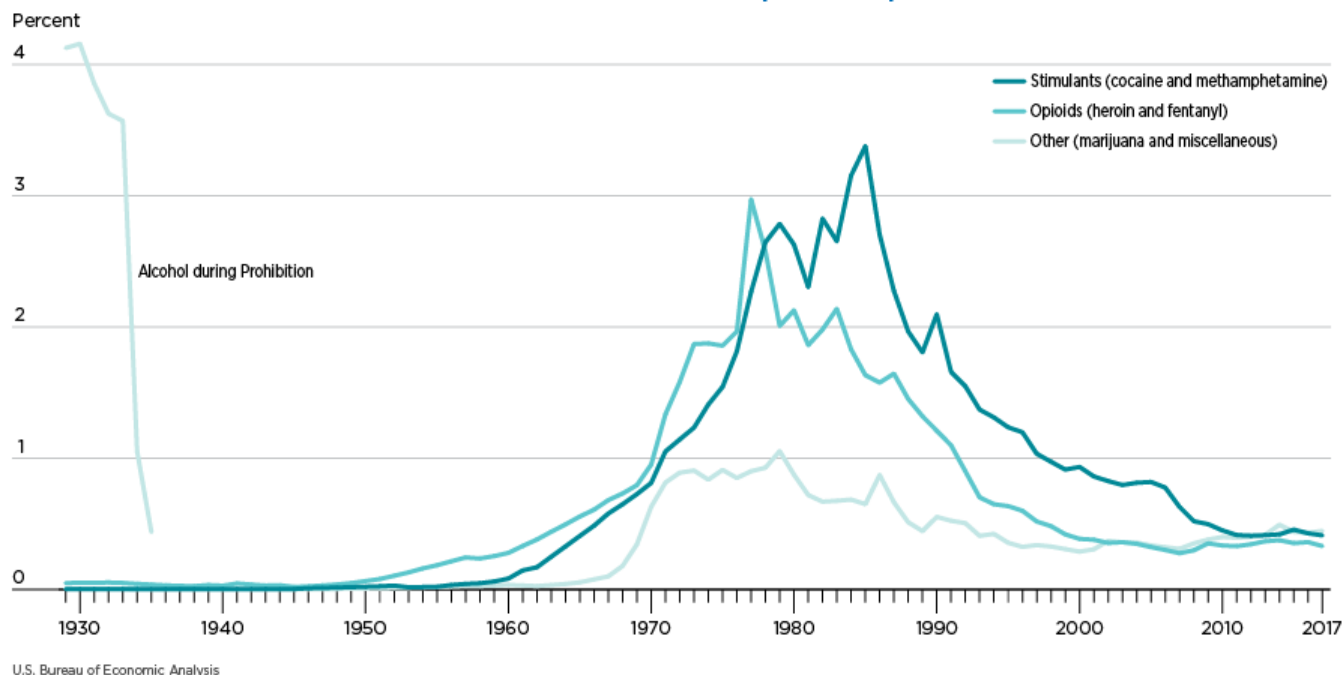
## Personal Consumption Expenditures on Illegal Products

### Illegal drugs and alcohol during Prohibition

The primary data in this analysis are taken from an official government report, *What America's Users Spend on Illegal Drugs: 2006–2016* (RAND 2019). This report gives spending for cocaine, opioids (heroin and fentanyl), marijuana, and methamphetamine from 2006 to 2016 and proxy indicators to extrapolate spending in 2017. Expenditure data between 1988 and 2005 for cocaine, heroin, marijuana, methamphetamine, and miscellaneous drugs are taken from table 72 of the official government report, *National Drug Control Strategy: Data Supplement 2016* (Executive Office of the President 2016). Before 1988, government surveys and academic literature estimates of drug quantities and average prices are used as proxies to extrapolate nominal spending for each drug category back to 1929 and nominal spending for miscellaneous drugs forward to 2017. The academic literature is also used to estimate alcohol expenditures during Prohibition<sup>1</sup> (Miron and Zweibel 1991).

Chart 1 shows that the expenditure shares for all three broad categories of illegal drugs grew rapidly after 1965 and peaked around 1980. In total, this analysis calculates that illegal drugs accounted for more than 5 percent of total personal consumption expenditures in 1980. This high expenditure share is consistent with contemporaneous news articles and may explain why BEA chose to study the underground economy in the early 1980s (Carson 1984a, 1984b). Chart 1 also shows that illegal alcohol during Prohibition accounted for almost as large a share of consumer spending as illegal drugs in 1980 and changed faster. Measured nominal growth in 1934, the first year after Prohibition ended, is badly overestimated when illegal alcohol is excluded from consumer spending.

**Chart 1. Nominal Expenditures on Illegal Drugs and Alcohol as a Share of Personal Consumption Expenditures**



## Illegal prostitution and gambling

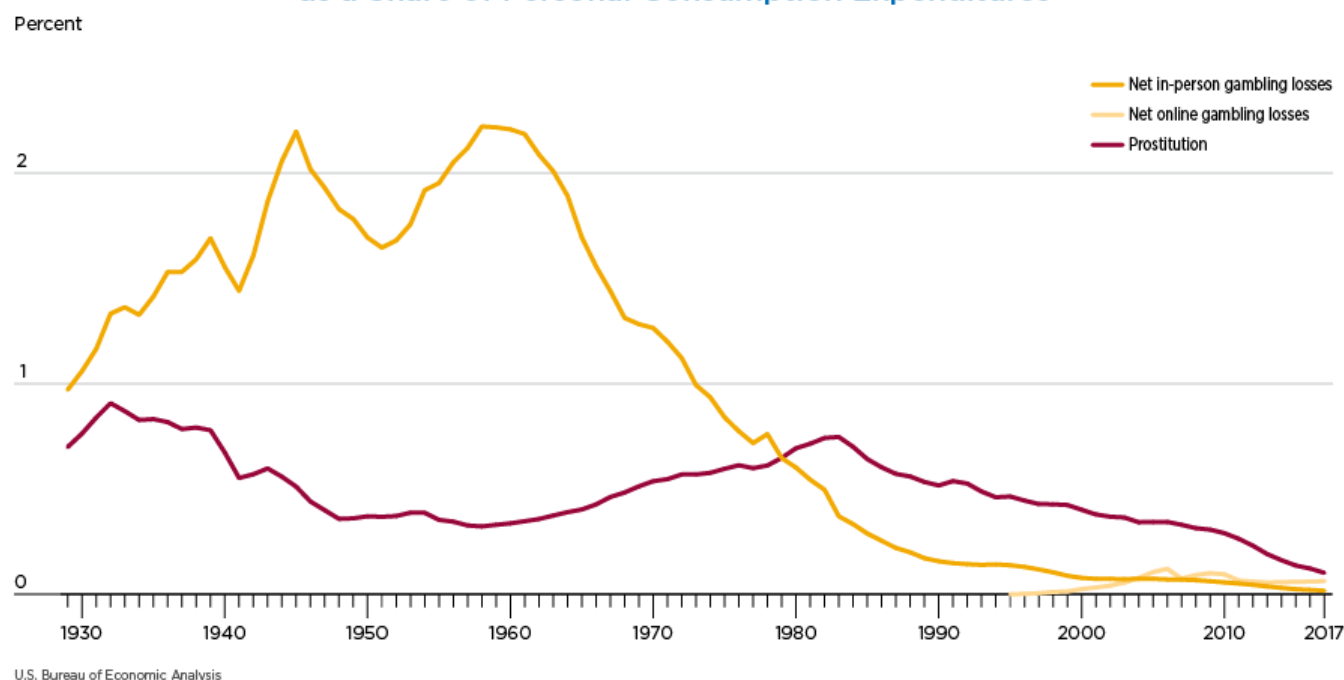
The federal government does not publish official reports on either prostitution or gambling. In the absence of better data, the analysis used estimated earnings and industry sources to proxy for nominal consumption in each category. These proxies are volatile and are therefore smoothed to reduce the influence of sampling error. *SNA 2008* defines the output of gambling providers as the difference between losses and wins (Section 8.136). For example, a gambler who buys \$100 of lottery tickets and wins \$50 in prizes is recorded as receiving \$50 of gambling services. This paper follows the *SNA 2008* accounting rules and therefore focuses on measuring net gambling losses.

For prostitution, the smoothed annual number of female arrests for prostitution and commercialized vice (Department of Justice 1929–2017) is multiplied by average earnings for workers in the legal personal care sector to get a time series of nominal earnings for female prostitutes. Historical data on male prostitution is not available, but one recent study estimates that males accounted for approximately 20 percent of prostitutes in the 2000s (Dank and others 2014). It is assumed that males account for a fixed 20 percent of prostitutes over time. That study also gives a qualitative discussion of intermediate inputs but no precise data. It is assumed that prostitutes spend a fixed 25 percent of their revenue on intermediate inputs. This constructed time series of nominal prostitution output is then benchmarked to an Internal Revenue Service (IRS) study (1983) estimating unreported income from *female* prostitution.

For gambling, the smoothed annual number of arrests for gambling (Department of Justice 1929–2017) is multiplied by the average wages in the accommodation sector to get a time series of nominal earnings for workers in the illegal in-person gambling sector. Just like prostitution, precise data on intermediate inputs was not located. However, BEA's published input-output tables show that legal gambling providers spent approximately one-quarter of their post-tax revenue on intermediate inputs. It is assumed that illegal gambling providers also spend a fixed 25 percent of their revenue on intermediate inputs. Most online gambling services are provided by foreign websites whose workers are not susceptible to arrest in the United States. Therefore, industry estimates of imported online gambling services are used to proxy for the nominal consumption of illegal online gambling. These two time series are then benchmarked to a California survey tracking gambling prevalence and gambling losses (Volberg, Nysse-Carris, and Gerstein 2006).

Chart 2 shows that both illegal prostitution and illegal gambling grew slower than overall personal consumption expenditures. Hence, measured growth rates are slightly overestimated when those illegal services are not tracked.

**Chart 2. Nominal Expenditures on Illegal Prostitution and Gambling  
as a Share of Personal Consumption Expenditures**



## Retail Prices for Illegal Products

Readers should note that none of the price indexes reported in this section are likely to precisely match the price indexes that the Bureau of Labor Statistics (BLS) might have reported if it had tracked illegal products in its Consumer Price Index. One major issue is that BLS's price index methodology requires consistent data on prices for a specific product at specific outlets over time. This type of consistent price data is difficult to collect for illegal products. The construction of historical price indexes for illegal products consistent with BLS's existing price indexes is a topic for future research.

### Illegal drugs

The primary data on illegal drugs are taken from the official government report *What America's Users Spend on Illegal Drugs: 2006–2016* (RAND 2019). Figure 4.1 in the report gives average prices per pure gram for cocaine, heroin, and methamphetamine. The report does not give an explicit price per gram for marijuana, but it provides an estimate of consumption in grams (figure 6.1), which can be combined with nominal spending (figure 5.4) to calculate an average cost per gram. For the period between 1981 and 2006, prices per gram for marijuana and prices per pure gram for cocaine, heroin, and methamphetamine are taken from the *National Drug Control Strategy: Data Supplement 2016* (Executive Office of the President 2016, supplement tables 73–75). This analysis uses academic sources and expert judgment to estimate prices for miscellaneous drugs, estimate prices for alcohol during prohibition, and extrapolate drug prices before 1981 and after 2016.

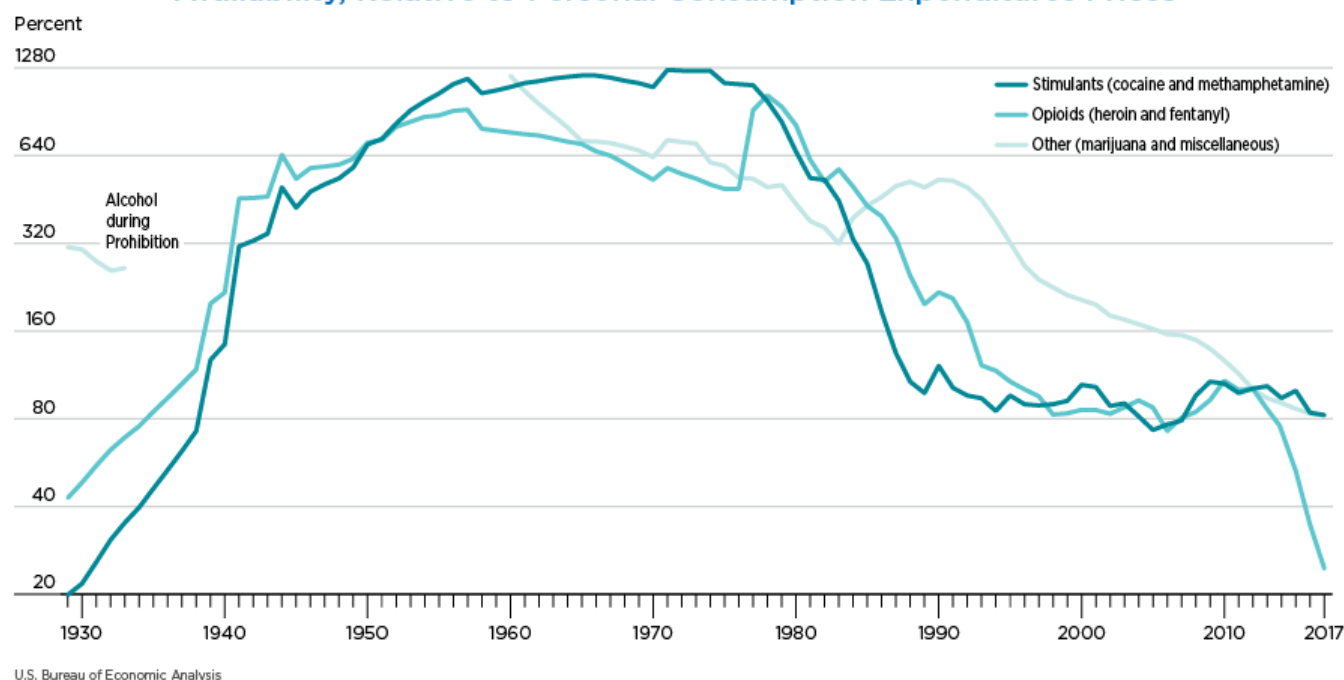
Next, drug prices are adjusted for potency changes over time. Opioid potency has rapidly increased due to the recent practice of mixing fentanyl, an extremely powerful opioid, with heroin. Marijuana potency has gradually increased due to new plant varieties that contain higher concentrations of the main psychoactive chemical in marijuana, tetrahydrocannabinol (THC). Annual data on the fentanyl share is taken from the National Forensic Laboratory Information System (Drug Enforcement Administration 2018), and annual data on the THC share is taken from the academic literature (Chandra and others 2019; ElSohly and

others 1984; and ElSohly and others 2000). In total, this *Research Spotlight* estimates the average illegal opioid dose tripled in potency from 2013 to 2017 and the average illegal marijuana dose increased more than ten-fold in potency from 1972 to 2017.

Finally, drug prices are adjusted for changes in availability. Many potential drug users report that drugs are not easily available (Miech and others 2019; Schulenberg and others 2019). Price measurement theory generally suggests that unavailable goods should be modeled as having a high shadow price (Diewert and Feenstra 2019). This *Research Spotlight* assumes that unavailable drugs have a shadow price triple the average price,<sup>2</sup> so increased drug availability corresponds with a large price decrease. This analysis also assumes that the availability increase associated with marijuana and alcohol legalization is equivalent to a 20 percent price decrease. Readers should note that other countries do not adjust their drug prices for either potency or availability, so the price indexes shown in this *Research Spotlight* will not necessarily match international price indexes.<sup>3</sup>

Chart 3 shows that drug prices dropped very rapidly after 1980 and then stabilized around 1990. This extremely rapid price decline may be highly unusual, but it is not a data error. The price declines shown in chart 3 are primarily driven by data taken directly from *National Drug Control Strategy: Data Supplement 2016* (Executive Office of the President 2016) and other official sources. Readers should also note that illegal drugs are a large enough spending category to influence aggregate inflation. Between 1980 and 1990, average personal consumption expenditures price growth falls by 0.7 percentage point per year when illegal activity is tracked in the NIPAs.

**Chart 3. Prices for Illegal Drugs and Alcohol after Adjustment for Potency and Availability, Relative to Personal Consumption Expenditures Prices**



## Illegal prostitution and gambling

It is difficult to construct a reliable price index for either prostitution or gambling. One major issue is that prices often depend on the exact services provided, client characteristics, and other variables. Another major issue is that BLS considers gambling to be out of scope for the consumer market basket and therefore does not produce a consumer price index for legal gambling (BLS 2018). Going forward, a clear conceptual framework of the production process and consumption process for these two services may help guide price measurement.

For now, this analysis uses proxy prices to deflate prostitution and gambling. For prostitution, BEA's preexisting price index for personal care services is used as a deflator.<sup>4</sup> For in-person gambling, daily casino revenue per visitor is used to deflate legal in-person gambling services (Las Vegas Convention and Visitors Authority 2019). The analysis then adjusts that gambling deflator for availability increases due to the gradual legalization of gambling over time. Finally, digital content costs are used as a deflator for online gambling services.

## Imports of Illegal Products

### Nominal imports of illegal drugs

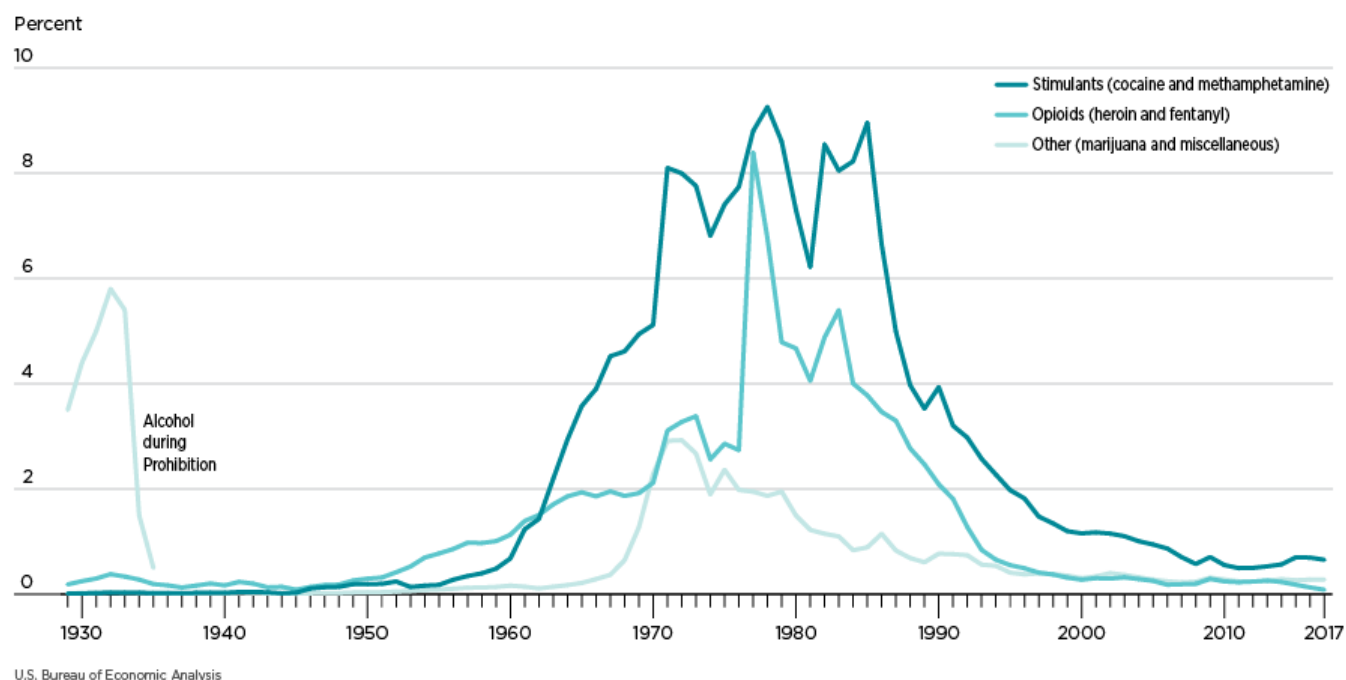
Drug dealers in the United States charge a large markup over import costs (Executive Office of the President 2016). As a result, most of the personal consumption expenditures shown in chart 1 represents domestically produced retail margin. Furthermore, only cocaine and opioids are entirely imported. This *Research Spotlight* uses the industry literature to estimate annual import shares for marijuana (Robinson, Cattán, and Bain 2015) and methamphetamine (Hinkes-Jones 2011). In addition, expert judgment was used to estimate the import share of miscellaneous drugs and alcohol during Prohibition.

The primary data on import prices is taken from a 2001 report by Abt Associates that gives average prices for four major quantity levels. It is assumed that prices at the smallest quantity level represent retail prices and prices at the second largest quantity level represent import prices soon after drugs enter the U.S. market. The difference between retail prices and import prices is assumed to be the domestically produced retail margin. Unfortunately, the 2001 Abt Associates report only tracks import prices from 1981 to 2000. Between 2000 and 2012, average wholesale prices from the National Drug Control Strategy: Data Supplement 2016 are used as a proxy for import prices. Wholesale price data were not available before 1981 or after 2012,<sup>5</sup> so retail prices and expert judgement are used to estimate drug markups for those years.

Chart 4 shows the same basic pattern as chart 1, with imports increasing rapidly after 1965, peaking around 1980, and then falling. Like all other imports, these newly tracked imports of illegal drugs are subtracted from measured GDP. As a result, the nominal GDP impact of tracking illegal drugs is slightly smaller than the nominal consumption increase shown in chart 1.



Chart 4. Nominal Illegal Drug and Alcohol Imports, as a Share of Total Imports



## Imports of prostitution and gambling services

The industry literature suggests that the vast majority of illegal gambling websites are hosted outside the United States. Based on that, this analysis assumes that all online gambling services are imported except for the portion of online poker services that are provided by domestic professionals who play amateurs online and win consistently. Unfortunately, no data on trade in illegal prostitution services or illegal in-person gambling services was located. For now, it is assumed that imports are equal to exports—so trade in those in-person activities does not have a net effect on GDP.

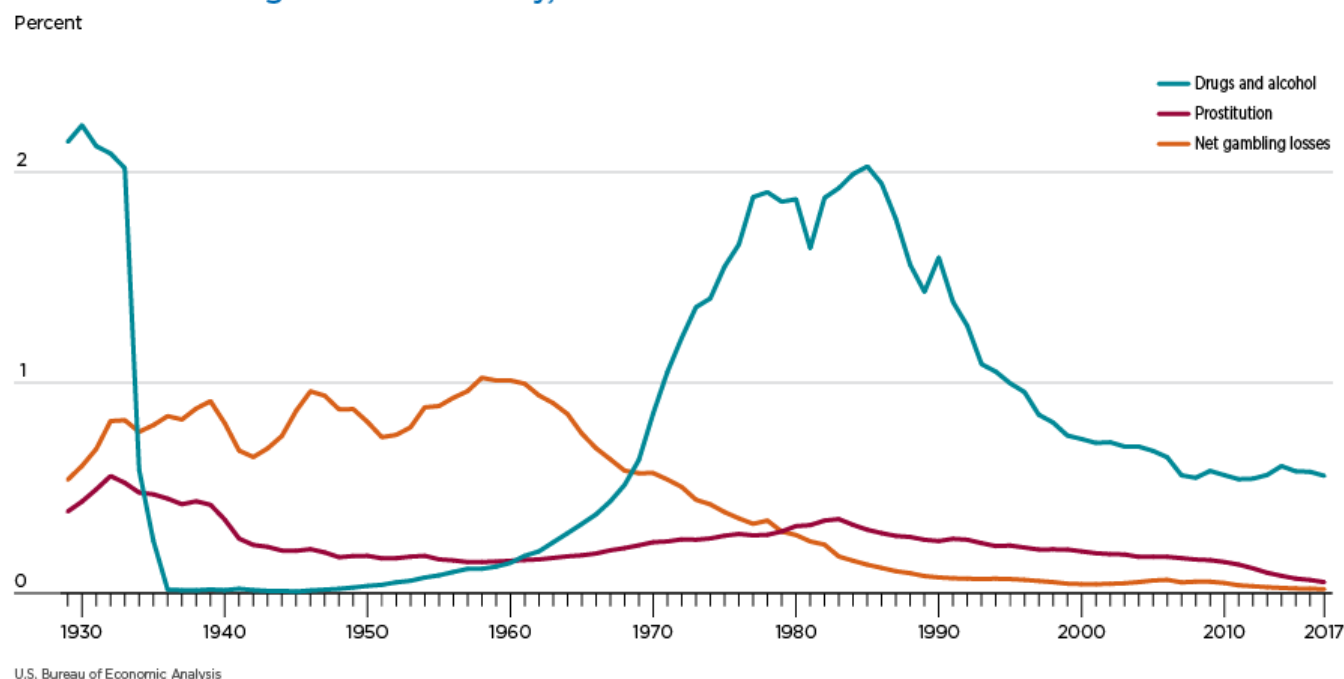
## Impact of Illegal Activity on the Aggregate Economic Statistics

Readers should note that this *Research Spotlight* does not study legal products that are produced by firms that do not follow all applicable regulations or do not file all required tax forms. Those firms are already captured in BEA's existing adjustment for underreporting and misreporting of output<sup>6</sup> and are therefore already tracked consistently with properly reported output in the NIPAs. Nevertheless, tracking illegal market activity has some impact on the measured consumption of legal products that this short *Research Spotlight* does not have time to discuss. However, the changes to measured consumption of legal products are still incorporated into the aggregate nominal GDP, real GDP, and productivity statistics presented.

The productivity results shown in this *Research Spotlight* are based on existing industry-level production accounts that track output, labor input, intermediate inputs, and capital services for 61 separate private business sector industries from 1948 to 2016 (Garner and others 2018, Jorgenson and others 2016). Each industry production account was then revised to include real output, real labor inputs, real intermediate inputs, and real capital services associated with illegal activity.<sup>7</sup> The productivity revision from tracking illegal market activity for each industry is defined as the difference between the revision to real output and the revision to real inputs.

Charts 5 to 8 show that tracking illegal market activity unambiguously raises the level of nominal GDP but has an ambiguous impact on real GDP growth and productivity growth. These charts also show the influence of major historical events. The crime epidemic during the 1970s has been analyzed for decades, so the general result of increasing illegal activity is well known in the sociological and legal literature. This paper extends those literatures by showing how the crime epidemic raised measured nominal GDP in chart 5. Similarly, the recent opioid epidemic has been analyzed extensively and is well known in the medical, sociological, and legal literature. This paper extends those literatures by showing how the opioid epidemic raised measured GDP growth and productivity growth in chart 6.

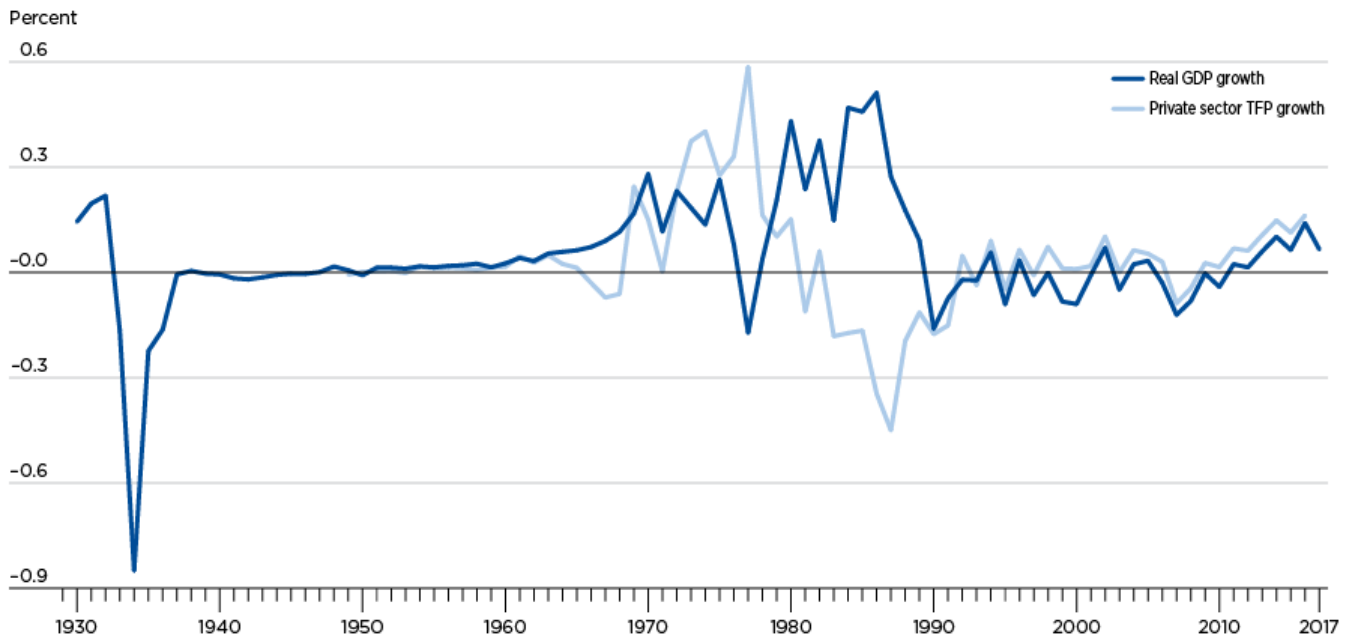
**Chart 5. Revision to Nominal Gross Domestic Product from Tracking Illegal Market Activity, as a share of Gross Domestic Product**



Charts 6 to 8 also show an interesting mismatch between real GDP growth and productivity growth. Between 1970 and 1990, tracking illegal activity has a smaller impact on productivity growth than it has on real GDP growth. Conversely, tracking illegal activity has a larger impact on productivity growth post-2008 than it has on real GDP growth post-2008. These differences are due to changes in real labor inputs over time. Researchers studying labor force participation, self-employment, inequality, and other labor force statistics may need to consider how tracking illegal workers might impact aggregate statistics.

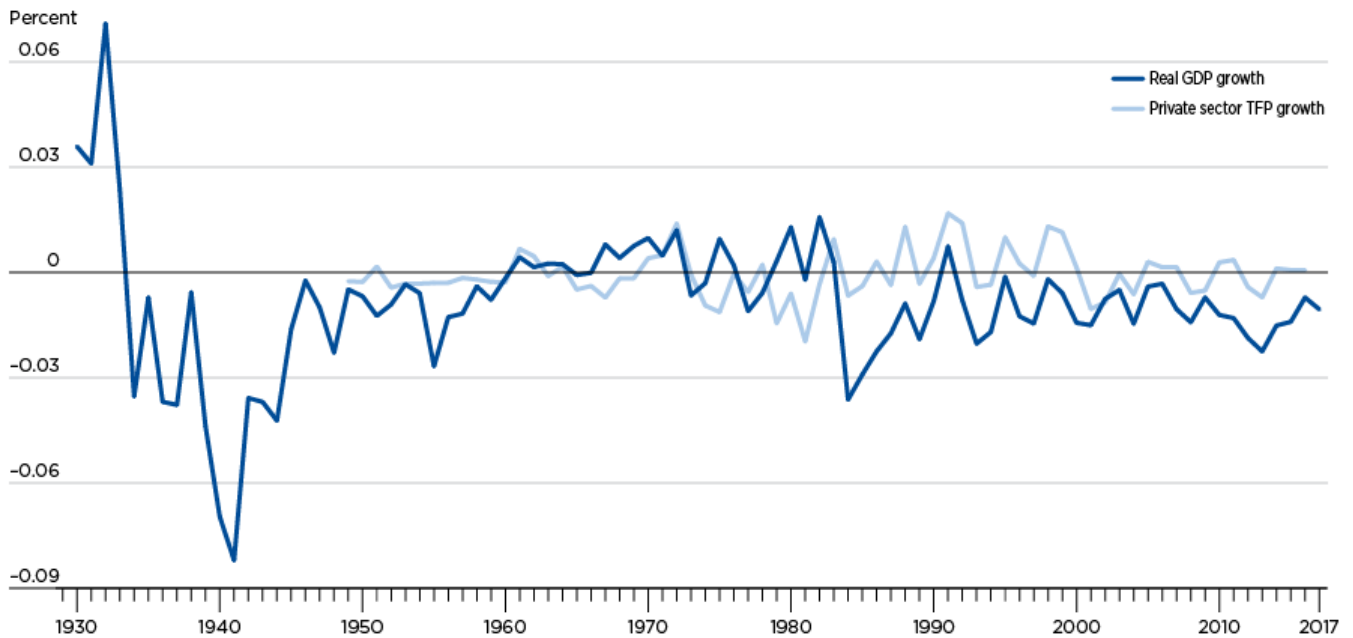


**Chart 6. Annual Revision to Real Gross Domestic Product (GDP) and Total Factor Productivity (TFP) Growth Rate from Tracking Illegal Drugs and Alcohol**



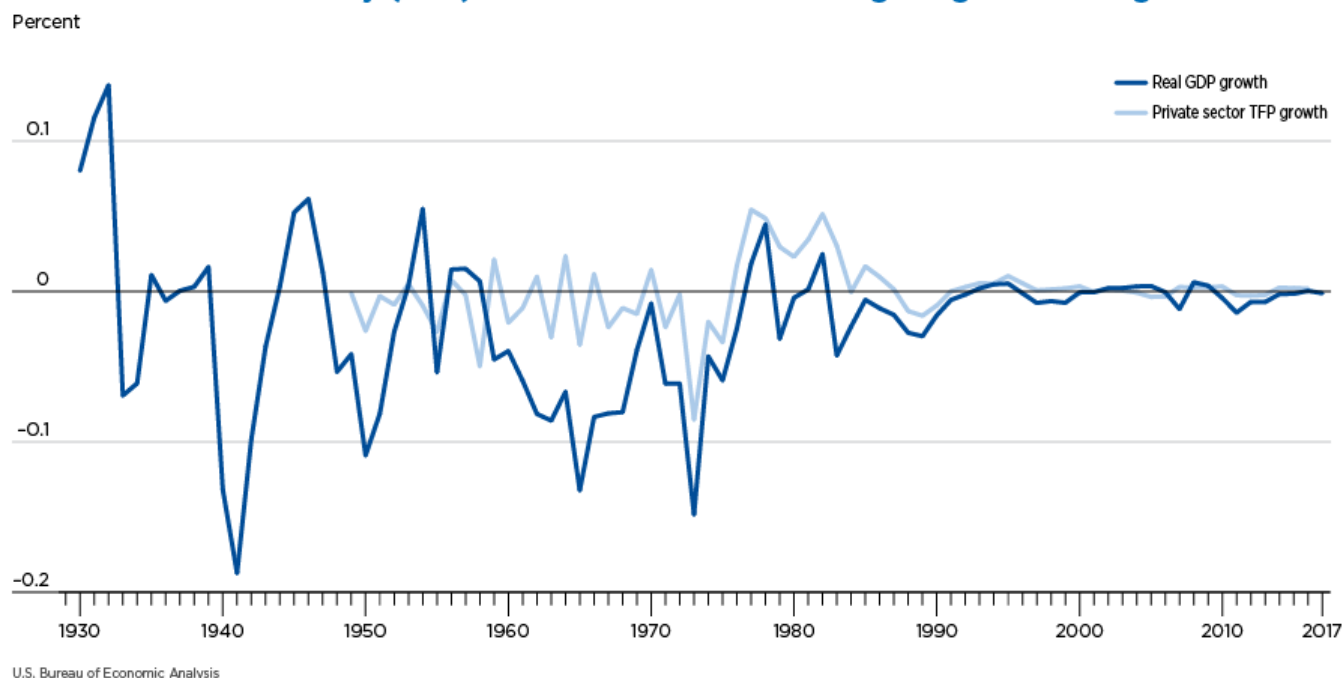
U.S. Bureau of Economic Analysis

**Chart 7. Annual Revision to Real Gross Domestic Product (GDP) and Total Factor Productivity (TFP) Growth Rate from Tracking Illegal Prostitution**



U.S. Bureau of Economic Analysis

**Chart 8. Annual Revision to Real Gross Domestic Product (GDP) and Total Factor Productivity (TFP) Growth Rate from Tracking Illegal Gambling**



## Conclusion

*SNA 2008* recommends that illegal market activity be included in measured output. Consistent with that recommendation, European Union countries have integrated illegal drugs and illegal prostitution into their national accounts (Eurostat 2018). BEA has not implemented the recommendation because of challenges in finding source data and because of different conceptual traditions (Carson 1984a, 1984b). This preliminary research explores how tracking illegal drugs, illegal prostitution, and illegal gambling might impact the U.S. National Economic Accounts. Much more work is needed before BEA could achieve a similar integration of illegal activity into the NIPAs.

1. Prohibition was a federal policy that banned alcohol almost completely. It started in January 1920 with the passage of the Volstead Act and officially ended in December 1933 with the passage of the 21st Amendment to the U.S. Constitution. This analysis assumes that illegal alcohol sales decreased rapidly after 1933 and were zero by 1936.
2. Powder cocaine is a close substitute for crack cocaine, so the shadow price for crack cocaine is only one and a half times the powder cocaine price.
3. The adjustments for fentanyl potency and availability only apply to retail prices but not import prices.
4. See line 304 in "[Table 4.4.4U. Price Indexes for Personal Consumption Expenditures by Type of Product](#)." The table only goes back to 1959. Before 1959, input costs are used to construct a deflator.
5. The published BEA working paper on illegal activity by the author states that wholesale prices from 1977–1980 were based on a RAND report tracking cocaine markups in New York City (Caulkins 1994). However, close analysis of the formulas reveal that this RAND report was not used in the final estimates.
6. Firms producing illegal drugs, illegal prostitution, or illegal gambling are out of scope for the underreporting and misreporting adjustment (IRS 2005).
7. Arrest statistics from the Federal Bureau of Investigation Uniform Crime Report (Department of Justice 1929–2017) are used as a proxy for real labor input in each sector of the illegal market. Other inputs are estimated using expert opinion.

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