The Effect of Stolen Goods Markets on Crime: Evidence from a Quasi Natural Experiment

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The Effect of Stolen Goods Markets on Crime: Evidence from a Quasi Natural Experiment

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Abstract

This paper investigates the effect of the market for stolen goods on crime, using county-level data for the United States between 1997 and 2010. We analyze this issue through the lens of *pawnshops*, a widespread business that offers secured loans to people, with items of personal property used as collateral. The endogeneity of pawnshops to crime is addressed exploiting the exogenous shift in the gold price - the main determinant of pawnbrokers' profit function - as a quasi natural experiment, where the intensity of the treatment is given by the initial concentration of pawnshops in the county. A one standard deviation increase in pawnshops' concentration raises by 0.05 standard deviation the effect of gold price on burglaries and robberies. No effect is detected on all other crimes.

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"If he's coming in my store with a VCR, I'm not asking him where he got it. It's the police's job to find out if it's stolen, not mine. You don't ask where things come from. If you don't take those, the guy down the street will" (Glover and Larubbia, 1996)

1 Introduction

Theft crimes produce a substantial harm to society. In 2010, there have been an estimated 9.5 million theft crimes in the US territory that caused an economic loss for the victims of almost $16 billions (FBI, 2010).[1] On this note, research from criminologists suggests that the availability of stolen goods markets might play a key role in burglar's choice of whether, or where, committing a theft (Sutton, 2010). Nevertheless, despite the critical importance of understanding the link between demand and supply of crime, a systematic empirical investigation is missing. Two main obstacles hinder this type of analysis. First, markets for stolen properties are hardly identifiable. Secondly, these are not randomly assigned to geographic locations.

This paper heavily contributes to the existing literature on the determinants of crime by investigating the effect of stolen goods markets on crime.[2] Specifically, we look at this mechanism through the lens of *pawnshops*, a widespread business that offers secured loans to people, with items of personal property used as collateral. Thus, can pawnshops' potential demand of stolen items cause an increase in the supply of theft crimes?

Pawnshops are second hand businesses where clients bring their personal items to be either

[1] Personal calculation from the author, obtained summing up data on larceny, robbery, burglary and motor and vehicle theft from the FBI reports for the year 2010.

[2] Different studies have analyzed a wide set of crime's potential determinants. Among these we find: the effect of police and incarceration (Levitt 1997, Di Tella and Schargrodsky 2004, Klick and Tabarrok 2005, Levitt 1996, Levitt 1998, Helland and Tabarrok 2007, Drago, Galbiati and Vertova 2009, Lee and McCrary 2009, Draca, Machin and Witt 2011), conditions in prisons (Katz, Levitt and Shustorovich 2003), parole and bail institutions (Kuziemko 2007), education (Western, Kling and Weiman 2001, Lochner and Moretti 2004), social interactions and peer effects (Case and Katz 1991, Glaeser, Sacerdote and Scheinkman 1996, Gaviria and Raphael 2001, Kling, Ludwig and Katz 2005, Jacob and Lefgren 2003, Bayer, Hjalmarsson and Pozen 2009), family circumstances (Glaeser and Sacerdote 1999, Donohue and Levitt 2001). Economists have also focused on the the effect of criminal histories on labor market outcomes (Grogger 1995, Kling 2006), the impact of unemployment and wages on crime (Grogger 1998, Raphael andWinter- Ebmer 2001), the strategic interplay between violent and property crime (Silverman 2004), the optimal law enforcement (Polinsky and Shavell 2000, Eeckhout, Persico and Todd 2009) the immigration status (Bianchi, Buonanno and Pinotti 2012) and the impact of violent movies and pornography on violent crimes (Dahl and Della Vigna 2009 and Bhuller, Havnes, Leuven and Mogstad 2011).

sold for cash, or to be used as a collateral, for high - interest loans. This type of business have long been suspected of illicit trade. While the proponents of these shops, led by the National Pawnbrokers Association, stigmatize the frequency of this phenomenon, public opinion, newspapers and criminologists point the finger against this "modern thief's automatic cash machine" (Glover and Larubbia, 1996). Despite the different standpoint, given that pawnbrokers assume the risk that an item might have been stolen, laws in many jurisdictions protect the brokers from unknowingly handling stolen goods. These laws usually require, for each transaction, a photo identification of the client (such as a driver's license or government-issued identity document), as well as a "holding" period on the item purchased by the pawnbroker, to allow local law enforcement authorities to track stolen items. For the same reason, in some jurisdictions, pawnshops must regularly communicate to police a list of all newly pawned items and, if possible, any associated serial number.

Regardless of the existence of an accurate legislation, different dynamics can turn a pawnshop into a market for stolen goods (Sutton, 2010). First of all thieves, exploiting the increase in personal properties' trade in the community, can circumvent the security measures of an honest pawnbroker, "disguising" the stolen property in the regular flow of allowed items. Then, in some cases, the competition for profits could undermine the security policy of a pawnbroker, leading him to accept - from time to time - items of uncertain origin. From the words of a pawnbroker: *"If he's coming in my store with a VCR, I'm not asking him where he got it. It's the police's job to find out if it's stolen, not mine. You don't ask where things come from. If you don't take those, the guy down the street will"*, (Glover and Larubbia, 1996). Finally, in a worst scenario, the pawnbroker could explicitly facilitate the sale of stolen goods in his shop (fencing), exploiting the lack of a strict law enforcement from local authorities or - for example - the fact that the majority of stolen goods lack of a unique identifier and are hardly recognizable by police or by the victims.[3]

While the exact understanding of these dynamics goes beyond the scope of this paper, obtaining

[3]Pawnbrokers have often been associated with fencing. While pawnbrokers do not like this characterization of their business, police efforts have indicated that some pawnbrokers are actually involved in fencing. For example, in the US, the Sarasota Police Department, Venice Police Department and North Port Police Department assisted with the undercover operation to sell gold jewelry to each business. Many were found to be in compliance. However, a number of businesses were operating under a 'no questions asked' policy, making no attempt to properly document the seller information, record the items being purchased or obtain the seller's fingerprint, all of which are state requirements" (Bill, 2011)

evidence on the causal effect of the availability of stolen goods markets on the supply of crime is complicated by a number of reasons. Pawnshops mainly serve the credit needs of low income people. Hence, the endogenous sorting of pawnshops in communities with a large presence of potential customers biases upward ordinary least squares (OLS) estimates, given that these communities usually experience an higher level of crime. Further biases are caused by omitted variables that correlates with both the presence of pawnshops and crime, or by the possibility that the endogenous sorting of pawnshops is a direct response of the expected level of crime in the community (reverse causality bias).

We address these issues in several ways. In the first part of the paper, the empirical strategy uniquely relies on the properties of the panel dataset constructed for the analysis: 2176 counties in 50 states, almost 70% of the US total, from 1997 to 2010. The variables of interest are 1) the number of crimes reported and 2) the number of pawnshops, both by county per year. The structure of the panel allows for the inclusion of county fixed effect, that control for unobserved time invariant heterogeneity across counties. The baseline empirical analysis focuses on the effect of the within county variation in the number of pawnshops on the number of reported theft crimes, both expressed in per capita terms. Year fixed effects and states linear trends are included to control for nationwide and state specific confounding shocks. Moreover, the analysis includes a rich set of county socio - economic controls. The clear attempt is to shut down possible endogeneity concerns due to the omission of county specific time varying unobservables, possibly related to the within county changes in the number of pawnshops and crime.

Ordinary least squares estimates show a strong effect of the number of pawnshops per capita only on two types of theft crimes: larceny and burglary, with an elasticity respectively of 1.4 and 0.9, both significant at the 1% level. These findings are robust to extensive robustness checks, the clustering of standard errors at different levels, the sensitivity to outliers, weighting the regression by a measure of the quality of the information available to the researcher and using different functional forms. Moreover, implicit falsification tests on other crimes - that should not be directly affected by the presence of these businesses - disprove the possibility that pawnshops might influence crime through different channels other than the potential demand for stolen goods. In particular, the

availability of data on motor - vehicle thefts gives the possibility of unambiguously testing the hypothesis of the paper. Very reassuringly, this particular theft crime is totally insensitive to the presence of pawnshops in the county. We have all the reasons to believe that this happens because motor and vehicles are never accepted in pawnshops' transactions. Results are further validated by the fact that no effect is detected on any other crime.

The effect of on crime is more acute in densely populated counties, where - plausibly - the anonymity of the environment amplifies the likelihood of the pawnshop being a convenient destination for stolen items. In less densely populated areas instead, pawnshops might be far from the crime scene, crime is generally less frequent and residents are more willing to defend the interests of the members of their communities. This could discourage thieves to use this channel to get rid of stolen items.

Moreover, we extend tha analysis in the attempt to detect geographical spillover effects on crime. We do so by constructing two different measures related to the concentration of pawnshops 1) in bordering counties 2) and at the state level. Interestingly, results show that within county changes in larcenies and burglaries are significantly affected from the variation of both the concentration of pawnshops in the same county and in the state. Conversely, we detect a negative - but insignificant - effect for pawnshops in bordering counties. On the one hand, these results confirm the findings obtained from several burglars' interviews (Sutton, 2010). In fact, knowing that the probability of arrest increases while stolen property is in possession, burglars prefer to commit thefts at a maximum distance of half an hour by car from the predetermined resale point (Sutton, 2010). On the other hand, we detect strong geographical spillover effects that show how burglars might take the risk of traveling far from the crime scene, plausibly to avoid suspects about the origin of the item or to outdistance the good from the place where it was stolen. Overall, these results seem to capture a non monotonic relationship between the distance of the theft crime's location and the planned resale point. These findings suggests interesting directions for future research.

Despite the use of panel data techniques, it is important to notice that the lack of random assignment of pawnshops to counties poses two different threats to the identification of a causal parameter. First of all, results might driven by the omission of time variant unobservables both

related to within county changes in the number of pawnshops and theft crimes. But, what magnitude should have the bias to completely invalidate our findings? The Altonji et al. (2005) method of assessing selection on unobservables using selection on observables is pursued in this context. The rule of thumb outlined in Nunn and Wantchekon (2012) is that any ratio above 1 is acceptable. In our case the Altonjii ratio is above 10 for theft crimes, finally suggesting that there is little concern that selection on unobservables is the main driver of our results. A second econometric concern is related to the bias arising from the reverse causality between pawnshops and larcenies/burglaries. We solve this issue in the last section of the paper, where we address the endogeneity of pawnshops exploiting the exogenous rise in the price of gold as a quasi natural experiment.

The choice of including the price of gold in the analysis depends on a different set of reasons. Gold has always been the major determinant of pawnbrokers' profit function, roughly representing 80 percent of the value of all pledges (Bos et al, 2012). Hence, given the inherent high profitability, pawnbrokers are characterized by an high demand for gold that materializes through the request of jewelry. But, what makes jewelry and - in particular - gold so profitable for pawnbrokers' activities? Along side the fact that gold is one of the most precious metal, a big part of the pawnbrokers' profits comes from the process of melting down the gold received by their clients through the "refinement" process. In fact, 90% of the times pawnbrokers sell their jewelry to a company that is known as a 'refiner.' A refiner will take all of the rings, necklaces, bracelets and other items and melt them. Truly professional outfits will then begin to remove impurities from the metals until they get something close to pure gold. Hence, stolen items, easily transformed into an unrecognizable bar of precious metal, can disappear forever from the second - hand market (Sutton, 2010). Clearly, this dynamic might facilitate burglars' (or pawnbrokers') attempt of safely getting rid of the stolen goods.

This persistent demand for jewelry and gold in particular might influence criminal behavior. In fact, as in any other type of economic activity, the exact knowledge of the demand for stolen goods might affect the type of items that are actually stolen. *The underlying hypothesis of the paper is that the shift in the resale value of gold, exogenously determined by changes in the macroeconomic conditions, while potentially increasing burglars' expected value of committing a theft uniformly in*

all counties, might cause relatively more theft crimes in counties with an higher concentration of markets interested in acquiring stolen jewelry. We test this hypothesis exploiting the exogenous rise in the price of gold as a quasi natural experiment, where the intensity of the treatment is measured by the initial concentration of pawnshops to the county. Specifically, the identification strategy relies on the exogeneity of the interaction between the gold price and the concentration of pawnshops in the county, fixed at the first year of the sample. Clearly, this research design shuts down the endogeneity concerns related to the bias arising from the presence of reverse causality.

Again, results support our hypothesis. A one standard deviation increase in the initial concentration of pawnshops in the county increases by 0.05 standard deviation the effect of the rise of gold price on burglaries and robberies, the two theft crimes whose likely outcome is jewelry. Conversely, the effect on larceny, that usually includes thefts of bicycles, motor vehicle parts and accessories, shoplifting, pocket-picking, or the stealing of any property or article that is not taken by force, is noisy and not precisely estimated. To further validate our hypothesis, no effect is detected on motor and vehicle thefts and on all other crimes.

We are aware that one of the main limitation of this study is the absence of a robust welfare analysis related to the possible opening or closing of a pawnshop in a particular county, mainly due to data unavailability on the financial service provided by these businesses. Nevertheless, one of the fundamental merit of this paper is to uncover a precise and previously undetected causal mechanism, showing that the presence of a potential market for stolen goods can indeed cause theft crimes. We believe that this has already the power to inform policy. A closer monitoring of pawnshops from local authorities, (as well as of other potential markets for crime not considered in this paper), in fact seems to be warranted. This improved monitoring could plausibly reduce the illegal demand for stolen goods and, consequently, the number of theft crimes in pawnshops' surrounding area.

Structure of the paper

This paper proceeds as follows. Section 2 presents some suggestive evidence related to the link between pawnshops and theft crimes. Section 3 presents the data and lays down the initial econometric framework, reporting the different results, various robustness checks and heterogeneity

in the results. Section 4 introduces the role of gold in the quasi natural experiment, outlines the research design and presents the results. Section 5 concludes the paper.

2 Pawnshops As a Market Place for Stolen Goods: Suggestive Evidence

Pawnshops, payday loans and check cashing outlets are all businesses that provide instant credit to "unbanked" clients at a very high interest rates.[4] Nevertheless, within all these activities, pawnbrokers offer a unique service: the supply of instant cash to their clients, only through the exchange of personal property's items. The standard procedure begins with the assessment of the monetary value of the item brought by the client. If the client agrees with the offer made by the pawnbroker, she can either directly sell the item to the pawnbroker or she can ask for a loan, using the pledge as a collateral. Usually, the offer made by the pawnbroker ranges from 30 to 75 per cent of the market value of the pledge, with the average loan value being 100$ for a two months period. The pawnbroker holds the personal item in custody until the maturity date of the loan. Importantly, in case the client does not return to claim back the pledged item at the maturity date, this becomes pawnbroker's property.[5] The majority of pawnshops transactions involve jewelry such as rings, bracelets and necklaces but also electronics items such as televisions, stereo, mp3 and camera equipment (Bos et al., 2012).

In principle, the pawnbroker assumes the risk that an item might have been stolen. Nevertheless, to be found guilty of criminal possession, the pawnbroker must know that the item he is accepting is

[4] U.S. households purchased more than $40 billion in high-cost short-term loans using the "fringe banking sector" in 2007, Fellowes and Mabanta (2008). Even if there is no official and reliable estimate of the total number of clients, industry reports suggest that 34 million adults demanded the services of these companies. The sector consists of several types of high-cost lenders, but two comprise the dominant portion: payday lenders and pawnshops. In 2007 pawnshops made 42 million transactions for an overall value of 2.5 billion dollars. The maximum interest rate set by pawnbrokers and payday lenders is generally regulated at the state level. For a complete review of pawnshops' operating system see Shackman and Tenney (2006).

[5] Alternatively, the pawnbroker becomes the owner of the item as soon as the sale process ends. Around 80 percent of pawn loans tend to be repaid and repeat customers account for much of the loan volume. Moreover, it is common for a customer to use the same pledge as collateral to obtain sequential loans (Avery, 2011).

actually stolen, a fact often difficult to prove. Consequently, the main risk that the pawnbroker faces is the loss of both the collateral and the amount loaned if the police seize the item. On this note, the National Pawnbrokers Association (NPA) states that the best way to avoid the unknowingly handling of stolen goods, and all its related issues, is *"...(by) refusing any items that are suspicious in nature or thought to be misappropriated"*. Nevertheless, always according to the NPA: *"... less than half of one per cent of all pawned merchandise is identified as stolen. That's because customers must provide positive identification and a complete description of the merchandise. This information is then regularly transmitted to law enforcement, which dramatically decreases the likelihood that a thief would bring stolen merchandise to a pawn store"*. The NPA claim is supported by some industry study. In an inspection of 65,000 pawn transactions made in Dallas County, only 0.4 per cent of the items were identified as stolen (Scott 1992). Similar results are reported for Oklahoma (Wheat 1998) and in Florida for Collier and Palm Beach counties (Florida Committee on Criminal Justice 2000).

Conversely, other investigative reports - narrowly focusing on the criminal histories of the most frequent pawners - support the hypothesis that pawnshops deal with stolen property items. The first analysis of this type was conducted by Glover and Larrubia (1996). The reporters, after gathering all 70,000 pawn slips in Ft. Lauderdale, ranked pawnshops clients by the number of transactions made in that year. Thirty-nine of these top 50 pawners had criminal arrest records, nineteen of which were for burglary, theft, or related offenses.[6] Fass and Francis (2005) used a similar approach to analyze a database of all pawn transactions recorded by the Dallas Police Department (DPD) during the six-year period from January 1, 1991, through December 31, 1996.[7] The evidence from this analysis is startling. The 14,500 people pawning 30 times or more during the period were responsible of the 24 per cent of total loan value. These frequent pawners *"... were two to three times more likely to have been convicted for theft, larceny, burglary, or robbery than those who*

[6]In a subsequent study Wallace (1997) describes how pawnshops may enable a few highly motivated criminals to commit many offenses. For example, an unemployed man visited a single pawnshop 38 times in less than two months and pawned, among other items, thirteen women's rings, ten men's rings, eleven necklaces, nine cameras, six watches, three VCRs, and two televisions. The day after his last visit to the pawnshop, the man was arrested for burglary. Another police survey of frequent pawners produced like findings in Portland, Oregon. 90 per cent of these pawners were chronic drug users with long criminal records (Hammond 1997).

[7]Each transaction shows a pawn ticket number, a pawner identification number, shop identification number, transaction date, and classification code for items pawned.

pawned once or twice". Moreover *"... nearly 65% of the 1,100 individuals within the group who pawned more than one hundred times had arrest records, more than half of them for some kind of stealing"*.[8]

Wright and Decker (1994) interviewing burglars in the St. Louis area, describe different mechanisms through which pawnshops may be used to quickly convert stolen goods into cash. First, even if the burglar must provide his name, address, and a form of identification, rarely jurisdictions make full use of this information. Moreover, these requirements can be easily deceived. The burglar may provide false information (Glover and Larrubia, 1996) or use false identification when needed. Alternatively, some burglars reported persuading friends to pawn the items for them, reducing the likelihood that the pawnbroker would not accept the item from a suspicious client (Wright and Decker, 1994). Finally, two important aspects seem to support the hypothesis that pawnshops might be used by burglars as a channel for getting rid of the stolen property. First of all, given that the majority of stolen goods lack of a unique identifier, their recognition might be extremely difficult for the pawnbroker, the police and even for the victim itself. Secondly, jewelry such as rings, bracelets and necklaces can be easily melted down, transforming forever stolen items into an unrecognizable bar of precious metal (Sutton, 2010). We will further discuss this second point in the last section of the paper.

[8]Within the sample of the top 100 pawners, 83 individuals had arrest records. *"Of these, 58 had accumulated 300 convictions for property as well as other offenses, or an average of 5.2 arrests per individual. Most property crime arrests, 74 per cent, were for theft, 11 per cent for burglary of vehicles, 7 per cent for burglary of homes or businesses, 5 per cent for robbery, and the rest for forgery and car theft. Other infractions mainly involved drug possession (23 per cent) or driving without a license (23 per cent)"*. A similar analysis, conducted by Comeau and Klofas (2012) for the city of Rochester, NY shows equivalent evidence.

3 Data and Empirical Analysis

Data

This paper focuses on a balanced panel of 2176 US Counties, (70% of all the counties in the United States), in 50 States from 1997 to 2010. The final dataset is obtained by merging information from several sources. Data on criminal offenses is taken from the National Archive of Criminal Justice Data.[9] Eight different type of crimes are reported: larceny, burglary, robbery, motor-vehicle theft, murder, aggravated assault, rape, arson.[10] Our analysis needs a clear distinction between the first three different crimes. The FBI's Uniform Crime Reporting (UCR) Program defines *larceny* as the unlawful taking, carrying, leading, or riding away of property from the possession or constructive possession of another.[11] *Burglary* instead is defined as the unlawful entry of a structure to commit a felony or theft. Finally, *robbery* is the taking or attempting to take anything of value from the care, custody, or control of a person or persons by force or threat of force or violence and/or by putting the victim in fear.[12] Data on our variable of interest - the total number of pawnshops by county per year - is obtained by Infogroup Academic, a US private company.[13] Figure 1 shows the geographic distribution of the number of pawnshops in 1997, the first year in our analysis.[14]

Figure 3.1:

[9]Data is freely downloadable at : http://www.icpsr.umich.edu/icpsrweb/content/NACJD/guides/ucr.html#desc_cl.

[10]County-level files are created by NACJD based on agency records in a file obtained from the FBI that also provides aggregated county totals. NACJD imputes missing data and then aggregates the data to the county-level. The FBI definition of the eight types of crime can be found in the data appendix.

[11]Examples are thefts of bicycles, motor vehicle parts and accessories, shoplifting, pocket-picking, or the stealing of any property or article that is not taken by force and violence or by fraud. Attempted larcenies are included. Embezzlement, confidence games, forgery, check fraud, etc., are excluded

[12]More information are available at the following web page: http://www2.fbi.gov/ucr/handbook/ucrhandbook04.pdf.

[13]More informations available at http://lp.infogroup.com/academic. Infogroup provided me with the overall number of pawnshops by county, per year. The data gathering process follows a six step procedure. In the compilation phase, data is taken directly from different sources such as: Government, public company filings, Utility Information, NCOA, Tourism Directories, web compilation and RSS Feeds etc... The second step in the process is the address standardization process followed by a phone verification phase with 40 millions call made per year. The last three phases include a standardization of elements and a duplicate removal, an enhanced content and a final quality check.

[14]In our sample of 70% of all the counties in the United States we have an average of 9800 pawnshops per year. These numbers are confirmed by other studies. See - for example - Fellowees and Mabanta (2008), Shackman and Tenney (2006).

Table 1 panel A shows an almost perfect balance of the panel for the 14 years considered in the analysis. This balance allows for an estimation free from compositional concerns. Panel B reports crime - related summary statistics, expressed by county and normalized per 100,000 people. The average number of pawnshops by county is 5.87, with a standard deviation of 6.32.[15] Larceny is the most common theft crime, followed by burglary and motor - vehicle theft.[16] Robbery, probably due to its violent nature, it is the less frequent theft crime. On average, all violent crimes and arson happen less frequently, with the lowest reported crime being murder, with an average of 3.62 and a standard deviation of 5.33.

Table 1:

Table 1 panel C shows the summary statistics for the wide set of county socioeconomic controls.[17] From the US Census Bureau we have gathered data on income, poverty, population, ethnic and racial composition of the county, density, number of commercial banks and savings institutions and amount of deposits. Data on labour condition (unemployment, number of social insurance recipients and social security average monthly payment) is obtained from the Bureau of Labor Statistics-Current Population Survey. Data on the number of sworn police officers and civilian employees comes from the Department of Justice-Federal Bureau of Investigation.[18]

[15] In our empirical framework we exploit the within county variation in the number of pawnshops per capita, that is 3.11 representing 54% of the sample mean.

[16] In the FBI's Uniform Crime Reporting (UCR) Program, property crime includes the offenses of burglary, larceny-theft, motor vehicle theft, and arson. The object of the theft-type offenses is the taking of money or property, but there is no force or threat of force against the victims. The property crime category includes arson because the offense involves the destruction of property; however, arson victims may be subjected to force. Because of limited participation and varying collection procedures by local law enforcement agencies, only limited data are available for arson. in the FBI's Uniform Crime Reporting (UCR) Program, violent crime is composed of four offenses: murder and non negligent manslaughter, forcible rape, robbery, and aggravated assault. Violent crimes are defined in the UCR Program as those offenses which involve force or threat of force.

[17] The majority of information is gathered through the following web site: http://censtats.census.gov/usa/usa.shtml.

[18] Sworn police officers are law enforcement employees with arrest powers. Civilian employees include personnel employed by each local agency who do not have arrest powers and include job classifications such as clerks, radio dispatchers, meter maids, stenographers and accountants.

Empirical Analysis

We start by estimating the following OLS equation:

$$y_{i,s,t} = \alpha_i + \gamma_t + \mu_{s,t} + X'_{i,s,t}\beta_0 + \#pawn_{i,s,t}\beta_1 + \epsilon_{i,s,t}$$

where i indicates the county, s the state and t the year. The outcome of interest is the number of reported crimes, by county per year. The coefficient of interest is β_1, the effect of pawnshops on crime. Both the number of crimes and the number of pawnshops are expressed in per capita terms. Standard errors are clustered at the county level, to allow for serial correlation of the error term within county.

The identification strategy heavily relies on the properties of the panel dataset. First, we exploit within county variation by including county fixed effects α_i. In this way we control for the presence of time invariant unobserved characteristics that can be related to the evolution of pawnshops and crime. Then, we condition on year fixed effects γ_t and state linear trends $\mu_{s,t}$ to control for nationwide and state specific confounding shocks. Finally we include $X'_{i,s,t}$, a vector of county time - varying socio - economic controls. The clear attempt is to shut down possible endogeneity concerns due to the omission of county - time varying unobservables, possibly related to the changes in the number of pawnshops and crime in the county. In the baseline specification we include income per capita, percentage of people below the poverty line, percentage of unemployment, the number of social security recipients and the average monthly payment per subsidy. Given the type of credit service provided by pawnshops, we add the number of commercial banks and saving institutions in the county. In fact, together with the amount of banking and saving deposits, these controls aim to capture time varying confounding unobservables, both related to the financial penetration in the county and the relative presence of crime. Finally, we add the number of sworn police officers and civilian employees, the population density and the racial/ethnic composition in the county.[19] [20]

[19] In the baseline specification we include sworn police officers and civilian employees at the state level in the year (t-1), due to some concern related to the possibility of controlling for a potential outcome. Estimates are essentially unaffected if we control for total police officers at the county level in year (t)

[20] The racial origin is defined according to the following four categories: White, Black, Asian and Indian American. Moreover each race is divided in Hispanic or Not Hispanic ethnic origin.

Results

Table 2 shows the evolution of β_1 both for the aggregated measure of theft crimes (obtained by summing up larceny, burglary, robbery and motor vehicle theft) and for the other crimes (murder, aggravated assault, rape, arson). The general decreasing pattern of the coefficient of interest indicates the importance of adding fixed effects and all the described socioeconomic controls. The results from the two most complete specifications are shown in column 5 and 10, where we include all fixed effects and all controls.[21] For the case of theft crimes, we observe a positive coefficient of 6.24, significant at the 1% level, while no significant effect of pawnshops on other crimes is detected.

Table 2:

In table 3 we perform the same analysis breaking down theft crimes and all other crimes.

Table 3:

Interestingly, we detect a positive and significant effect only on larcenies and burglaries.[22] The coefficient of pawnshops on larcenies is 4.444 and it is significant at the 1% level, while the coefficient on burglaries is 1.620 and it is again significant at the 1% level. No effect is detected on robberies, motor - vehicle thefts and on all other crimes.

Table 4 shows the results when we use a log - log specification.

Table 4:

Results do not depend on the functional form used. In fact, a one percent increase in the number of pawnshops per capita is related to a 1.5 and 0.9 percentage increase in the number for larcenies and burglaries, respectively. No effect is detected on all other crimes.

Discussion of the Results

[21] Results are totally unchanged if we include state FE * year FE instead of state linear trends.

[22] We use a linear specification in our baseline regression, due to the presence of more than 20% of "measured zeros" for pawnshops and the different amount of zeros across different crimes.

The above results strengthen the hypothesis that pawnshops might influence theft crime through their potential demand for stolen goods. In particular we are reassured by two specific points. First of all, we observe a strong positive effect of the number of pawnshops *only* on larcenies and burglaries. Larceny is the most generic (and most frequent) type of theft. It includes shoplifting, pocket picking, purse snatching, theft of objects from motor vehicles, theft of bicycles and theft of items from buildings in which the offender has legal access. Burglaries instead, are essentially larcenies aggravated by the unlawful entry in a private property. These two types of crimes seem to have in common a certain degree of premeditation that - plausibly - could be encouraged by the presence of pawnshops in the county.

Moreover, the precision of the underlying mechanism is tested by implicit falsification exercises that we implement by running regression on crimes that are not supposed to be directly affected by the presence of pawnshops. Among all of these, the most meaningful falsification test is on motors and vehicles thefts, because - as we will show in the last section of the paper - vehicles cannot be sold to pawnshops. We do not detect any effect on this crime as well on robbery, (the most violent theft crime that will turn up to be significant in the second part of the paper), and on all the other crimes.

Selection on Unobservables

Nevertheless, given the lack of random assignment, we can not exclude that the omission of some time variant unobservables might be driving the results on larcenies and burglaries. But, how big should be this bias in order to completely invalidate our results? The Altonji et al. (2005) method of assessing selection on unobservables using selection on observables is pursued in this context. The intuition behind the test is to measure how strong the selection on unobservables must be relative to the selection on observables in order to explain away the effects. This strategy relies on a comparison between a regression run with potentially confounding factors controlled for, and one without.[23] The rule of thumb is that any ratio above 1 is acceptable, as it indicates that selection on unobservables must be larger than selection on observables in order to invalidate the

[23] Let c denote the estimate with controls, and nc denote the estimate without controls. The Altonji ratio is $|\frac{\beta_c}{\beta_{nc}-\beta_c}|$.

results (Nunn and Wantchekon, 2012). In our specification, the Altonjii ratio is above 10 for theft crimes, finally suggesting that there is little concern that selection on unobservables is driving the results of the analysis.

Reverse Causality

A second major econometric concern is related to the possible bias due to the reverse causality between pawnshops and larcenies or burglaries. Naively, crime can be the cause - and not the result - of the rise in the number of pawnshops. Once again, we find hard to believe that this change of causality might be driving the results, mainly because we detect the effect only on two theft crimes. If, for example, organized crime was creating pawnshops "ad-hoc" , we would plausibly expect to observe some positive effect also on other - more violent - crimes.

Nevertheless, the pawnbroker's choice of locating the business in a particular county might depend on the contemporaneous level of burglaries and larcenies. In one extreme case, pawnbrokers might decide to avoid to locate their shop in counties with high level of these two theft crimes. If that were the case, our β_1 coefficient would suffer - if anything - from a downward bias. In the opposite case, pawnbrokers might decide to locate their shop in counties with an high level of larcenies and burglaries. This phenomenon, while potentially inflating the effect of pawnshops on crime and hence undermining the precision of our estimate, it would not make the analysis less interesting. In fact, what would be the logic of deliberately locating a pawnshop in a high crime community? Honest pawnbrokers would expect less honest customers, (ceteris paribus, relatively more potential clients would have been victim of a theft). Moreover, this particular choice might endanger the same pawnbroker, increasing the likelihood of being a victim of a theft.[24] In synthesis, if the coefficient is inflated by the systematic choice of locating a pawnshop in high-risk communities, we find hard to believe that this is not due the willingness of consciously allowing for the opportunity of receiving stolen goods. Table 5 further investigates this aspect focusing on the lagged structure of the number of pawnshops.

[24] Another source of concern could be related by the "ad hoc" targeting of pawnshops from burglars. We tend to disprove this possibility for three reasons. First, there does not seem any evidence related to the possibility that pawnshops are a constant target from burglars, while a quick google search shows that pawnshops are usually associated to be a potential market for stolen goods. Second, this shops usually have an high level of security that should not allow clients to commit an harmless larceny in the shop. Third, 74% of the burglaries hit residence while only 26 affect stores (FBI, 2010).

Table 5:

For the case of larceny, the inclusion of pawnshops at $t-1$ determines a loss of precision of the estimate that is re - established in the specification where we include the number of pawnshops up to $t-2$. For the case of burglaries, we observe a similar pattern that shows how the inclusion of pawnshops at $t-1$ and $t-2$ dominates the effect of the contemporaneous number of pawnshops. These results seem to suggest that the number of pawnshops in the previous years is the main driver of our results.

To conclude, it is important to notice that the reverse causality issue will be totally addressed in the last section of the paper where we will rely on the exogeneity of the interaction between the gold price and the initial concentration of pawnshops in the county, fixed at the first year of the sample.

Robustness Checks

Table 6 shows the set of robustness checks for larceny (Panel A) and burglary (Panel B).

Table 6:

Column 1 reports the coefficient when we cluster standard errors at the state level, while in column 2 we show the results with double clustering at county - year level (taking into account both autocorrelation of the error structure within county over time and the spatial correlation in each year across counties). In column 3 we show the results by weighting the regression by the coverage indicator reported by the agency, a measure of the reliability of the information available to the researcher.[25] Finally, we perform two tests to check the sensitivity to outliers. In column 4

[25]The Coverage Indicator variable represents the proportion of county data that is not imputed for a given year. The indicator ranges from 100, indicating that all ORIs in the county reported for 12 months in the year, to 0, indicating that all data in the county are based on estimates, not reported data. The Coverage Indicator is calculated as follows:
$CI_x = (1 - (sum((ORIipop/countypop)((12 - monthsreported/12)))) * 100$
where
CI = Coverage Indicator
x = county
i = agency within county

we eliminate from the sample the counties in the top 1% of the pawnshops' per capita distribution. In column 5 we drop from the sample of the analysis the counties in the top 1% of the population distribution. The stability of the coefficient is shown across all different specifications.

Heterogeneity in the Results

In this part of the paper we attempt to detect 1) heterogeneity in the intensity of the effects related to differences in the environment where pawnshops are located 2) geographical spillover effects that the presence of pawnshops might have on crime.

Population Density

The anonymity and the dispersion of a big city might amplify the likelihood of the pawnshop being a convenient destination for stolen goods. In rural and less densely populated areas instead, the pawnshop might be far from the crime scene. Moreover, in these quiet and remote areas criminal activity is generally less frequent, and residents are more willing to defend the interests of the members of their communities. All these considerations could undermine the burglars' incentives of trying to use the local pawnshop to sell stolen goods (and hence to commit a burglary in its proximity). For this reason, we investigate for the possible presence of an heterogeneous effect, dividing the sample in "low" and "high" population density counties. The two categories are computed with respect to the median density in the sample.

Table 7:

Table 7 shows results in line with the hypothesis that population density can be an important factor that amplifies the effect of pawnshops on theft crimes. For the case of larceny, the coefficient is 9.433 and it is significant at the 1% level only in high densely populated counties. For burglaries the effect is bigger in densely populated counties but it is significant in both sub - samples.

Geographical Spillovers

The empirical analysis has been focused so far on understanding the effect of the within county change in the number of pawnshops on the changes of theft crimes *in the same county*. This section of the paper extends the analysis focusing on the presence of geographical spillover effects.

We do so by estimating the following OLS regression:

$$y_{i,s,t} = \alpha_i + \gamma_t + \mu_{s,t} + X'_{i,s,t}\beta_0 + \#pawn_{i,s,t}\beta_1 + \#pawnbord_{i,s,t}\beta_2 + \#pawnstate_{i,s,t}\beta_3 + \epsilon_{i,s,t}$$

where $\#pawnbord_{i,s,t}$ is the number pawnshops per capita in $i's$ bordering counties and $\#pawnstate_{i,s,t}$ is measure of the number of pawnshops per capita in $i's$ state. To avoid collinearity issues and difficulty of interpretation, these two variables do not include the number of pawnshops in the county where crime is actually measured.

Before proceeding to the analysis of the results, two important caveats to the analysis should be emphasized. First of all, given that our final dataset includes data on 2176 counties (70 % of the US total) and not all the counties of the United States, we observe these two measures with error. This inevitably leads to a downward bias in the estimated coefficients. A more serious econometric concern is instead related to the fixed effect structure of our estimating equation. The inclusion of two independent variables that belong to a different geographical unit of the dependent variable potentially worsen the reliability of the estimate of these two coefficients. In fact, we are increasing the likelihood of omitting some time variant factor related - as an example - both to the variation of crime in the county and the variation of the number of pawnshops close to its borders.

Table 8 shows the results of this specification.

Table 8:

The inclusion of these two new variables does not change the effect and the significance of the number of pawnshops in county i on larcenies and burglaries (first row of table 8). Interestingly, no

effect of pawnshops in the neighboring counties is detected, while but we find a large and significant coefficient of the number of pawnshops at the state level for larceny (24.55 significant at the 10 % level) and for burglaries (13.89 significant at the 1% level).

From one side, these results corroborate the findings of different criminologists that - from interviews with burglars - describe how the presence of a market of stolen goods might strongly affect the choice of whether and where committing a theft. In fact, burglars know exactly that the probability of being caught increasess while the stolen property is in possession and - for this reason - prefer to commit a theft at a maximum distance of half an hour by car from the resale point, (Sutton, 2010). From the other side, our results seem to capture some strong spillover effect that shows how burglars might take the risk of traveling far from the crime scene, plausibly to avoid suspects about the origin of the item or to outdistance the good from the place where it was stolen. Finally - even if not significant - we find an interesting negative coefficient related to the number of pawnshops in bordering counties. While not precisely estimated, this result seems to validate the hypothesis that the location of a potential market for stolen goods might be a key determinant in burglars decision of where committing a theft.

4 The Response to Gold Price: Evidence From a Quasi Natural Experiment

In this section of the paper we further address the endogeneity of pawnshops to crime, exploiting the exogenous rise in the price of gold as a quasi natural experiment. Before going into the details of the research design, we will carefully describe the mechanism behind the importance of gold in our context. Then, we will move to the description of the identification strategy and to analysis of the final results.

The Importance of Gold Price

The Demand side

Gold has always been the major determinant of pawnbrokers' profit function.[26] Bos et al. (2012) describe that in the US 34% of men and 63% of women used jewelry as pledge in pawn transactions, with gold representing roughly 80 percent of the value of all pledges.[27] Table 9, borrowed from Carter and Skiba (2012), reports the number of loans for each collateral category, the percentage of observations, and the average amount and standard deviation of the items pawned for each category. The sample of observations is from a pawnshop lender in Texas between 1997 and 2002 .

Table 9:

Forty-nine percent of pawnshops' loans in the dataset are collateralized with jewelry, with over half of the items in the jewelry category consisting of rings, including both men's and women's

[26]The importance of gold in pawnbrokers' activities is reflected in its symbol: three spheres suspended from a bar. The three sphere symbol is attributed to the Medici family of Florence, Italy, owing to its symbolic meaning of Lombard. This refers to the Italian province of Lombardy, where pawn shop banking originated under the name of Lombard banking. The three golden spheres were originally a symbol medieval Lombard merchants hung in front of their houses, and not the arms of the Medici family. It has been conjectured that the golden spheres were originally three flat yellow effigies of byzants, or gold coins, laid heraldically upon a sable field, but that they were converted into spheres to better attract attention.

[27]Similar evidence is found in Comeau et al. (2011).

class and wedding rings. The next most popular category of pledges is televisions and electronics, including satellite dishes, stereos, and CD players. Individuals also commonly pawn tools, household items such as small appliances, sporting equipment, guns, musical instruments, and camera equipment. The average loan amount for loans collateralized by jewels is 96$, a value only lower than guns and musical instruments. Moreover - as mentioned before - pawnbrokers do not accept motor - vehicles in their transaction.

But, what makes jewelry and - in particular - gold so profitable in pawnbrokers' activities? Along side the fact that gold is one of the most precious metal, a big part of the pawnbrokers' profits comes from the process of melting down the gold received by their clients through the "refinement" process. In fact, 90% of the times pawnbrokers sell their jewelry to a company that is known as a 'refiner.' A refiner will take all of the rings, necklaces, bracelets and other items and melt them. Truly professional outfits will then begin to remove impurities from the metals until they get something close to pure gold.[28] Hence, stolen items, easily transformed into an unrecognizable bar of precious metal, can disappear forever from the second - hand market (Sutton, 2010), ending in the Bullion Market or in similar places.[29] This dynamic might hence potentially facilitate the burglars' - or the pawnbrokers' - attempt of safely getting rid of the stolen goods.

The Supply Side

This strong demand for jewelry and gold in particular might influence criminal behavior. In fact, as in any other type of economic activity, the exact knowledge of the demand for stolen goods affects the type of items that are actually stolen. Even if most thieves have an ever-changing hierarchy of items that they prefer to steal (Sutton, 2010), crime statistics and victim surveys describe how the

[28]Refiners typically have minimum quantities of metals that they will accept and work with. They normally work with several pounds of the material, so the direct link between clients and refiner can rarely happen. Information about this argument can be found online from a lot of different sources. As an example: http://www.pawn-nerd.com/where-do-pawn-shops-sell-their-gold-and-silver/ or http://www.economist.com/news/finance-and-economics/21591230-falling-price-gold-hurting-pawnbroking-business-hock-and-sinker.

[29]The Bullion Market is a forum through which buyers and sellers trade pure gold and silver. The bullion market is open 24 hours a day and is primarily an over-the-counter market, with most trading based in London. The bullion market has a high turnover rate and most transactions are conducted electronically or by phone. Gold and silver derive their value from their industrial and commercial uses; they can also act as a hedge against inflation.

most commonly stolen items during burglaries are cash, jewelry and consumer electrical.[30] Table 10 shows the percentage of stolen items during burglaries. Police recorded crime data are from the Sanwdwell Metropolitan Borough Council area of the West Midlands (Burrel and Wellsmith, 2010).

Table 10:

Similarly, table 11 shows the percentage of stolen items during burglaries, by type of item in 1994, 2001 and 2011 in the United States. The category we are interested in is "personal portable objects" that include clothing, furs, luggage, briefcases, jewelry, watches, keys and other.

Table 11:

In the period of our study, gold price raised of about 37% until 2005 and then experienced an impressive increase of almost 200% in the last five years of the sample.[31]

Figure 4.1:

Research Design and Identification Strategy

In this section we describe the research design used to detect the causal effect of pawnshops on crime. Specifically, we attempt to answer the following question: *does the exogenous increase in the expected resale value of gold cause relatively more theft crimes in counties with an higher initial concentration of pawnshops?* The underlying hypothesis is that the shift in the resale value of gold, exogenously determined by changes in the macroeconomic conditions, while potentially increasing burglars' expected value of committing a theft uniformly in all counties, might cause relatively more theft crimes in counties with an higher concentration of markets interested in acquiring the stolen jewelry.

[30] Similar evidence is found in Fitzgerald and Poynton (2010), Sorensen (2011) and Walters et al. (2013).

[31] I use as unit of measurement the price of gold in US dollars (averaged over the entire year) per troy ounce. Data are freely downloadable at the following website: http://www.gold.org.

More in detail, we estimate the following OLS equation:

$$y_{i,t} = \alpha_i + \gamma_t + X'_{i,t}\beta_0 + [\#pawnshops_{i,t=1997} * goldprice_t]\,\beta_2 + \epsilon_{i,t}$$

where i indicates the county, s the state and t the year. Also in this case, the outcome of interest is the number of reported crimes, by county per year. The coefficient of interest is β_2, the effect on crime of he interaction between the initial concentration of the number of pawnshops per capita fixed in the first year of our sample (1997) and the gold price at time t. Standard errors are clustered at the county level.

The key requirement for our exclusion restriction to hold is the lack of correlation between the error and the interaction term, once we condition on the fixed effect structure of the estimated model and on all controls. For this reason, as in the first part of the paper, we use a within county specification including county fixed effect. A key role in this specification is played by the inclusion of the year FE, that partial out from the estimate the direct and uniform effect that the rise in gold price might have on the growth of theft crimes in all counties. Moreover, while arguably gold price is related to the stability of the global economic conditions, our specification uses a wide set of socio - economic controls related to the conditions of the local economy. Furthermore, in order to control for the presence of other possible time - varying confounding factors, we add the interaction between each control fixed in year 1997 and the price of gold.[32] Another possible concern could be related the endogeneity of the initial allocation of the number of pawnshops in the county and the within county variations of the number of crimes. To minimize this concern we add the interaction between the number of pawnshops fixed in 1997 and annual linear trends.[33] Importantly, this specification totally addresses the reverse causality concerns between pawnshops and crime expressed in the first part of the paper.

[32] Results are qualitatively unchanged if we allow all the the controls to vary with the gold price.

[33] Results are almost identical if we include the interaction between pawnshops in year 1997 and quadratic trends.

Results

Table 12 reports the results, where the first row shows again the effect of the contemporaneous number of pawnshops, while the second row reports the results of the interaction term of interest.

Table 12:

The coefficients related to the number of pawnshops are essentially identical to the previous specifications. Moreover, looking at the second row of the table, we find a coefficient of 0.339 significant at the 10% level only on burglaries. To put this result into perspective, a one standard deviation increase in gold price generates a 0.05 standard deviation increase in the effect of the initial concentration of pawnshops on burglaries. Or - equivalently - a one standard deviation increase in the initial concentration of pawnshops in the county increases by 0.04 standard deviation the effect of the gold price on burglaries. The effect on larceny is not precisely estimated. These might be due to the fact that jewelry is a rare outcome for this generic type of theft, that includes thefts of bicycles, motor vehicle parts and accessories, shoplifting, pocket-picking, or the stealing of any property or article that is not taken by force. The positive effect on robberies is also not precisely estimated with a p-value of 20%. Furthermore, no effect is detected on all other crimes.

In Table 13 we use a similar specification where we use grouped year fixed effects. We do so in order to avoid the likely attenuation effect on the variable of interest due to the positive trend of gold price for almost all the periods of the sample.[34] We believe that this change of specification, while not altering the quality of the identification strategy, can allow for a more flexible estimation of the variable of interest.

Table 13:

In this case, the coefficient of the interaction term on burglaries is 0.460 and it is significant at the 5% level. Moreover, the coefficient on robberies is 0.05 and it is significant at the 1% level. In

[34] In this specification we group year FE, one dummy every three years (two years for the last period) and we include gold price (given that is not collinear anymore with year FE).

both cases a one standard deviation in the price of gold increases the effect of the initial allocations of pawnshops in 1997 of about 0.05 standard deviations. No effect is detected on all other crimes.

Robustness Checks

Table 16 shows the set of robustness checks for burglary (Panel A) and robbery (Panel B).

Table 14:

Column 1 reports the coefficient when we cluster standard errors at the state level, while in column 2 we show the results with double clustering at county - year level. Both in the case of burglaries and robberies we loose precision in the estimates, with a p - value ranging from 11 to 14 per cent. As in the first part of the paper, column 3 shows the results when we weight the regression by the coverage indicator, in column 4 and 5 we eliminate respectively the counties in the top 1% of the pawnshops and population distribution. Coefficients both in case of burglary and robbery are stable across all different specifications.

In table 17 we include in the analysis the price of other two precious metals: silver and platinum.

Table 15:

As we did for the price of gold, we interact with these two prices with the initial concentration of pawnshops in the county. Despite the high correlation between the price of these three precious metals that vary between 92 and 98 per cent, the interaction term with gold price increases both its value and its significance, finally outlying the key role of the price of gold in this context.

5 Concluding Remarks

This paper has investigated the role that market for stolen goods might have in causing crime. In particular, motivated by the richness of anecdotal evidence, we have looked at this issue trough the lens of pawnshops, a business that have long being suspected of illicit trade. The endogeneity of pawnshops to crime has been addressed in multiple ways.

In the first part of the paper we have mainly exploited the panel properties of the data. Results confirm that the number of pawnshops is a strong and significant predictor of larcenies and burglaries. The findings are robust to extensive robustness checks, the clustering of standard errors at a different levels, the sensitivity to outliers, averaging the regression by a measure of the quality of the information available to the researcher and using a log - log model. The mechanism behind the findings is corroborated by numerous falsification tests on other crimes that disprove the possibility that pawnshops might affect crime trough channels other than the transaction of stolen goods. Moreover we have attempted to enter in the black -box of this phenomenon by analyzing possible geographical spillover effects and the heterogeneity in the results across counties with a different population density.

In the second part of the paper we have used the rise in the gold price as a quasi natural experiment to finally detect a causal parameter. In particular, the identification strategy relied on the exogeneity of the interaction between the price of gold, constantly demanded by pawnbrokers in the form of jewels that are usually melted down to be transformed into a bar of the precious metal, and the initial allocation of the number of pawnshops in the county. A one standard deviation increase in the gold price generates a 0.05 standard deviation increase in effect of the initial allocations of pawnshops on the change of burglaries and robberies. Also in this case, results are robust to a wide set of robustness checks and are corroborated by the presence of falsification tests on crimes that should not be affected by the presence of pawnshops.

While uncovering a precise and previously undetected causal mechanism, this paper offers new direction of future research. A direct spin off of this work would be the analysis of other possible market for stolen goods, such as flea markets, junkyards and online web sites such as Ebay or

Craiglist. Moreover, entering in the "black box" of the causal mechanism that links demand and supply of crime is critical for the understanding of criminal behaviour. Two mechanisms might in fact play an important role in this context. On the one hand, the increase in the size of stolen goods' markets might increase crime by reducing the criminal expected probability of being arrested (negative deterrence effect). On the other hand, the increase in the level of competition in the resale market might push up prices, raising the expected resale value of the stolen item (price effect). This and other interesting aspects are left for future research.

The main and, we believe, most relevant contribution of this paper is a first step towards a systematic empirical investigation of the causal role of the market for stolen goods, an issue never properly explored in the existing literature on the determinants of crime.

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Data Appendix

Crimes Definition

1. Murder (criminal homicide): The willful (non negligent) killing of one human being by another.

2. Forcible rape: The carnal knowledge of a female forcibly and against her will.

3. Robbery: The taking or attempting to take anything of value from the care, custody, or control of a person or persons by force or threat of force or violence and/or by putting the victim in fear.

4. Aggravated assault: An unlawful attack by one person upon another for the purpose of in inflicting severe or aggravated bodily injury. This type of assault usually is accompanied by the use of a weapon or by means likely to produce death or great bodily harm.

5. Burglary: The unlawful entry of a structure to commit a felony or a theft.

6. Larceny: The unlawful taking, carrying, leading, or riding away of property from the possession or constructive possession of another. Common types of larcenies include shoplifting, pocket-picking, purse snatching, theft of objects from motor vehicles, theft of bicycles and theft of items from buildings in which the offender has legal access.

7. Motor vehicle theft: The theft or attempted theft of a motor vehicle.

8. Arson: any willful or malicious burning or attempting to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft, personal property of another, etc.

Hierarchy Rule

In some cases, a single incident may have consisted of two distinct offenses. For example, during the course of a robbery, a victim may have been fatally shot. In cases in which multiple offenses are committed by the same offender against the same victim during a given felonious act, the hierarchy rule is employed to determine how the crime is classified. A crime is classified according to the

most serious offense committed. Importantly, the hierarchy rule does not apply to the offense of arson. In fact, when arson is involved in a multiple offense situation, the reporting agency must report two part I offenses, the arson as well as the additional part I offense.

Table 1 Descriptive Statistics

Panel A - Panel Structure

Number of Counties	2176		
Panel Period	1997 - 2010		
Year	Freq.	Per cent	Cum.
1997	2,175	7.14	7.14
1998	2,175	7.14	14.28
1999	2,174	7.14	21.42
2000	2,174	7.14	28.55
2001	2,174	7.14	35.69
2002	2,180	7.16	42.84
2003	2,175	7.14	49.98
2004	2,176	7.14	57.13
2005	2,176	7.14	64.27
2006	2,181	7.16	71.43
2007	2,176	7.14	78.57
2008	2,176	7.14	85.71
2009	2,176	7.14	92.86
2010	2,176	7.14	100

Panel B - Pawnshops and Crime Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Pawnshops	30454	5.87	6.32	0	112.85
Larcenies	30454	1721.34	1107.40	0	12072.79
Burglaries	30454	611.89	413.63	0	2959.85
Robberies	30454	49.33	72.67	0	822.37
Motor - Vehicle Thefts	30454	178.07	180.07	0	2385.28
Murders	30454	3.62	5.33	0	128.87
Rapes	30454	25.51	22.69	0	513.47
Aggravated Assaults	30454	221.90	204.82	0	2676.22
Arsons	30454	16.95	20.59	0	604.24
Total Enforcement	25073	143.68	116.61	1.72	4141.03

Panel C - Socioeconomic and Demographics

Banks and Savings Institutions	30453	40.34	17.87	0	257.52
% Unemployment	30400	6.04	2.68	0.7	30.1
% Of People Below the Poverty Line	30454	0.14	0.06	0	0.50
Social Security Recipients	30464	19662.11	45986.32	0	1148135
Social Security Monthly Average Payment	30464	408.67	75.82	0	2457
Income per Capita	30422	27049.01	7816.2	8419	124742
Total Population	30464	121856.2	345971.3	2400	9554556
Density	30445	304.91	1965.97	0.18	67589.02
% White non Hispanic	29521	0.8	0.18	0.02	0.99
% White Hispanics	29521	0.06	0.11	0	0.97
% Black Hispanics	29521	0.002	0.004	0	0.13
% Black not Hispanics	29521	0.09	0.14	0	0.86
% Asians not Hispanics	29521	0.01	0.02	0	0.63
% Asians Hispanics	29521	0.0005	0.001	0	0.05
% American Indians Hispanics	29521	0.001	0.003	0	0.05
% American Indians not Hispanics	29521	0.01	0.06	0	0.88

Notes: the number of pawnshops all reported crimes, banks and savings institutions are normalized per 100.000 people.

TABLE 2
Theft Crimes vs. Other Crimes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Theft Crimes					Other Crimes				
Pawnshops per capita	17.86***	17.41***	24.79***	6.89***	**6.24*** **	2.994***	2.985***	2.22***	0.189	**0.217**
	(5.32)	(5.32)	(6.177)	(2.191)	**(2.19)**	(0.633)	(0.634)	(0.574)	(0.435)	**(0.437)**
Observations	30,454	30,454	30,454	30,454	29,478	30,454	30,454	30,454	30,454	29,478
Adjusted R-squared	0.005	0.007	0.233	0.841	0.845	0.007	0.007	0.343	0.732	0.743
YEAR FE	NO	YES	YES	YES	YES	NO	YES	YES	YES	YES
STATE TRENDS	NO	NO	YES	YES	YES	NO	NO	YES	YES	YES
COUNTY FE	NO	NO	NO	YES	YES	NO	NO	NO	YES	YES
Controls	NONE	NONE	NONE	NONE	ALL	NONE	NONE	NONE	NONE	ALL

*** p<0.01, ** p<0.05, * p<0.1. Standard errors are clustered at the county level. The number of pawnshops and reported crimes are expressed in per capita terms. The unit of analysis is the county. Theft Crimes include: larcenies, robberies, burglaries and motor – vehicle thefts. Other crimes include: murders, rapes, aggravated assaults and arsons. The table shows the evolution of the coefficients when fixed effects and controls are included. The most complete specification (with county FE, year FE, State linear trends and all controls) is shown in column 5 and 10.

TABLE 3
Crimes Breakdown

	(1) Larcenies	(2) Burglaries	(3) Robberies	(4) M-V Thefts	(5) Murders	(6) Rapes	(7) Assaults	(8) Arsons
Pawnshops per capita	**4.444*** **	**1.620*** **	0.01318	0.1687	0.017	0.0199	0.1282	0.0516
	(1.66)	**(0.619)**	(0.059)	(0.187)	(0.0174)	(0.0453)	(0.414)	(0.0393)
Observations	29,478	29,478	29,478	29,478	29,478	29,478	29,478	29,478
Adjusted R-squared	0.830	0.798	0.912	0.840	0.300	0.557	0.731	0.526
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. All the standard errors are clustered at the county level. The table shows the results from 8 different regressions, one for each type of reported crime. All the specifications include county FE, year FE, state trends and all controls.

TABLE 4
Crimes Breakdown – Log/Log Specification

	(1) Larcenies	(2) Burglaries	(3) Robberies	(4) M-V Thefts	(5) Murders	(6) Rapes	(7) Assaults	(8) Arsons
Pawnshops per capita	**1.512****	**0.923****	0.00663	0.106	0.0172	0.115	0.0223	0.0483
	(0.711)	**(0.375)**	(0.0523)	(0.139)	(0.0165)	(0.284)	(0.0414)	(0.0366)
Observations	29,478	29,478	29,478	29,478	29,478	29,478	29,478	29,478
Number of fips	2,106	2,106	2,106	2,106	2,106	2,106	2,106	2,106
Adjusted R-squared	0.196	0.174	0.087	0.188	0.010	0.072	0.073	0.066
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. All the standard errors are clustered at the county level. The table shows the results from 8 different regressions, one for each type of reported crime. All the specifications include county FE, year FE, state trends and all controls. The independent variable of interest is computed as Ln (0.01 + pawnshops_percapita). We compute similarly all the reported crimes.

TABLE 5
Pawnshops' lagged structure

	(1)	(2)	(3)	(1)	(2)	(3)
	Larcenies			Burglaries		
Pawnshops per capita	**4.444*** **	**1.961**	1.816	**1.620*** **	0.187	-0.0799
	(1.663)	**(1.391)**	(1.330)	**(0.620)**	(0.523)	(0.520)
Pawnshops per capita (T-1)		**2.38**	0.037		**1.450** **	0.409
		(1.537)	(1.318)		**(0.628)**	(0.565)
Pawnshops per capita (T-2)			**2.696***			**1.216** **
			(1.383)			**(0.585)**
Observations	29,478	27,373	25,272	29,483	27,378	25,272
Adjusted R-squared	0.830	0.836	0.848	0.798	0.805	0.812
Year FE	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. All the standard errors are clustered at the county level. In both columns 1, both for larcenies and burglaries, we show the baseline specification with the contemporaneous number of pawnshops. In columns 2 we add the number of pawnshops per capita, at t-1. Finally, in columns 3 we include the number of pawnshops per capita at t-2.

TABLE 6
Robustness Checks

	(1)	(2)	(3)	(4)	(5)
	Panel A - Larcenies				
Pawnshops per capita	4.438*	4.438***	4.441***	4.624***	4.397***
	(2.273)	(1.697)	(1.569)	(1.761)	(1.668)
	Panel B - Burglaries				
Pawnshops per capita	1.620**	1.620**	1.475**	1.647**	1.610***
	(0.687)	(0.766)	(0.631)	(0.648)	(0.620)
Year FE	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. Panel A shows the results for larcenies, while panel B shows the results for burglaries. Column 1 shows the results when we cluster at the state level, while in column 2 we cluster at the county/year level. In column 3 we perform a weighted regression using as weight the FBI coverage indicator. In column 4 we eliminate from the sample the counties in the top 1% of the pawnshops' per capita distribution. In column 5 we eliminate from the sample the counties in the top 1% of the population distribution.

TABLE 7
Heterogeneity in the Results: Density

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Larcenies		Burglaries		Robberies		M/V Thefts	
	Low	High	Low	High	Low	High	Low	High
Pawnshops per capita	**2.958**	**9.423*** **	**1.312***	**2.508***	-0.0212	0.0786	0.145	-0.0657
	(1.940)	**(3.642)**	**(0.704)**	**(1.355)**	(0.0597)	(0.163)	(0.198)	(0.467)
Observations	14,798	14,680	14,798	14,680	14,798	14,680	14,798	14,680
Adjusted R-squared	0.779	0.843	0.722	0.850	0.679	0.927	0.657	0.872
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at the county level. The sample is divided in counties below the median density and above the median density. The density percentiles are computed with respect to the density of the county, averaged for each county in the 14 years of the sample (1997 - 2010).

TABLE 8
Geographical Spillovers

	(1) Larcenies	(2) Burglaries	(3) Robberies	(4) M/V Thefts
Pawnshops (Same County)	**4.37*** **	**1.583*** **	0.010	0.157
	(1.66)	**(0.619)**	(0.0588)	(0.186)
Pawnshops (Bordering Counties)	-2.31	-1.472	-0.107	-0.688
	(2.95)	(1.019)	(0.0927)	(0.425)
Pawnshops (State Level)	**24.55***	**13.89*** **	0.879	2.60
	(12.76)	**(4.652)**	(0.554)	(1.99)
Observations	29,147	29,147	29,147	29,147
Adjusted R-squared	0.832	0.799	0.912	0.842
Year FE	YES	YES	YES	YES
State Trends	YES	YES	YES	YES
County FE	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. All the standard errors are clustered at the county level. Each column shows the results from a different regression where the outcome variable is the number of reported crimes (per capita) in the county. In each regression we include the number of pawnshops in the county, the number of pawnshops in the bordering counties (excluding the number of pawnshops in the county where crime is measured), the number of pawnshops in the state (excluding the number of pawnshops in the county where crime is measured).

Table 9
Collateral by Category (Carter and Skiba, 2012)

Category	Number of Observations	Percentage of Observations	Average Loan Amount	Standard Deviation
Jewelry	199,288	**49.98%**	$96.28	105.02
TVs/Electronics	126,297	31.68%	$58.80	62.34
Tools/Equipment	31,600	7.93%	$50.18	60.67
Household Items	10552	2.65%	$42.92	44.7
Missing	7,833	1.96%	$63.75	72.54
Guns	7,734	1.94%	$146.97	98.75
Instruments	7,700	1.93%	$116.92	104.66
Camera/Equipment	4,052	1.02%	$75.85	77.87
Misc	3,666	0.92%	$51.50	62.46

Table 9 reports the number of loans for each collateral category, the percentage of observations, and the average amount and standard deviation of the items pawned for each category. All amounts are in 2002 dollars. The sample of observations is from a pawnshop lender in Texas between 1997 and 2002, (Carter and Skiba, 2012).

Table 10 (Burrel and Wellsmith, 2010)
Items stolen during burglaries

Cash	40%	Documents	5%
Jewellery	**31%**	Ornaments	5%
Audio	25%	Food	5%
VCR	17%	Tools	5%
TV	17%	Furniture	3%
Personal	12%	Cigarettes	3%
Telecom	12%	Vehicles	2%
Computer	11%	Cycle	2%
Photographic	11%	DVD	2%
Games	10%	Building	1%
Purse	10%	Garden	1%
Cards	10%	Digital	0%
Luggage	9%	Sports	0%
Clothing	9%	Antiques	0%
Domestic	7%		
Keys	6%		

This table show percentage of the stolen items during burglaries. Police recorded crime data are from the Sanwdwell Metropolitan Borough Council area of the West Midlands. The period covered is from 1997 to 2003. Percentage do not sum to 100 due to the stealing of multiple categories.

Table 11
Items taken during completed household burglaries, by type of item

	1994		2001		2011	
	Number	Per cent	Number	Per cent	Number	Per cent
Total completed burglaries	5,261,200		3,067,800		2,845,500	
Cash/checks, credit/bank cards, purses/wallets	786,600	15	553,200	18	482,200	16.9
Motor vehicles	33,400	0.6	33,400	1.1	38,600	1.4
Motor vehicle parts/accessories, gasoline/oil	217,300	4.1	130,800	4.3	128,500	4.5
Bicycles or parts, toys, recreation/sport equipment	698,600	13.3	382,700	12.5	246,500	8.7
Household appliances/portable electronics	1,433,900	27.3	844,400	27.5	978,700	34.4
Household furnishings/collections	359,000	6.8	225,300	7.3	179,100	6.3
Personal portable objects	**1,482,600**	**28.2**	**905,400**	**29.5**	**885,200**	**31.1**
Firearms	161,000	3.1	116,500	3.8	81,900	2.9
Tools/miscellaneous equipment	776,500	14.8	448,200	14.6	462,100	16.2
Farm/garden produce, food/liquor	272,900	5.2	169,700	5.5	129,200	4.5
Animals	21,700	0.4	2,800	0.1	3,500	0.1
Other	322,300	6.1	173,500	5.7	86,000	3
Unknown	11,000	0.2	7,400	0.2	7,300	0.3

This table show percentage of the stolen items during burglaries, by type of item in 1994, 2001 and 2011. Personal portable objects include clothing, furs, luggage, briefcases, jewelry, watches, keys and other. Source: Bureau of Justice Statistics, National Crime Victimization Survey, 1993 – 2011.

TABLE 12
Response to Gold Price

	(1) Larcenies	(2) Burglaries	(3) Robberies	(4) M/V Theft	(5) Murder	(6) Assault	(7) Rape	(8) Arson
Pawnshops per capita	**4.378*** **	**1.789*** **	0.026	0.172	0.01	0.197	0.02	0.059
	(1.679)	**(0.665)**	(0.063)	(0.209)	(0.01)	(0.42)	(0.047)	(0.04)
Pawnshops (t0)*Gold Price (t)	0.481	**0.339***	**0.0243**	0.030	0.00294	-0.103	0.0119	-0.00631
	(0.560)	**(0.194)**	**(0.0195)**	(0.064)	(0.00389)	(0.121)	(0.0151)	(0.0120)
Observations	29,465	29,465	29,465	29,465	29,465	29,465	29,465	29,465
Adjusted R-squared	0.811	0.778	0.910	0.837	0.297	0.720	0.537	0.507
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES	YES	YES
Pawnshops (t0)* Year	YES	YES	YES	YES	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
Controls*Gold Price	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. All the standard errors are clustered at the county level. This table shows the results of the specification where pawnshops per capita and the interaction between pawnshops in 1997 (the first year of the sample) and Gold price at time t are included. We also include: 1) the interactions between all controls fixed in the year 1997 and the gold price at time t, 2) the interaction between pawnshops at time 0 and linear trends.

TABLE 15
Response to Gold Price (Grouped Year Fixed Effects)

	(1) Larcenies	(2) Burglaries	(3) Robberies	(4) M/V Theft	(5) Murder	(6) Assault	(7) Rape	(8) Arson
Pawnshops per Capita	**4.33*** **	**1.69** **	0.0008	0.17	0.09	0.18	0.021	0.059
	(1.68)	**(0.66)**	(0.63)	(0.21)	(0.017)	(0.42)	(0.047)	(0.041)
Pawnshops (t0)*Gold Price (t)	0.581	**0.460** **	**0.050*** **	0.05	0.00427	-0.0786	0.0110	-0.00464
	(0.532)	**(0.187)**	**(0.0188)**	(0.0624)	(0.00382)	(0.117)	(0.0147)	(0.0115)
Observations	29,470	29,470	29,470	29,470	29,470	29,470	29,470	29,470
Adjusted R-squared	0.811	0.778	0.910	0.837	0.297	0.720	0.537	0.507
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
County FE	YES	YES	YES	YES	YES	YES	YES	YES
Pawnshops (t0)* Year	YES	YES	YES	YES	YES	YES	YES	YES
Controls	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL
Controls*Gold Price	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. All the standard errors are clustered at the county level. This table shows the results of the specification where pawnshops per capita and the interaction between pawnshops in 1997 (the first year of the sample) and Gold price at time t are included. We also include: 1) the interactions between all controls fixed in the year 1997 and the gold price at time t, 2) the interaction between pawnshops at time 0 and linear trends. We used grouped year FE, one dummy every three years (two years for the last period) and we include gold price (given that is not collinear anymore with year FE).

Table 16
Robustness Checks

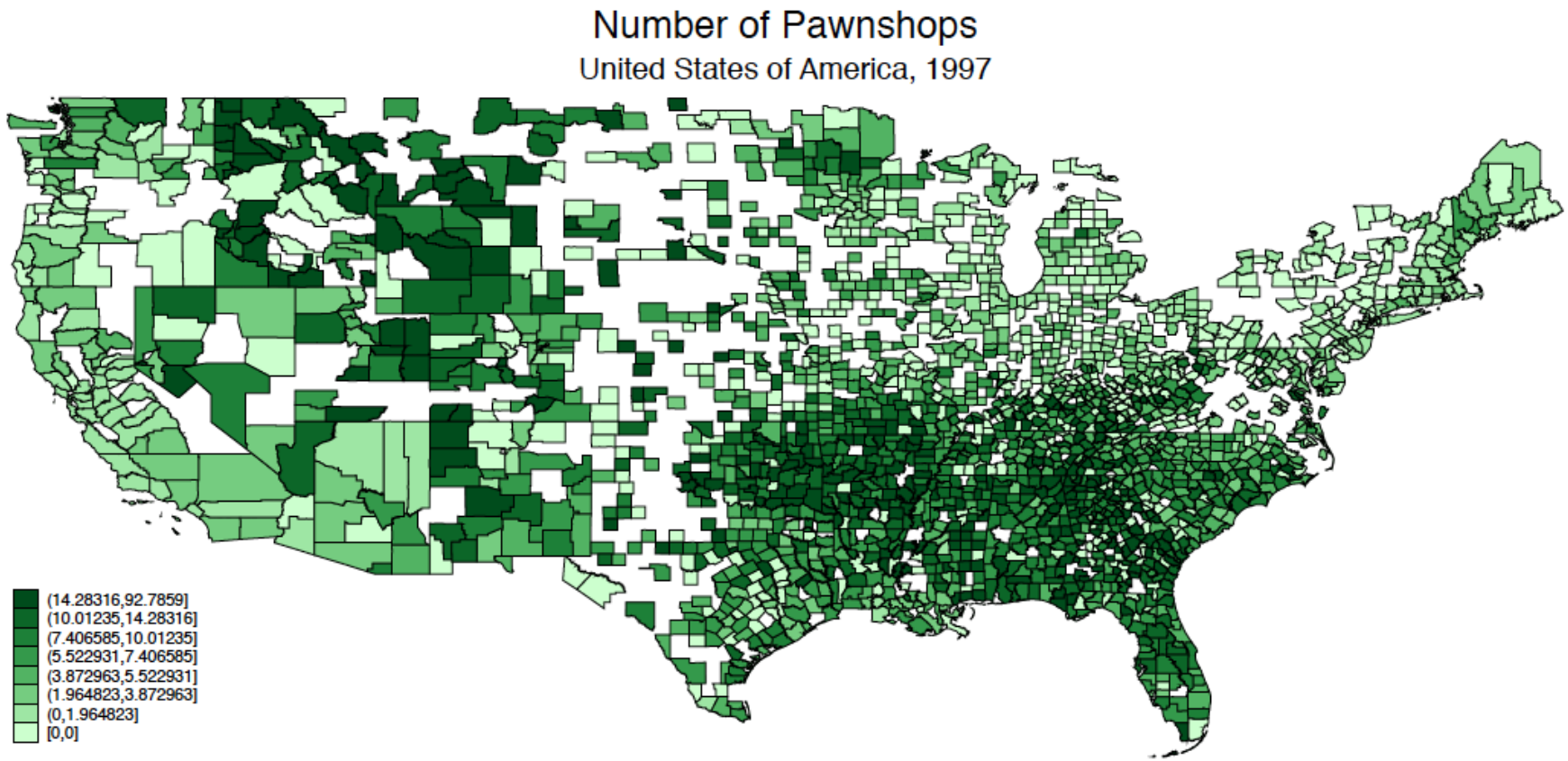
	(1)	(2)	(3)	(4)	(5)
	Panel A - Burglaries				
Pawnshops (t0)*Gold Price (t)	0.461*	0.461	0.540***	0.448**	0.476**
	(0.249)	(0.298)	(0.175)	(0.212)	(0.187)
	Panel B - Robberies				
Pawnshops (t0)*Gold Price (t)	0.0504	0.0504	0.0598***	0.0526**	0.0567***
	(0.0311)	(0.0343)	(0.0189)	(0.0219)	(0.0187)

*** p<0.01, ** p<0.05, * p<0.1. Panel A shows the results for larcenies, panel B shows the results for burglaries, panel C show the results for Robberies. Column 1 shows the results when we cluster at the state level, while in column 2 we cluster at the county/year level. In column 3 we perform a weighted regression using as weight the FBI coverage indicator. In column 4 we eliminate from the sample the counties in the top 1% of the pawnshops' per capita distribution. In column 5 we eliminate from the sample the counties in the top 1% of the population distribution.

TABLE 17
The Response to Gold – Silver and Platinum Prices

	(1) Burglaries	(2) Robberies
Pawnshops (t0)*Gold Price (t)	**1.743***** **(0.463)**	**0.115**** **(0.0467)**
Pawnshops (t0)*Platinum Price (t)	0.319* (0.179)	0.108*** (0.0289)
Pawnshops (t0)*Silver Price (t)	-0.899*** (0.290)	-0.0775** (0.0318)
Observations	29,465	29,465
Adjusted R-squared	0.777	0.909
Year FE Grouped	YES	YES
County FE	YES	YES
Controls	ALL	ALL
Controls*Gold Price	ALL	ALL

*** p<0.01, ** p<0.05, * p<0.1. All the standard errors are clustered at the county level. In this specification we include the price of platinum and silver both interacted with the number of pawnshops in the first year of the sample.



Number of pawnshops per 100,000 people. The state of Alaska and Hawaii - while being in the sample of analysis - are eliminated for illustrative puposes only.

Average price of gold by year expressed in US dollard per troy ounce and normalized by 100