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Crime and Unemployment: Evidence from Europe

Duha Tore Altindag
Louisiana State University

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Department of Economics
Louisiana State University
Baton Rouge, LA 70803-6306
http://www.bus.lsu.edu/economics/

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Abstract

This paper investigates the impact of unemployment on crime using a country-level panel data set from Europe that contains consistently-measured crime and police force statistics. Unemployment has a positive impact on monetary crimes, and instrumenting unemployment with the exchange rate produces larger estimates than those obtained from OLS specifications. The unemployment rate is decomposed into various components such as gender-specific and education-specific unemployment. The analysis of specific population sub-groups' unemployment reveals that about 65% of the overall impact of unemployment on crime is attributable to the unemployment of males with low education.

Keywords: *Crime, Europe, Unemployment*

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1. Introduction

In recent years there have been large increases in crime in Europe. For example, between 1975 and 2000, crime has risen by 97% in France, 145% in U.K., and a staggering 410% in Spain. Consequently, it has become a major concern among Europeans. According to a 2005 European Commission report, at least 35% of the population in 12 European Union member countries[2] feels unsafe on the streets after dark because of the prevalence of crime. In 13 member countries[3], at least 50% of the population has installed anti-theft devices against burglaries or thefts (The Burden of Crime in Europe, 2005). As a result, crime reduction has been placed to the top of the central policy issues by some of Europe's prominent politicians[4].

The economics literature has suggested that criminal activity is primarily motivated by net relative benefits to illegal activities. First pointed out by Becker (1968), potential criminals weigh the costs and benefits of committing crime. Crime and labor markets are not mutually exclusive choices but they represent a continuum of legal and illegal income-generating competing activities (Mocan, Billups and Overland 2005, Machin and Meghir 2004, Block and Heineke 1975, Erlich 1973). Individuals with potentially better current and future opportunities in the legal labor market are less likely to commit crime. These opportunities in the labor market can be captured by the unemployment rate, which fluctuates over the business cycle. During a recession, when the unemployment rate goes up, employment chances in the labor market

[2] Greece, Luxembourg, Italy, Portugal, Estonia, Spain, Poland, United Kingdom, Germany, Ireland, Hungary, Belgium

[3] This list includes the same countries from the previous footnote except Estonia and Poland, but also includes Sweden, Austria and Netherlands

[4] For example, Nicolas Sarkozy who was initiator of "get tough on crime" policies in France when he was the Interior Minister in early 2000s, was elected president, thanks to his efforts on reducing crime.

diminish. As long as the employment prospects of individuals are influenced by the legal labor market, the changes in the unemployment rate will impact the crime rate which is an aggregation of individuals' criminal activities. During times of high unemployment, the relative benefit of working in the legal labor market for an individual decreases on the margin, increasing the crime rate in the country.

This theoretical expectation has been confirmed by many empirical studies that generally make inference based on data from one country. For example, Corman and Mocan (2000), Raphael and Winter-Ebmer (2001), Gould, Weinberg and Mustard (2002) and Lin (2008) used data from the U.S. to investigate the impact of unemployment on crime. Other researchers have examined the same question using non-U.S. data, such as Edmark (2005) and Oster and Agell (2007) who made use of Swedish municipal-level panel data, and Buonanno (2006) who used Italian regional data.

However, in an international context the impact of unemployment on crime has not been studied extensively. Only Wolpin (1980) analyzed unemployment's impact on crime by using burglaries in Japan, U.K. and U.S[5]. Lin (2007) investigated the relationship between democracy and crime. Fajnzylber, Lederman and Loayza (2000, 2002) investigated the impact of income inequality on crime by analyzing only homicides and robberies.

The primary reason for the paucity of research based on international data is the absence of comparable crime statistics across countries. Legal practices, such as definitions and recording methods of crimes differ across countries. Another reason for non-comparability is the fact that some crimes are underreported. Underreporting is a more serious issue for developing countries

[5] He assumes that similar definitions are used for burglary in these countries. Furthermore, in his study U.S. is represented by California.

and especially for low-value property crimes, such as theft and for crimes carrying a social stigma for the victim, such as rape (Soares 2004). Fajnzylber, Lederman and Loayza (2000, 2002) dealt with this measurement problem by assuming a time-invariant form for the measurement error in crimes. In this paper a similar approach is used to deal with potential underreporting. In addition, differences in legal practices across countries are accounted for. The crime data employed in this paper have the advantage of having consistent measures of crime across countries as explained in more detail below.

This paper identifies the impact of unemployment on crime by employing a uniformly collected international data set from European countries. In this international context, using the unemployment rate as an explanatory variable has an additional advantage. Analyses based on city level or state level data may suffer from reverse causality as crime may impact the local unemployment rate (Cullen and Levitt 1999). However, variation in a country's crime rate is not expected to directly affect the unemployment rate of that specific country, minimizing the concern of a bias. Nevertheless, I also estimate instrumental variable models where the exchange rate of a country is used as an instrument for the unemployment rate of that country.

The recent literature shows that the overall unemployment rate may not be an appropriate measure to identify the marginal criminal. Raphael and Winter – Ebmer (2001) and Lin (2008) argue that employment conditions among certain population groups may drive the impact of unemployment on crime. To investigate this possibility, I analyze the impact of gender and education specific unemployment on crime. The results show that changes in the number of unemployed males with low education influences the impact of the overall unemployment rate on crime.

The remainder of the paper is organized as follows: section 2 explains the empirical framework and discusses the issues about identification; section 3 describes data used; section 4 presents OLS estimates of overall unemployment rate; and section 5 analyzes the impact of population sub-groups' unemployment on crime; section 6 discusses IV estimation and finally section 7 concludes.

2. Empirical Framework

Following previous research, the estimated crime equation depicted by equation (1) below, includes controls for deterrence, economic incentives, consumption goods associated with crime and other socio-demographic controls (Raphael and Winter-Ebmer 2001 and Gould, Weinberg and Mustard 2002).

(1) $$Crime_{i,t} = f\{Unemployment_{i,t}, Police_{i,t-1}, GDPGR_{i,t}, Alcohol_{i,t}, Urbanization_{i,t}, TeenPr_{i,t}, OldPerYoung_{i,t}\}$$

$Crime_{i,t}$ stands for crimes per hundred thousand people in country *i*, in year *t*. Six specific types of crimes are analyzed: homicide, assault, rape, robbery, theft and burglary. In some of the specifications, I use two categories of crime aggregates: monetary crimes and non-monetary crimes. Monetary crimes involve monetary returns for the offender, i.e. robbery, burglary and theft. Non-monetary crimes include homicide, rape and assault. The relationship between unemployment and crime is expected to be stronger for monetary crimes than for non-monetary crimes. However, as noted by Corman and Mocan (2000), there may be some impact of unemployment on non-monetary crimes[6].

[6] This is because non-monetary crimes and monetary crimes can take place together in one incident. For example, a murder can follow a robbery.

Unemployment$_{i,t}$ denotes the unemployment rate in country *i*, in year *t*. As explained in the introduction, in an individual level framework, participation in criminal activity is associated with own employment status of the individual. As long as the employment prospects of individuals are influenced by the legal labor market opportunities in the country, the changes in the unemployment rate will impact the crime rate which is an aggregation of individuals' criminal activities. However, there may be mechanisms through which unemployment may impact crime other than through labor market opportunities. One of these channels is the consumption patterns of crime-related goods. For example, Ruhm (1995) has shown that alcohol consumption increases during expansions and decreases during recessions. Raphael and Winter-Ebmer (2001) argue that gun availability and drug use may also move pro-cyclically. Another link between unemployment and crime may be driven by the availability of theft-worthy goods. Specifically, during a recession individuals' incomes decline and this possibly reduces the consumption of high value-storing goods such as jewelry or consumer durables. The decrease in consumption of such wealth-storing goods may decrease the expected returns to criminal activity and therefore leads to reduction in crime rate. A third mechanism may work through income inequality. Mocan (1999) and the papers he cites find that increases in unemployment worsen the relative position of low-income groups. Kelly (2000) and Fajnzylber, Lederman and Loayza (2002) suggest that a higher degree of income inequality induces more criminal activity. They suggest that the mechanism-at-work is that in areas where income inequality is prevalent, poor individuals who have low returns from labor market are more likely to be living close to wealthy individuals who have theft-worthy goods. Therefore, for those poor individuals living in areas where there is greater degree of income inequality, the relative return to criminal activity is also greater.

The first two of the mechanisms mentioned above are directly controlled for in this analysis. Specifically, the impact of unemployment on crime is isolated from the impact of consumption of crime-related goods as two proxies for such consumption are included as control variables: alcohol consumption per capita and teenage pregnancy rate. The latter does not have a direct influence on crime, but rather an indirect one since teenage pregnancy is correlated with many negative social factors such as drug consumption (Verner and Cardoso 2008). In addition, I also control for the growth in GDP per capita. This may help isolate the impact of theft-worthy goods from the impact of the unemployment. A similar approach is taken by Witte (1980).

Income inequality is not explicitly controlled for in my analysis because the sample size would have been reduced to almost half if a measure of inequality such as the Gini coefficient was added as a control variable. However, the inability to include an income inequality measure is not a significant problem for the sample I employ. Previous research documents that the source of the unemployment's impact on income inequality is mainly due to the structural component of unemployment (Mocan 1999). A change in structural unemployment requires many years and some deep transformation in the economy. In this study, the number of years covered is limited to 1995-2003 (only 8 years). Therefore, for the countries in the sample, the structural component of unemployment should be rather stable in each country and its impact should be captured by the country fixed effects.

In addition, as mentioned in the introduction, exogeneity of unemployment in a crime regression could be questionable. Specifically, employers may be reluctant to employ people with criminal records or they may move their businesses away from areas where the crime rate is high, leaving fewer employment chances in these areas (Cullen and Levitt 1999). Therefore, reverse causality from crime to the unemployment rate is possible. Previous literature provided

mixed evidence on the exogeneity of unemployment in this context. For example, with a state panel data set, Gould, Weinberg and Mustard (2002) have shown that there is not much difference between OLS and IV estimates of unemployment in a crime equation, suggesting reverse causality is not a major issue with state level data. However, Lin (2008) and Raphael and Winter-Ember (2001) have found that IV estimates of the unemployment rate are consistently larger than the OLS estimates.

In this paper, by using a panel of countries (more aggregated units of observation) I try to minimize the concern for reverse causality, because variations in the crime rate of a country in a given year are not expected to influence the unemployment rate of the country in that same year. I also estimate instrumental variable models in which the unemployment rate is instrumented by the exchange rate. Since the model is just identified, it is not possible to directly check the validity of the instrument. Therefore, I indirectly test the validity of the exchange rate by using a falsification test and a reverse causality test from crime to a very vulnerable economic activity, tourism, and consequently the exchange rate. As explained in detail in IV estimation section, both tests provide evidence for the validity of the instrument, the exchange rate. Furthermore, Lin (2008) and Oster and Agell (2007) also made use of the exchange rate to construct the instruments they employ for the state-level and municipality-level unemployment[7].

The impact of the exchange rate on the unemployment rate is theoretically well-founded. Revenga (1992) argues that any change in import competition that leads to a shift in industry product demand will tend to shift employment in the same direction. This mechanism may be

[7] However, as their estimation was based on one country, to generate variation in their instruments within states or municipalities, the exchange rate was interacted with other state or municipality-specific characteristics. In this paper, such interaction is not necessary since the exchange rate varies for each country and the impact on a country' unemployment rate of changes in foreign competition can be captured by the exchange rate of that country.

linked through the impact of currency appreciation on profits (Sheets 1992; Clarida 1997), investment (Campa and Goldberg 1999) and/or production location (Goldberg 1993). When the exchange rate appreciates, goods and services in the country become more expensive compared to the rest of the world. This leads to a decrease in foreign demand for domestic goods and an increase in domestic demand for foreign goods. As a result, exports and eventually production in the domestic country declines which increases the unemployment rate. That is, if the exchange is calculated as the amount of domestic currency per U.S. dollar, then theoretically there should be an inverse relationship between the exchange rate and the unemployment rate. This IV method is designed to pick up the variation in employment statuses of individuals who can easily be laid-off due to the change in foreign competition.

Lin (2008) and Raphael and Winter-Ember (2001) suggested that unemployment of population sub-groups may be the driving force of the impact of overall unemployment rate on crime. To gauge the potentially differential impact on crime of the unemployment rate prevailing in different population groups in a country, various unemployment rate measures are constructed. Specifically, in various specifications, I employ female unemployment rate, male unemployment rate, unemployment rate of the low-educated and the unemployment rate of the high-educated. I also use the ratio of the unemployed people in certain sub-groups of the population to the total labor force. For example, labor force share of unemployed females (males) is calculated by dividing the number of unemployed females (males) by the total labor force. Similarly, labor force share of the unemployed with low education (with high education) is the ratio of the number of unemployed with low education (with high education) to the total labor force. Notice that the sum of the labor force shares of the unemployed from population sub-groups equals to the overall unemployment rate. Therefore, employing the overall

unemployment rate in the specification restricts the coefficients of the labor force share variables to be equal to each other. For example, the unrestricted form depicted by equation (2) below would reduce to equation (3) under the restriction that the coefficients β_m and β_f are equal to β_u. Similarly, labor force shares of the unemployed with low and high education will be used in estimation.

(2) $$Crime = (\beta_m Unemployed\ Males + \beta_f Unemployed\ Females)/Labor\ Force + X\gamma + \varepsilon$$

(3) $$Crime = \beta_u\ Unemployment\ Rate + X\gamma + \varepsilon$$

Control variables include $Police_{i,t-1}$, $GDPGR_{i,t}$, $Alcohol_{i,t}$, $Urbanization_{i,t}$, $TeenPr_{i,t}$, $OldPerYoung_{i,t}$. $Police_{i,t-1}$ is the total number of police officers per hundred thousand people. It is lagged by one year to avoid a potential reverse causality problem (Corman and Mocan, 2000; 2005). $GDPGR_{i,t}$ stands for the GDP growth rate, $Alcohol_{i,t}$ is alcohol consumption per capita in liters. The socio-demographic controls include the urbanization rate ($Urbanization_{i,t}$), teen pregnancy rate ($TeenPr_{i,t}$) and ratio of old population to young population ($OldPerYoung_{i,t}$). Urbanization rate is the share of population living in urban areas. Teen pregnancy rate measures the number of births to mothers aged 15 to 19 per 1,000 females. $OldPerYoung_{i,t}$ is calculated by dividing the number of people who are older than 39 to the number of people between 15 and 39.

3. Data

The crime and police officers data are obtained from the last two waves of European Sourcebook of Crime and Criminal Justice, covering the period between 1995 and 2003. The first wave of the European Sourcebook, which covers the period between 1990 and 1994, is not included in this analysis because police officers data are not available. Prosecutions and convictions are available in all three waves and they can be considered as measures of

deterrence. However, they are not consistently measured between and within the countries over time, making the comparison difficult[8].

The data set includes information from 22 countries[9] each of which contributes at least 3 observations to the panel. Crime in these countries is measured by reported complaints to the police, similar to FBI's Uniform Crime Reports. The crime and the police personnel statistics in the Sourcebook of European Crime and Criminal Justice data sets are consistently measured unlike those in other international crime data sets. For example, the United Nations Surveys of Crime Trends and Operations of Criminal Justice Systems provide data reported by law enforcement agencies in each country. The crime and police personnel statistics in the U.N. dataset are neither standard across countries nor are they verified by a third party, unlike the European Sourcebook data.

Although the crime in European Sourcebook of Crime and Criminal Justice is consistently measured, there are some minor differences between the criminal justice practices of countries. For example, the standard definition of homicide is "intentionally killing of a person." According to this definition, euthanasia should be included as homicide, since euthanasia involves killing a fetus intentionally. However, euthanasia is not considered a homicide by the

[8] In most of the European countries the police use discretion to decide whether to prosecute or not. For example, the criminal can get away with a warning for small scale thefts or burglaries. Most importantly, the crime definitions used by the judicial system and the police are not identical. Although offence definitions adopted by the various police systems present uniformity among countries, rules for recording punishments can vary substantially.

[9] The number of countries in the European Sourcebook is greater than 22, but missing unemployment and police force data reduces the sample size. The included countries are: Austria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Sweden, Switzerland, Turkey and the U.K.

legal system of some countries. Similarly, an attempt to kill a person should not be counted as a homicide, but there are conflicting practices about doing so in different countries. The European Sourcebook handles these minor differences by providing information about responses of legal system to such controversial actions for each country. Specifically, each country's legal practices for certain types of actions, such as euthanasia and attempts to kill, are reported (whether they are counted as crime or not). Therefore, any non-conformity to definitions or data recording methods[10] is controlled by a set of dummy variables.

The source of labor market variables and income, teen pregnancy and urban population controls is the World Development Indicators[11]. The ratio of old population to the young population is constructed using the data from the U.S. Census Bureau's International database[12]. Alcohol consumption per capita variable is obtained from the World Health Organization's Global Alcohol Database[13]. Table 1 presents the definitions and the descriptive statistics of all the variables as well as their sources.

4. OLS Results

The baseline model, depicted by equation (1) is estimated by OLS. The results are provided in panels 1 and 2 of Table 2 for non-monetary crimes (homicide, rape, assault and the

[10] There are differences in timing and unit of collection, whether the principal offence rule is applied and the ways of dealing with multiple offences and crimes committed by more than one offender between the countries. Some of the countries record crimes as soon as they are reported to the police and others record subsequently or after investigation. Some countries count offences whereas others only count offenders.

[11] http://ddp-ext.worldbank.org/ext/DDPQQ/member.do?method=getMembers&userid=1&queryId=135

[12] http://www.census.gov/ipc/www/idb/

[13] http://www.who.int/globalatlas/default.asp

total non-monetary crimes) and monetary crimes (robbery, burglary, theft and total monetary crimes), respectively. The regressions include country fixed effects and year dummies. Robust standard errors are reported in parentheses.

This analysis of the monetary and non-monetary crime rates allows for a test of the theoretical expectation that a change in the unemployment rate is more strongly associated with crimes that involve monetary benefits. Being unemployed can induce motivation to earn income illegally, but it does not necessarily increase violent behavior. The estimates in Table 2 support this expectation. The sign of the unemployment rate's coefficients are positive and significantly different from zero for all monetary crimes. This positive and significant impact of unemployment on monetary crimes continues to hold when $TeenPr_{i,t}$ and $Alcohol_{i,t}$ are excluded individually and jointly from the crime regression. However, the unemployment rate does not a significantly impact non-monetary crimes.

In order to check whether the estimated impacts are same across countries, I estimate the equation 1 with quantile regressions. For all monetary crimes, the marginal effect of the unemployment rate at each percentile falls within the OLS confidence intervals. An illustration of this overlap is provided in Figure 1 for the total monetary crimes. Furthermore, the marginal effect of the unemployment rate on total monetary crimes for 25^{th}, 50^{th} and 75^{th} percentiles are not different from each other at conventional significance levels. Similar results are obtained for robberies, burglaries and thefts. Therefore, it is safe to state that the impact of the unemployment rate on monetary crimes which is estimated by OLS is similar across different countries.

5. Impacts of Population Sub-Groups' Unemployment on Crime

As discussed in the introduction and empirical framework sections and by Gould, Weinberg and Mustard (2002), Raphael and Winter-Ebmer (2001) and Lin (2008), overall unemployment rate may not be able to identify the marginal criminal. The coefficient of the unemployment rate captures the average effect of the overall unemployment rate among individuals. However, this impact of the unemployment rate may differ between population sub groups. In other words, individuals who belong to two different population sub-groups (such as highly educated individuals versus poorly-educated ones or males versus females) and who are financially at the margin of committing a crime may respond differently when they become unemployed. For example, Freeman (1995), Grogger (1998), and LaGrange, Teresa C. and Robert A. Silverman (1999) argued that males are more likely to commit a crime than females do. Similarly, Becker and Mulligan (1997), Lochner (2004), and Lochner and Moretti (2004) have suggested that higher educational attainment decreases criminal activity. Furthermore, Grogger (1998) and Gould, Weinberg and Mustard (2002) has reported that unskilled and uneducated males respond to changes in their employment statuses most significantly. To investigate the possibility that some population sub-group's unemployment drives the impact of the overall unemployment rate on crime, I will employ education and gender-specific unemployment measures in crime equations as control variables in the next sub-sections.

5.1. The Effect of Gender-specific Unemployment on Crime

I investigate whether the effect of male unemployment on crime is different from that of female unemployment by using the two measures of unemployment as described in the empirical framework section: the labor force share decomposition of the overall unemployment rate and

the gender-specific unemployment rates. The results are summarized in Table 3 where only the coefficients of monetary crimes[14] are reported although all control variables are included in the regressions. The signs and significance of the control variables are similar to those in the model with the overall unemployment rate (Table 2).

The results from the analysis using the female and male unemployment rates as the explanatory variables are presented in panel 1 of Table 3. In all cases except theft, male unemployment rate is a more significant determinant of monetary crimes than the female unemployment rate. Female unemployment rate becomes insignificant when it is included jointly with male unemployment rate. However, male unemployment rate continues to be positive and significant, or it is at least greater than its standard deviation. The estimates from the model that uses the labor force shares of unemployed males and females are shown in panel 2 of Table 3. The results of the models that employ labor force shares of the unemployed males and females are very similar to the results presented in panel 1. Both of the models suggest that male unemployment is more influential in driving unemployment's impact on aggregate monetary crimes, robberies and burglaries. However, the dominant impact of male unemployment is not observed in case of theft.

5.2. The Effect of Education-specific Unemployment on Crime

Similar to previous sub-section, education-specific unemployment measures are employed in equation (1) to gauge their differential impacts. Specifically, the unemployment rates of low and high educated people (results are presented in Panel 1 of Table 4) and the shares

[14] For non-monetary crimes, the coefficients of gender-specific unemployment measures are statistically insignificant.

of the unemployed people with high and low education in the labor force (in Panel 2 of Table 4) are included in equation (1) instead of the overall unemployment rate. Both analyses yield the same conclusion that the unemployment of low-educated people has a greater influence in robberies than does the unemployment of the high-educated. For total monetary crime rate, the impact of unemployment of high educated people is highly insignificant, whereas the unemployment of the low educated have p-values around 0.20. On the other hand, the models produce conflicting results for thefts and burglaries. Although significant and positive when included individually, unemployment of low and high educated people becomes highly insignificant when both are included jointly. The results of this analysis indicate the unemployed with low education are associated with more robberies but neither of the education-specific unemployment particularly drives thefts or burglaries.

5.3. The Effect of Gender-and-Education-Specific Unemployment on Monetary Crimes

Education and gender-specific unemployment rates are not available in the data source and these variables cannot be calculated using the available information. Therefore, I only use the labor force share variables in regressions. Equation (1) is modified to include labor force shares of the unemployed males and females with low and high education instead of the overall unemployment rate, i.e. there are four unemployment variables in this specification.

The results are displayed in Table 5. On all monetary crime types, the effects of the labor force share of the unemployed males with low education are positive and significant. The labor force shares of both unemployed males and females with high education do not significantly impact any monetary crime. The basic finding here is that the relationship between monetary

crimes and unemployment is mostly influenced by the unemployment of males with low education.

For each percentage point increase in the labor force share of the unemployed males with low education, total monetary crime, robbery, theft and burglary rates increase by 6.5%, 39%, 6.7% and 7.8%, respectively. On average about 20% of the unemployed people are males with low education. For one percentage point increase in the unemployment rate, the labor force share of the unemployed males with low education increases by 0.2 percentage points. Therefore, 65% of the impact of the overall unemployment rate on total monetary crime rate is due to the unemployment of low educated males. Shares of the overall unemployment rate's impact that is driven by the unemployment of the low educated males are 94%, 67% and 61% for robbery, burglary and theft rates.

6. 2SLS Results

As discussed in the empirical framework section, unemployment can be endogenous in a crime regression. Although using a country-level panel data set minimizes this concern, I nevertheless estimate IV models where the unemployment rate is instrumented by the exchange rate. The exchange rate impacts unemployment rate through its effect on foreign competition. For example, if the exchange rate is calculated as the amount of domestic currency per foreign currency, then a decrease in the exchange rate will result in a decrease in purchasing power of the foreign currency. Everything else held constant, this will lead to a fall in foreign demand and consequently the unemployment rate will rise.

The exchange rate data are obtained from Penn World Tables[15] where the exchange rate is calculated as domestic currency units per U.S. dollar. However, some of the countries analyzed in this study changed their national currency when they joined the currency union of the European Union. Among the countries considered, Austria, Finland, Ireland, Italy, Luxemburg, the Netherlands and Portugal have been parts of the European Monetary Union starting with 1999 with Greece joining them in 2001[16]. In the analysis for these countries, after they joined the European Monetary Union, the Euro-U.S. Dollar exchange rate is used.

The 2SLS estimates of the unemployment rate's impact on monetary crimes are presented in Table 6. Rows A and B show the point estimate of the unemployment rate in the second stage of 2SLS estimation and its standard error, respectively. Row C presents the coefficient of the exchange rate in the first stage. Row D gives the t statistic of the exchange rate's coefficient in the first stage. Row C in Table 6 indicates an inverse relationship between the unemployment rate and the exchange rate. The coefficients of the exchange rate are always negative and highly significant. The t-statistics are close to 5 satisfying the rule of thumb for a strong instrument.

Similar to the OLS results, the estimates of unemployment rate from the second stage of 2SLS are positive and significant in all cases. For all crime types 2SLS estimates are greater than OLS results[17]. Specifically, when significant, the estimate for elasticity of each crime with

[15] http://pwt.econ.upenn.edu/php_site/pwt62/pwt62_form.php

[16] Slovenia and Cyprus became members in 2007 and 2008, but these years are not covered in this study.

[17] Because the 2SLS estimates of the unemployment rate provides the impact of the overall unemployment rate that is caused by the movements in the exchange rate; it is not surprising to see that the 2SLS estimates of the overall unemployment rate are greater than those of the OLS estimates. If an exchange rate shock primarily increases the unemployment of low educated males to as argued by Bertrand (2004), then the increase in the overall unemployment rate that is captured by the 2SLS estimator is mostly due to increase in the number of unemployed

respect to a specific unemployment measure is twice as large as OLS elasticities. Similar findings have been reported by Lin (2008) and Raphael and Winter-Ember (2001), who suggest that 2SLS estimates of semi elasticity of monetary crimes with respect to unemployment is about 5% when OLS estimates of semi-elasticities are about 2%.[18]

The implications of the instrumental variable estimation are consistent with those obtained from OLS. Bertrand (2004) suggests that the employment statuses of males with low education are more vulnerable to changes in foreign competition. In other words, males with low education are more likely to get laid-off in response to an exchange rate shock. Moreover, according to the findings from the OLS estimation, the variation in the unemployment of males with low education generates the biggest impact on property crimes. Therefore, both estimation methods predict that the marginal criminal is among males with low education.

The validity of the exchange rate cannot be tested directly in this analysis as the model is just-identified. However, Angrist and Krueger (1999) proposed an indirect method of testing the validity of an instrument in a just-identified model[19]. The method involves an investigation of

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males with low education. As suggested by the OLS estimates, the unemployment of this group have a greater impact on crime more than the unemployment of other groups do. Therefore, the increase in the overall unemployment rate due to a movement in the exchange rate will impact property crimes more than an increase of same magnitude in the overall unemployment rate (which includes all gender-and-education specific groups).

[18] When labor force share of the unemployed males with low education is used instead of the overall unemployment rate, similar results are obtained. The elasticity of the monetary crimes with respect to this labor force share variable is larger than its OLS estimate and in the first stage the exchange rate is highly significant. In these IV and OLS regressions, among the labor force share variables only the labor force share of unemployed males with low education is included together with all the control variables.

[19] An application of this method can be found in Oster and Agell (2007).

whether the instrument has an impact on the dependent variable in specifications where the impact should be non-existent. In this spirit, I regressed twice and three-times lagged crime rates on the contemporaneous exchange rate and other dependent variables except for the unemployment rate in reduced form regressions. The absolute values of the obtained t-statistics of the exchange rate are all less than 2, suggesting that the monetary crime rates indeed are not influenced by the future values of the exchange rate.

One possibility that may invalidate the instrumental variable is that the dependent variable influences the instrument, i.e. crime impacting the exchange rate. This may happen if crime impacts economic activity and this effect gets filtered out through a change in the exchange rate. In order to investigate if crime has an influence on economic activity, I analyzed tourism industry which is one of the most crime-vulnerable economic activities. I regressed the international incoming tourists per capita and international tourism revenue per capita on crimes considered in this analysis and control variables[20]. The crime rate is lagged by one year to avoid potential reverse causation from tourism activity to crime. The results[21] showed that non-monetary crimes (homicide, rape and assault) impact tourism activity significantly, whereas monetary crimes (theft, robbery and burglary), on which this paper is focused, do not. Therefore, an impact from monetary crimes to the exchange rate through tourism is not plausible since monetary crimes do not influence tourism.

[20] The control variables in these regressions include the unemployment rate, GDP growth rate, urbanization rate, teenage pregnancy rate, ratio of old-to-young people, exchange rate, tuberculosis rate and number of hospital beds per 1,000 people as well as country fixed effects and year dummies.

[21] Results from this regression are not reported. But they are available upon request.

As an extension to the IV estimation described above, I used the interaction of a country's exchange rate and ratio of its total trade to the GDP as the instrument of the unemployment rate.[22] If a country has a larger trade sector, then more jobs in this country should depend on foreign competition, and consequently the impact of the exchange rate on the unemployment rate should be greater in magnitude. The coefficient of the interaction term in the first stage is negative and significant at 1%, implying that the impact of the unemployment rate on monetary crimes is larger when the trade share of the country is greater.

7. Summary and Conclusion

This paper investigates the impact of unemployment on crime using a panel data set of 22 European countries, and it is one of the few papers which studies crime in an international context. The primary advantage of the data set is that it contains consistently measured crime and police force variables across countries and over time.

In addition to OLS estimation, 2SLS is employed to eliminate the potential endogeneity of unemployment in the crime regressions, instrumenting the unemployment rate with the exchange rate. In line with Raphael and Winter–Ebmer (2001) and Lin (2008), the comparison of 2SLS and OLS results shows that the unemployment rate is endogeneous even in an international context as 2SLS produces greater coefficients than OLS does. Specifically, 2SLS estimates are twice as large as OLS estimates.

Because the overall unemployment rate may not be able to identify people on the margin of committing a crime, even after controlling for endogeneity (Lin 2008 and Raphael Winter-Ebmer 2001), the impacts of gender-specific and education-specific unemployment on crime are

[22] See footnote 17.

investigated using the unemployment rate and labor force share of these groups. The results show that the unemployment of males with low education is more influential in driving the impact of the overall unemployment rate on crime. About 65% of the impact of the overall unemployment rate on crime can be attributable to the unemployment of low educated males.

This finding is consistent with the results of the IV estimation. Since the low-educated males' employment statuses are most likely to be affected by the foreign competition (Bertrand 2004), the variation in the overall unemployment rate due to the exchange rate movements is more likely to impact this group. Both analyses point out that the marginal criminal is among the unemployed males with low education.

The magnitude of the unemployment's impact on crime is economically significant. For example, U.K. and Italy suffer about 45,000 and 80,000 additional monetary crimes per year for one percentage point increase in the unemployment rate according to OLS and 2SLS estimates, respectively. If the social cost per monetary crime is roughly $45,000[23] in 1999 dollars, then Italians and Britons incur an extra cost of about $2-$4 billion due to the impact of one percentage point increase in the unemployment rate which is caused by the corresponding increase in monetary crimes.

[23] I used Anderson (1999)'s estimates for US. According to his calculations, lost production due to crimes and the opportunity costs of crime total $527 billion, implying about 45,000$ cost per monetary crime in 1999 dollars. I assume, due to violent and property crimes people incur the same level of production loss and opportunity cost.

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Table 1
Definitions and Descriptive Statistics

Variable	Definition	Source	Observation	Mean	Standard Deviation
Non-Monetary Crimes	Total Homicides, assaults and rapes per 100,000 people	A	168	163.48	219.34
Monetary Crimes	Total thefts, burglaries and robberies per 100,000 people	A	184	3790.47	2726.96
Homicide Rate	Homicides per 100,000 people	A	169	4.58	3.75
Assault Rate	Assaults per 100,000 people	A	189	190.22	236.60
Rape Rate	Rapes per 100,000 people	A	190	7.75	5.77
Robbery Rate	Robberies per 100,000 people	A	189	67.63	65.64
Theft Rate	Thefts per 100,000 people	A	189	2752.49	2050.24
Burglary Rate	Burglaries per 100,000 people	A	184	961.67	737.61
Police Rate	Total number of police officers per 100,000 people	A	190	319.70	117.84
GDP Growth Rate	Growth rate of GDP, in percentages	B	190	3.13	2.57
Alcohol	Alcohol Consumption per capita, in liters	C	212	9.95	2.76
Urbanization Rate	Ratio of the population living in urban areas to the total population, in percentages	B	190	66.84	11.80
Teen Pregnancy Rate	Births to mothers aged 15-19 per 1000 females	B	210	127.34	89.70
Old/Young	Ratio of population aged more than 40 to population aged 15-39, in percentages	D	210	120.18	12.96
Unemployment Rate	Ratio of unemployed population to labor force	B	221	8.57	5.06
Male unemployment rate	Ratio of unemployed male population to male labor force, in percentages	B	221	8.14	5.05
Female unemployment rate	Ratio of unemployed female population to female labor force, in percentages	B	221	9.21	5.49

Table 1 Continued

Variable	Definition	Source	Observation	Mean	Standard Deviation
Share of Unemployed Males in Labor Force	Ratio of unemployed male population to total labor force, in percentages	B	221	4.63	2.94
Share of Unemployed Females in Labor Force	Ratio of unemployed female population total labor force, in percentages	B	221	3.93	2.27
Unemployment among the poorly-educated	Ratio of unemployed population with at most primary schooling to total labor force with at most primary schooling, in percentages	B	190	11.67	7.20
Unemployment among the well-educated	Ratio of unemployed population with more than primary schooling to total labor force with more than primary schooling, in percentages	B	189	7.41	3.82
Labor Force Share of the Poorly-educated and the Unemployed	Ratio of unemployed population with at most primary schooling to total labor force, in percentages	B	206	2.94	1.59
Labor Force Share of the Well-educated and the Unemployed	Ratio of unemployed population with more than primary schooling to total labor force, in percentages	B	206	5.22	3.21
Labor Force Share of Poorly-educated and Unemployed Males	Ratio of unemployed male population with at most primary schooling to total labor force, in percentages	B	206	1.61	1.04
Labor Force Share of Well-educated and Unemployed Males	Ratio of unemployed male population with more than primary schooling to total labor force, in percentages	B	206	2.68	1.69
Labor Force Share of Poorly-educated and Unemployed Females	Ratio of unemployed female population with at most primary schooling to total labor force, in percentages	B	206	1.13	0.67

Table 1 Concluded

Variable	Definition	Source	Observation	Mean	Standard Deviation
Labor Force Share of Well-educated and Unemployed Females	Ratio of unemployed female population with more than primary schooling to total labor force, in percentages	B	206	2.53	1.59
Exchange Rate	Amount of domestic currency that one U.S. dollar can buy	F	232	25943	168275

A – European Sourcebook of Crime and Criminal Justice.
B – World Development Indicators.
C – World Health Organization, Global Alcohol Database.
D – U.S. Census Bureau, International Database.
E – United Nations, Common Database.
F – Penn World Tables

Table 2
The Effect of Total Unemployment Rate on Specific Crimes
Panel 1: Non-Monetary Crimes

Variable	Non-monetary Crimes[a]	Homicide	Assault	Rape
Unemployment Rate	-3.223	-0.091	-1.713	0.510**
	(4.796)	(0.068)	(4.158)	(0.224)
$Police_{t-1}$	0.751**	0.017***	0.618*	0.011
	(0.367)	(0.004)	(0.312)	(0.009)
Urban	15.837*	-0.422*	17.073**	0.371
	(8.477)	(0.234)	(7.071)	(0.228)
GDP Growth	5.822*	-0.095*	4.156	0.321***
	(3.056)	(0.051)	(2.682)	(0.098)
Old/Young	20.790*	-0.014	-4.681	0.326***
	(11.257)	(0.051)	(2.899)	(0.112)
Alcohol	-3.933	0.066	17.187	0.285
	(3.182)	(0.097)	(10.649)	(0.244)
Teen Pregnancy Rate	1.346*	0.016*	1.254*	0.023
	(0.684)	(0.008)	(0.654)	(0.020)
N	125	126	136	137

Panel 2: Monetary Crimes

Variable	Monetary Crimes[a]	Robbery	Theft	Burglary
Unemployment Rate	74.712**	5.986*	55.023**	22.779**
	(30.689)	(3.147)	(21.602)	(9.623)
$Police_{t-1}$	-6.478***	-0.136	-2.283*	-2.242***
	(2.000)	(0.171)	(1.280)	(0.662)
Urban	26.932	3.981	28.921	6.101
	(45.474)	(4.874)	(27.733)	(16.694)
GDP Growth	-3.682	-0.186	1.892	-2.691
	(15.379)	(2.011)	(10.210)	(4.991)
Young/Old	-70.183*	1.412	-0.999	-5.071
	(38.805)	(1.810)	(10.550)	(4.387)
Alcohol	-8.674	-1.686	-29.244	-23.228
	(15.251)	(3.583)	(27.529)	(14.175)
Teen Pregnancy Rate	-0.848	-0.07	-0.452	-0.506
	(3.499)	(0.451)	(2.452)	(1.049)
N	131	136	136	131

Each column is output from one regression. Dependent variables are listed on top of each column. All models include data collection and time dummies and country indicators. Robust standard errors are in parentheses. *, ** and *** denotes significance at 10%, 5% and 1% respectively.

[a] Monetary crime rate includes robbery, theft and burglary rates. Non-Monetary crime rate includes homicide, rape and assault rate. See Table 1 for definitions of other variables.

Table 3
The Impact of Gender-Specific Unemployment on Monetary Crimes

Panel 1: Unemployment Rates

	Monetary Crimes[a]			Robbery			Theft			Burglary		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Male	75.48**		97.58	6.46**		11.70*	50.19**		21.11	25.10**		45.64*
	(30.74)		(65.96)	(3.14)		(5.90)	(21.00)		(40.86)	(10.08)		(23.60)
Female		58.07**	-26.40		3.67	-6.24		52.50**	34.61		14.97*	-24.54
		(29.05)	(63.48)		(2.62)	(4.75)		(20.76)	(40.97)		(8.94)	(22.43)

Panel 2: Labor Force Shares of the Unemployed

	Monetary Crimes[a]			Robbery			Theft			Burglary		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Males	130.45**		146.97	11.46**		21.02**	89.57**		55.38	42.56**		63.25
	(53.22)		(108.97)	(5.52)		(9.71)	(36.70)		(68.88)	(17.28)		(39.26)
Females		139.28**	-25.51		8.94	-14.71		114.93**	52.62		38.99*	-31.92
		(66.42)	(136.71)		(6.04)	(9.29)		(47.81)	(90.28)		(20.50)	(48.84)

Panel 1 presents results with the independent variables male and female unemployment rate. Panel 2 shows the results of the model where labor force share of the unemployed males and females are used as independent variables. For each dependent variable there are three sets of results. Columns (I) and (II) show estimates from the models where female unemployment and male unemployment is excluded respectively. Third column present the results when both are included jointly. Only the estimates for the variables of interest are reported. Each model includes lagged police rate, GDP growth rate, urbanization rate, alcohol, teen pregnancy rate, old/young as well as data collection and country indicators and time dummies. The unreported estimates are available upon request. Robust standard errors are in parentheses. *, ** and *** denotes significance at 10%, 5% and 1% respectively.

[a] Monetary crime rate includes robbery, theft and burglary rates. See Table 1 for definitions of other variables.

Table 4
The Impact of Education-Specific Unemployment on Monetary Crimes

Panel 1: The Unemployment Rate

	Monetary Crimes[a]			Robbery			Theft			Burglary		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Low educated[b]	57.03**		38.18	5.916**		8.83**	37.98**		13.96	16.30**		10.15
	(22.10)		(24.51)	(2.61)		(3.50)	(15.08)		(17.73)	(7.05)		(7.99)
High Educated[b]		98.85**	46.96		4.98	-7.11*		77.79**	58.68		29.12*	15.32
		(47.26)	(54.95)		(3.55)	(3.61)		(31.75)	(38.95)		(15.27)	(18.34)

Panel 2: Labor Force Share of the Unemployed

	Monetary Crimes[a]			Robbery			Theft			Burglary		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Low Educated[b]	148.85**		105.70	18.95**		20.79**	119.40**		101.10	38.15*		18.22
	(74.54)		(86.16)	(7.66)		(8.74)	(57.08)		(65.60)	(20.30)		(23.81)
High Educated[b]		85.89*	47.68		5.59	-2.07		57.69*	20.47		28.62*	22.03
		(47.22)	(51.88)		(4.17)	(4.23)		(32.10)	(33.71)		(16.17)	(18.89)

Panel 1 presents results with the independent variables unemployment rates of low and high educated people. Panel 2 shows the results of the model where labor force share of the unemployed with low and high education are used as independent variables. For each dependent variable there are three sets of results. Columns (I) and (II) show estimates from the models where unemployment of the high educated and unemployment of the low educated are excluded respectively. Third column present the results when both are included jointly. Only the estimates for the variables of interest are reported. Each model includes lagged police rate, GDP growth rate, urbanization rate, alcohol, teen pregnancy rate, old/young as well as data collection and country indicators and time dummies. The unreported estimates are available upon request. Robust standard errors are in parentheses. *, ** and *** denotes significance at 10%, 5% and 1% respectively.

[a] Monetary crime rate includes robbery, theft and burglary rates. See Table 1 for definitions of other variables.

[b] High educated people are those who completed schooling beyond primary school.

Table 5
The Impact of Gender and Education-Specific Unemployment on Monetary Crimes

Labor Force Share of the Unemployed

	Monetary Crimes[a]			Robbery			Theft			Burglary		
	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)	(I)	(II)	(III)
Males with Low Education[b]	317.26**		247.84**	23.84*		26.42*	224.07**		185.29*	103.46***		75.16**
	(122.12)		(124.52)	(13.45)		(15.80)	(93.48)		(96.37)	(37.39)		(36.46)
Females with Low Education[b]	-190.24		-200.97	11.31		11.60	-120.05		-127.96	-79.93*		-84.24*
	(133.66)		(133.06)	(11.65)		(11.16)	(96.24)		(97.82)	(47.32)		(45.97)
Males with High Education[b]		199.05	164.67		18.58	10.27		98.95	73.18		82.96	75.81
		(164.41)	(170.02)		(13.04)	(12.62)		(104.27)	(108.63)		(61.12)	(62.56)
Females with High Education[b]		-49.4	-73.95		-10.31	-17.02		7.39	-16.93		-36.01	-40.69`
		(161.05)	(163.90)		(12.53)	(12.48)		(108.25)	(109.19)		(58.27)	(59.31)

The table shows the results of the model where labor force share of the unemployed males and females with low and high education are used as independent variables. For each dependent variable there are three sets of results. In column (I), labor force shares of males and females with high education are excluded. Column (II) shows estimates from the model where labor force shares of the unemployed males and females with low education are excluded. Third column present the results when all variables listed are included jointly. Only the estimates for the variables of interest are reported. Each model includes lagged police rate, GDP growth rate, urbanization rate, alcohol, teen pregnancy rate, old/young as well as data collection and country indicators and time dummies. The unreported estimates are available upon request. Robust standard errors are in parentheses. *, ** and *** denotes significance at 10%, 5% and 1% respectively.

[a] Monetary crime rate includes robbery, theft and burglary rates. See Table 1 for definitions of other variables.

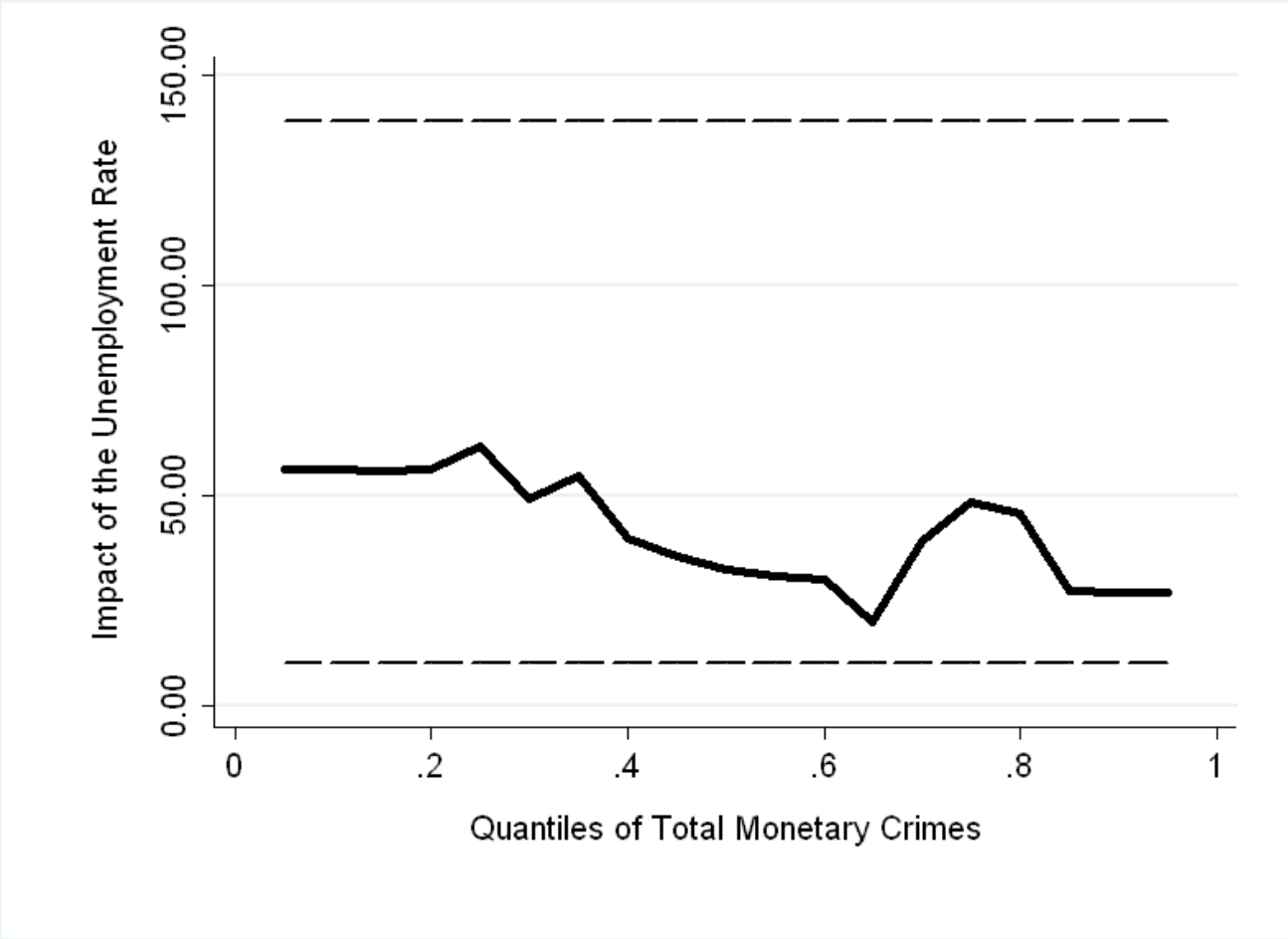
[b] High educated people are those who completed schooling beyond primary school.

Table 6
The Impact of Unemployment on Monetary Crimes, 2SLS Results

		Monetary Crimes	Robbery	Theft	Burglary
A	Coefficient of the Unemployment Rate in the 2nd stage	152.179***	12.783*	116.009***	39.882**
B	Standard error of the Unemployment Rate	(53.291)	(7.818)	(39.222)	(16.544)
C	Coefficient of the exchange rate in the 1st stage	-0.0000198	-0.0000196	-0.0000196	-0.0000198
D	t-statistic of the exchange rate	[-4.66]	[-4.93]	[-4.93]	[-4.66]

Only the estimates for monetary crimes are reported. The unemployment rate is instrumented with the exchange rate. Each regression includes all control variables as well as data collection and country indicators and time dummies. *, ** and *** denotes significance at 10%, 5% and 1% respectively. Monetary crime rate includes robbery, theft and burglary rates. See Table 1 for definitions of other variables.

Figure 1
Impact of the Unemployment Rate on Monetary Crimes over the Distribution of Monetary Crimes



The solid line depicts the impact of the unemployment rate on total monetary crime rate over distribution of total monetary crime rate from a quantile regression which is depicted by the equation (1). The dashed line shows the OLS confidence intervals.