MONASH University

Macro-Economic Evidence on Crime and Income Inequality

Zeresh Errol
MSc International Business Economics

A thesis submitted for the degree of Doctor of Philosophy
Monash University 2018
Department of Economics

Copyright notice

Contents

List of Tables

List of Figures

Abstract

This thesis looks at the development of crime and income inequality from different perspectives. Three essays contribute to this thesis. The first essay (chapter 2) examines the effect of income inequality on social transfers for 20 Organisation for Economic Co-operation and Development (OECD) countries for a period of 1860-2013. The second essay (third chapter) explores the effect of alcohol, drugs and deterrence on homicide for 14 OECD countries for a period of 1800-2016. In the third essay (fourth chapter) the effect of income inequality on aggregate measures of crime, more specifically, property and violent crimes is examined for 17 OECD countries over the last two centuries.

This thesis, overall, constructs data for eight variables (Threat of Revolution, Homicide, Violent and Property crime, Imprisonment, Capital Punishment, Alcohol and Drugs). Majority of these variables cover a period of almost two centuries. This long data coverage enables us to see the big picture and identify the long-term trend of these variables.

Chapter 2 revisits the median voter theory which suggests that when there is income inequality the spread of franchise extends political power to the poorer people in the society thus leading to higher taxes and greater redistribution. The Ordinary Least Squares (OLS) results of this study are in sharp contrast to the median voter theory and shows that unequal democracies (with high inequality) rather than increasing social transfers tend to reduce it. This study is different from earlier literature because it treats the problem of endogeneity by using instrumental variables. A two-way relationship between inequality and social transfers as well as democracy and social transfers has been proposed by several studies which suggest that it is quite important to treat this problem of endogeneity. The Instrument variable (IV) results support the OLS findings and show that unequal democracies indeed reduce redistribution.

The third and fourth chapter look at the development of crime considering two different dimensions. The economic literature has neglected the role of alcohol in determining crime. However, studies from other disciplines (psychology, biology, and neuroscience etc.) have emphasized on different mechanisms (dulls brain signals, reduces self-control etc.) through which alcohol can affect crime. The third chapter based on these mechanisms develops a simple model in which criminality is jointly determined through addiction and deterrence. This study contributes to the existing literature by showing that alcohol along with drugs and deterrence is a significant, robust and strong determinant of homicides.

Most of the economic literature that has investigated the relationship between inequality and crime have included segregated measures of violent and property crime and are cross-sectional. However, more recently few studies have extended the literature by using panel data, but they

only include post 1960 period for segregated measures. The fourth chapter of this thesis contributes to the existing literature by considering the effect of income inequality on both violent and property crime in aggregate and shows that unequal incomes is a strong determinant of both crimes, but the effect is larger for the former.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

Signature:

Print Name: Zeresh Errol

Date: 21/08/2018

This thesis is dedicated to my family
Whom I love the most.

Acknowledgement

With the finishing of this thesis a feeling of gratification fills me. I thank Almighty God from the beginning to the end of my PhD journey.

Professor Jakob Madsen accepted me as his PhD student and I thank him for being a wonderful supervisor to me. Undoubtedly his valuable comments, ideas and direction through the daily challenges helped me to move further. His open-door policy, high calibre of research and generosity has shaped and refined my thinking process. He has left a lifelong impression on my life with the kind of commitment and responsibility he has for his students.

For the whole thesis I would extend my appreciation and thanks to Dr. Solmaz Moslehi, my associate supervisor. Her attention to intricate and meticulous details helped me in the writing of the whole thesis. Her words of encouragement, suggestions and friendly approach made me understand a lot of things required for professional life. She is a person I would always look up to and remember with great regard. I would like to thank both supervisors for giving me opportunities to present at different conferences.

I am thankful to Angela Kousourakis for her administrative support during my study and writing this thesis. Also; I am grateful to the Australian Government for the Australian Postgraduate Award (APA) which helped me to pursue my degree without financial stress.

During the PhD life I enjoyed the company of my friends Yang Li, Lei Pan, Abebe Hailemariam and Anwesha Bandhopadya through coursework and research. All my friends have contributed to the culmination of this thesis with their ideas, comfort and encouragement.

The sacrifice of my parents-in-law during this time by taking care of my daughter and home can never be forgotten or ignored. I will always remember their love in my challenging time. The prayers and love of my parents is always with me and their support is the main motivation behind achieving this mark. I thank my sister Hina Joshua for her timely comments and concern for my work.

Finally, I acknowledge the contribution of my family; husband -Errol Francis and Daughter-Catherine E. Francis in helping me achieve this milestone. Errol’s love and support during this time in all forms can never be undermined. Catherine is the source of all inspiration to pursue my goals and with all that I achieve I aspire to be a role model for her future life.

Chapter 1

Introduction

1.1 Survey of the literature on crime

On February 14, 2018, a gunman opened fire at a school in Florida killing seventeen students and staff members and injuring seventeen others. The shooting sparked unparalleled demand for gun controls and spurred the foundation of a committee by students to demand judicial action on weapons. Such stories of violence are heard and seen frequently in everyday life and are of prime concern in today's world. Despite violence being universally condemned it is found everywhere. Crime is seen as "a multifaceted, socially constructed and highly ambivalent phenomenon" (Haan, 2008, pp. 27-40)

To date, scholars from criminology, sociology, psychology etc. have undertaken studies to understand criminal behaviour. This vast literature is based on several theories including self-control theory, interactional theory etc (for detailed explanation see Entorf and Spengler, 2002). Becker (1968) revolutionised the existing literature on crime by introducing the economic rational choice theory. This theoretical framework suggests that crime is a rational choice taken by accounting for cost (likelihood of conviction and severity of punishment) and benefit (rewards from crime compared to legitimate activities) of crime. Becker's seminal paper changed the way of looking at criminal behaviour as it indicated channels through which different economic determinants affect criminal behaviour. Consequently, enormous literature on crime has studied several economic variables that determine criminal choices and behaviour of agents. These include severity and certainty of punishment, education, unemployment, social factors and income inequality which are discussed below.

Becker's model was first empirically tested by Ehrlich (1973) in his seminal paper 'Participation in Illegitimate Activities: A theoretical and Empirical Investigation' using statistical techniques to understand socio-economic causes of crime in U.S. Since then researchers from various disciplines have produced hundreds of multivariate crime studies using wide variety of data sets and econometric techniques. Economic literature has stressed the importance of punishment in context to crime following Becker and Ehrlich (Levitt, 1996; Becker, 1968; Chaflin and Mcrary, 2017; Ehrlich, 1972). They see punishment as a way through which crime can be reduced as it not only deters but also incapacitates individuals from participating in illegal activities. However; a lot of literature has argued that there is a two-way relation between crime and punishment. Areas with high crime can also cause more people to

be imprisoned and therefore the magnitude of the coefficient of punishment on crime can be biased. To overcome the problem of endogeneity several studies have used instruments to verify this relationship between punishment and crime (see, e.g., Levitt, 1996; Spelman, 2005)

Numerous studies have seen the level of education attained to be related to individual's criminal behaviour (Lochner, 1999; Freeman, 1991; 1996; Lochner and Moretti, 2001). Lochner (1999) emphasizes in his study that individuals with low education are more likely to engage in criminal behaviour than educated people since their returns from education are lower compared to people with higher levels of education. According to Kelly (2000) and Cooper *et al*., (2011) people belonging to the age group between 16 and 24 are more prone to commit crime. Therefore, young men are seen to be more active in crime related activities than the other population aged less than 16 and above 24. Freeman (1991) suggests that fall in earnings and employment opportunities for less educated people reduces the opportunity cost of crime and may convince young people to not engage in the legal economic market. He also shows that expansion of drug business has contributed massively to increase in adolescence/youth crime.

Glaeser (1996) and Zenou (2003) show that social factors, interactions and networks are strongly related with the tendency to commit crime. These studies suggest that if early childhood is spent in neighbourhoods that do not foster good values children subsequently have lower quality of social behaviour. They acquire less education, belong to the group of drop outs from school and have a higher risk of being involved in delinquent behaviour. Case and Katz (1991) find that family background and peers have a strong effect on youth behaviour. Glaeser (1999) find that criminal activities are higher in urban areas compared to rural with sparse population.

A more recent development in the crime literature is the role of legalized abortion in determining crime. Donhoue and Levitt (2001) show that legalized abortion has contributed considerably to recent crime drops and explains 50% of the recent decline in crime. They argue that legalized abortion may lead to reduced crime either through "reductions in cohort sizes or through lower per capita offending rates for affected cohorts". François & Weill (2014) find that for homicide as well as theft legalized abortion plays a significant role.

1.2 Survey of the literature on income inequality

Income inequality in the past years has been a growing concern particularly the blatant upsurges and substantial widening of income gap in European economies. Over the past three decades an interesting picture is observed which shows a general trend of widening of the gap starting in

1980s. The consequences of this divide in incomes between 1% and 99% of the population has led to the expansion of literature on income inequality and important social outcome variables. The main social outcome variables that have been considered in literature are, health, education, happiness, criminality and redistribution.

Almost hundred published articles have tried to explore the relationship between income inequality and health. This indicates that it is quite hard to uncover this relationship particularly because of the two-way relationship between these two variables. Three mechanisms have been used in literature to associate income inequality and health. Absolute income hypothesis postulates that there is a nonlinear relationship between the two variables and this is present across countries but also exists within countries (Deaton, 2003; Leigh *et.al.,* 2009). The relative income hypothesis suggests that an individual's relative position in society can be seen as chronic stress which later translates to an unhealthy life (Leigh *et.al.*, 2009). The third mechanism is through societal effects because the effect of a rise in crime not only leads to higher death rates but also to increases in levels of stress which tend to worsen heath conditions. The two main indicators used in these studies for health are mortality rates and life expectancy while for income inequality Gini coefficient is the main variable but also 90/10 ratio, 50/10 ratio, Robin Hood Index etc. have been used. The empirical evidence shows no negative effect of inequality on health among rich countries in europe (Lorant *et.al*, 2001; Gerdtham and Johannesson, 2004; Regidor *et al*, 1997) while for U.S there is consistent evidence for a negative relationship (Lynch *et.al*, 2004).

Although positive correlation between education and income is well established in the literature the relationship between income inequality and education is unclear. The rise in wage inequality encourages investment in education, however, according to intergenerational theory rising income inequality may affect resources that households have to finance education. Several studies document the relationship between income inequality and education. Acemoglu and Pischke (2001) examine the effect of distribution in wages on education and find that an increase in income is related with a higher chance of being in college. Checchi (2003) results show a negative correlation between income inequality and secondary enrolment. His results support the idea of poor families finding it hard to access education.

The relationship between income inequality and happiness rests in the idea that an individual's utility not only depends on his own income but also on his relative position in society. Empirical studies measure happiness through survey responses while inequality is usually measured through Gini coefficient as well as alternative measures such as Theil, Atkinson or Stark Index. For

European countries Senik (2006) and for Germany individually Schwarze and Harpfer (2007) find inequality to have a negative effect on life satisfaction. The former study shows that inequality is negative for old European countries while positive for the post transition economies and U.S. The latter study decomposed post-government income inequality into pre-government inequality and redistribution. Pre-government income inequality affects happiness regardless of separate income levels suggesting that individuals are disinclined towards inequality. Moreover, the extent of redistribution depends on pre-government income inequality and the incomplete effect of pre-government income inequality on life satisfaction/happiness establishes weak support for inequality aversion. The overall literature on this topic suggests that the negative effect of inequality on happiness depends critically on country mobility, political preferences and age.

A strand of literature looks at income inequality being the major cause of crime. The literature suggests that with income inequality the gap between rich and the poor widens encouraging people to commit more crimes. The people at bottom of income distribution face lower opportunity cost in terms of engaging in criminal activities since they have little to lose. The positive relationship between inequality and crime is mostly found in cross sectional studies. A lot of literature (see, e.g., Fajnzylber, 2002a; 2002b) has criticized their findings since these cross-sectional studies do not control for unobserved heterogeneity across countries and their results suffer from bias (Kelly 2000; Ehrlich, 1973; Brush, 2007). Moreover; studies that combine cross sectional data with time series information produce more mixed results. Nilsson (2004) looks at Sweden for a period of 1973-2000 and Brush (2007) use data on county level for a period of 1994-2000. Both studies show that relationship between inequality and crime is not robust after controlling for fixed effects. Fajnzylber (2000) Choe (2008) and Machin and Meghir (2004) are contrary to the former studies and show that inequality is a very strong determinant of crime after controlling for unobserved heterogeneity across countries. Apart from economic underpinning for the relationship between crime and income inequality studies from other disciplines have also seen Inequality as being indirectly related to sociological factors which contribute in increasing crime. Merton's (1938) strain theory argues that individuals at bottom of the social structure feel frustrated by not being able to achieve the material attributes of success. The higher the inequality; the higher is the frustration and the probability to become alienated from the society which tends to induce criminal behaviour. Social disorganisation theory (1942) suggests that crime occurs when ties of social control are weakened. The factors that account for such weakening are poverty, racial heterogeneity, residential mobility and family instability. In this case inequality causes crime by being indirectly associated with poverty.

1.3 Contribution of this Thesis

The survey on both income inequality and crime carried out above shows that both variables have been rigorously studied in the literature. However; this thesis contributes to the existing literature in several ways which are discussed further. Chapter 2 of this thesis revisits the wellknown median voter theory by looking at the relationship between income inequality and social transfers in a democratic setting. According to Meltzer and Richard (1981) in unequal societies the spread of franchise extends political power to poor in society which encourages implementation of greater redistribution. However; this chapter shows that the fundamental hypothesis may not be true in every situation. It is seen that the way democracies behave depends on the way democracies are born. If the elites are very powerful and influential democracies may not be in favour of higher redistribution (Acemoglu, Ticchi & Vindigni, 2011).

There exists a two-way relationship between income inequality and social transfers as well as democracy and social transfers (Aidt and Jensen, 2013). By applying valid instruments for democracy (threat of revolution) and income inequality (unionisation) this chapter finds that high inequality (measured by top income shares) may not positively affect the size or composition of government spending in a democratic environment. Thus, this study's results are in sharp contrast to results put forward by median voter theory.

Chapter 3 and 4 of this thesis look at development of crime considering the macro-economic variables discussed above and highlighting their contribution within different contexts. The economic theory of crime over the years has extended its dimension by including social and demographic characteristics. However; almost entire economic literature has neglected the role of addiction as being an important predictor of crime. It has been completely ignored in economic literature. Alcohol and drug intoxication lower self-control and fosters aggression, violence and madness as it removes inhibitions (Uihlein, 1994; Bartholow *et.al*., 2012), has weakening effects on self-awareness (Hull, 1981), and acts as a mediator of violent crime (Felson *et al*., 2008). With a novel perspective the third chapter using a simple model of crime shows that alcohol consumption and drugs along with deterrence are important predictors of crime.

The fourth chapter of this theses is built on the foundations of rational choice of crime. As per economic theory and enormous literature on crime, income inequality and deterrence are significant determinants of crime rates. Evidence on criminality and delinquency in europe is rare. Several studies address criminal behaviour in context of U.S. but little is known about

crime trends in europe. An underlying reason for this is the unavailability of crime data. Most of the data on crime covering a long-time period is for homicides. Homicides although under the category of violent crime occurs quite infrequently compared to other crimes such as assault, rape and robberies. It is not a good proxy to understand the crime trends across countries (Buonanno, 2014). To overcome this problem this chapter uses aggregate measures of crime. Differences in crime rates are subject to many different factors such as cultural and legal practices. With the intention of making crime rates as comparable as possible across countries this study collects data on homicide rate, violent and property crime from several historical archives for last two centuries. Most of the literature that has looked at relative deprivation and deterrence are cross sectional or within country studies for post 1960 period when data is easily available (see, e.g., Kelly, 2000; Ehrlich, 1973). To advance this literature further this study uses panel data for 17 OECD countries for a period of 1800-2016. The main finding of this chapter is that inequality and deterrence are indeed significant predictors of both violent and property crime.

This thesis constructs data for eight variables for a period of 1800-2016 for threat of revolution, homicide, violent crime, property crime, deterrence, capital punishment, alcohol consumption and drug abuse. It is collected from statistical yearbooks of different countries and other historical archives as mentioned in the appendices. Estimating parameters using an extensive period reduces the problem of bias present in smaller samples. Fixed effect estimator becomes more consistent and the bias in IV based parameter is reduced (Davidson and Mackinnon, 2006). The tests of over identifying restrictions also fail to reject the null hypotheses often due to size distortions in small samples (Murray, 2006). Moreover; two centuries data also help in identifying different economic cycles thus giving lots of identifying variation in data.

1.4. Structure of the Thesis

The thesis is a collection of three essays on income inequality and crime and are organised as follows. Chapter two tests the median voter theory logic using top income shares as measures of inequality for a period of 1860-2013 using 20 OECD countries. The third chapter examines the effect of alcohol consumption, drug abuse and deterrence on homicides using a simple model of self-control for a period of 1800-2016 using 14 OECD countries. Fourth chapter studies over the last two centuries for 17 OECD countries whether inequality and deterrence have a strong effect on violent and property crime.

References

Acemoglu, D., & Pischke, J. S. (2001). Changes in the wage structure, family income, and children's education. *European Economic Review*, *45*(4-6), 890-904.

Acemoglu, D., Ticchi, D., & Vindigni, A. (2011). Emergence and persistence of inefficient states. *Journal of the European Economic Association*, *9*(2), 177-208.

Aidt, T. S., & Jensen, P. S. (2013). Democratization and the size of government: evidence from the long 19th century. *Public Choice*, *157*(3-4), 511-542.

Bartholow, B. D., Henry, E. A., Lust, S. A., Saults, J. S. and Wood, P. K. (2012). Alcohol effects on performance monitoring and adjustment: Affect modulation and impairment of evaluative cognitive control. *Journal of Abnormal Psychology*, 121(1), 173-86. Becker, G. S. (1968). Crime and punishment: An economic approach. In *The economic dimensions of crime* (pp. 13-68). Palgrave Macmillan, London.

Brush, J. (2007). Does income inequality lead to more crime? A comparison of cross-sectional and time-series analyses of United States counties. *Economic letters*, *96*(2), 264-268.

Buonanno, P., Drago, F., Galbiati, R., & Vertova, P. (2014). How much should we trust crime statistics? A comparison between EU and US. *European Journal of Law and Economics*, 1-15.

Case, A. C., & Katz, L. F. (1991). *The company you keep: The effects of family and neighborhood on disadvantaged youths* (No. w3705). National Bureau of Economic Research.

Chalfin, A., & McCrary, J. (2017). Criminal deterrence: A review of the literature. *Journal of Economic Literature*, *55*(1), 5-48.

Checchi, D. (2003). Inequality in incomes and access to education: a cross-country analysis (1960–95). *Labour*, *17*(2), 153-201.

Choe, J. (2008). Income inequality and crime in the United States. *Economics Letters*, *101*(1), 31-33.

Deaton, A. (2003). Health, inequality, and economic development. *Journal of Economic Literature*, *41*(1), 113-158.

Donohue III, J. J., & Levitt, S. D. (2001). The impact of legalized abortion on crime. *The Quarterly Journal of Economics*, *116*(2), 379-420.

Ehrlich, I. (1972). The deterrent effect of criminal law enforcement. *The Journal of Legal Studies*, *1*(2), 259-276.

Ehrlich, I. (1973). Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy*, *81*(3), 521-565.

Entorf, H., & Spengler, H. (2002). *Crime in europe: causes and consequences*. Springer Science & Business Media.

Fajnzylber, P., Lederman, D., & Loayza, N. (2002). What causes violent crime?. *European Economic Review*, *46*(7), 1323-1357.

Fajnzylber, Pablo, Daniel Lederman, and Norman Loayza. "Inequality and violent crime." *The Journal of Law and Economics* 45, no. 1 (2002): 1-39.

Felson, R., Savolainen, J., Aaltonen, M. and Moustgaard, H. (2008). Is the association between alcohol use and delinquency causal or spurious? *Criminology*, 46(3), 785-808. François, A., Magni-Berton, R., & Weill, L. (2014). Abortion and crime: Cross-country evidence from europe. *International Review of Law and Economics*, *40*, 24-35.

Freeman, R. B. (1991). *Crime and the employment of disadvantaged youths* (No. w3875).

National Bureau of Economic Research.
Freeman, R. B. (1996). Why do so many young American men commit crimes and what might we do about it?. *Journal of Economic perspectives*, *10*(1), 25-42.
Gerdtham, U. G., & Johannesson, M. (2004). Absolute income, relative income, income inequality, and mortality. *Journal of Human Resources*, *39*(1), 228-247.
Glaeser, E. L., & Sacerdote, B. (1999). Why is there more crime in cities?. *Journal of Political Economy*, *107*(S6), S225-S258.
Glaeser, E. L., Sacerdote, B., & Scheinkman, J. A. (1996). Crime and social interactions. *The Quarterly Journal of Economics*, *111*(2), 507-548.
De Haan, W. (2008). Violence as an essentially contested concept. In *Violence in europe* (pp. 27-40). Springer, New York, NY.
Hull, J. G. (1981). A self-awareness model of the causes and effects of alcohol consumption. *Journal of Abnormal Psycholog*y, 90(6), 586-600.
Kelly, M. (2000). Inequality and crime. *Review of Economics and Statistics*, *82*(4), 530-539.
Leigh, A., Jencks, C., & Smeeding, T. M. (2009). Health and economic inequality. *The Oxford Handbook of Economic Inequality*, 384-405.
Levitt, S. D. (1996). The effect of prison population size on crime rates: Evidence from prison overcrowding litigation. *The Quarterly Journal of Economics*, *111*(2), 319-351.
Lochner, L. (1999). Education, work, and crime: theory and evidence.
Lochner, L., & Moretti, E. (2004). The effect of education on crime: Evidence from prison inmates, arrests, and self-reports. *American Economic Review*, *94*(1), 155-189.
Lorant, V., Thomas, I., Deliège, D., & Tonglet, R. (2001). Deprivation and mortality: the implications of spatial autocorrelation for health resources allocation. *Social Science & Medicine*, *53*(12), 1711-1719.
Lynch, J., Smith, G. D., Harper, S. A., Hillemeier, M., Ross, N., Kaplan, G. A., & Wolfson, M. (2004). Is income inequality a determinant of population health? Part 1. A systematic review. *The Milbank Quarterly*, *82*(1), 5-99.
Machin, S., & Meghir, C. (2004). Crime and economic incentives. *Journal of Human Resources*, *39*(4), 958-979.
Meltzer, A. H., & Richard, S. F. (1981). A rational theory of the size of government. *Journal of Political Economy*, *89*(5), 914-927.
Merton, R. K. (1938). Social structure and anomie. *American Sociological Review*, *3*(5), 672682.
Murray, M. P. (2006). Avoiding invalid instruments and coping with weak instruments. *Journal of Economic Perspectives*, *20*(4), 111-132.
Nilsson, A. (2004). *Income inequality and crime: The case of Sweden* (No. 2004: 6). Working Paper, IFAU-Institute for Labour Market Policy Evaluation.
Regidor, E., Navarro, P., Dominguez, V., & Rodriguez, C. (1997). Inequalities in income and long term disability in Spain: analysis of recent hypotheses using cross sectional study based on individual data. *BMJ*, *315*(7116), 1130-1135.
Schwarze, J., & Härpfer, M. (2007). Are people inequality averse, and do they prefer redistribution by the state?: evidence from german longitudinal data on life satisfaction. *The Journal of Socio-Economics*, *36*(2), 233-249.

Senik, C. (2006). Ambition and Jealousy. Income Interaction in the Old europe versus the New europe and the United States. *Revue économique*, *57*(3), 645-653.
Bartholow, B. D., Henry, E. A., Lust, S. A., Saults, J. S. and Wood, P. K. (2012). Alcohol effects on performance monitoring and adjustment: Affect modulation and impairment of evaluative cognitive control. *Journal of Abnormal Psychology*, 121(1), 173-86.
Spelman, W. (2000). The limited importance of prison expansion. *The Crime Drop in America*, *97*, 123-125.
Spelman, W. (2005). Jobs or jails? The crime drop in Texas. *Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management*, *24*(1), 133-165.
Spelman, W. (2000). What recent studies do (and don't) tell us about imprisonment and crime. *Crime and Justice*, *27*, 419-494.
Uihlein, C. (1994). Drugs and alcohol. In Hirschi, T. and Cottgredson, M. R. (eds), *The Generality of Deviance*, (pp. 149–157). New Brunswick, NJ: Transaction Publishers
Zenou, Y. (2003). The spatial aspects of crime. *Journal of the European Economic Association*, *1*(2-3), 459-467.

Chapter 2

Can Income Inequality and Democracy explain Social Transfers?

Abstract

The vast literature on political economy suggests that franchise extension results in higher redistribution of social transfers. This belief is embedded in the logic that when there is income inequality the spread of franchise extends political power to the poorer people in the society and encourages the implementations of pro poor policies. Thus, democratization leads to higher taxes and greater redistribution. By using historical data (1860-2013) for 20 OECD countries and two different measures of democracy (voter participation & polity score) this study tests the redistributive model's logic. The results of this study reveal that the fundamental hypothesis derived from the redistributive logic is unable to predict government redistributive spending. Unequal democracies (with high inequality) rather than increasing social transfers actually tend to reduce it.

2.1 Introduction

The enormous literature of political economy suggests that franchise extension leads to greater government redistribution. This notion is rooted in an important model of voting over redistribution established by Meltzer and Richard (1981) (henceforth M&R). The model suggests that in unequal societies the gap between incomes of median and mean voters is large. Thus, with franchise extension the median voter is able to exercise more political pressure for redistributive government transfers in unequal societies. This occurs because the benefits to median voter of redistributive transfers offsets the costs of funding them.

This study revisits the M&R hypothesis and tests its efficacy by assessing the impact of income inequality and democracy together on government redistributive spending. The analysis looks at both size and composition of government spending by incorporating two different measures of democracy (polity score and voter turnout) of 20 OECD countries for a period of 1860-2013. We find that a) democracy has a positive effect on social spending; (b) inequality has a positive effect on social spending but; c) the interaction between democracy and inequality has no positive effect rather its effect is robustly negative. Particular attention is given to the interaction between inequality and democracy since the preferences of the median voter are taken into consideration in the political process under majority voting. As measure of inequality incorporated in this study are top income shares (0.1%, 1% and 5%), interaction term suggests, that as the rich get more distant from low and middle-income citizens it erodes support for social spending for poor and disadvantaged. Hence; in contrast to the M&R model the results show that high inequality may not lead to high social transfers in a democratic environment.

Robert Dahl (1971, p.1) states "I assume that a key characteristic of a democracy is the continued responsiveness of the government to the preferences of its citizens, considered as political equals." However, there are multiple reasons to believe that preferences are not treated equally by policymakers. Wealthier citizens in contrast to poor citizens are quite likely to have more political awareness, a high voter turnout, contacts and access to politicians and contribute heavily to political campaigns. So, while money may not buy votes money is able to buy access tying voting to lobbying (Assolabehere *et.al,* 2003). These differences seem to generate larger responses from political representatives towards the wealthy. This subsequently does not lead to higher redistribution because low income groups do not have political power, voice and access to legitimize these rights.

This study is distinct from previous studies (see, e.g., Ansell and Samuels, 2010; Mulligan and Gill, 2004; Schwabish *et.al*, 2006; Shelton, 2007) which have addressed the same question but have not corrected for the problem of endogeneity between social transfers and income

inequality. The welfare state is a complex construct which consists of different social programmes that have different objectives and different effects on the distribution of pre and post government incomes. The initial or first order effect of the welfare state on inequality is negative (Whitford, 2008; Immervoll *et al*., 2005). As long as social transfers are redistributive i.e. they redistribute from the rich to poor they will tend to reduce inequality in post transfer incomes. Housing benefits and income guarantees have huge inequality reducing effect. Moreover, social benefits are also associated with behavioral second-order effects and affect pre- government income inequality. Standard consumer theory suggests that transfer payments create disincentives to work and reduce labor supply; leading to a rise in pre- government income inequality. Average labor elasticities reduce with income (Aaberge and Colombino, 2006). In contrast the median voter model suggests that if income distribution is skewed to the right median voter will demand higher social transfers (M&R, 1981). It is, therefore, vital to address the reverse causality issue between income inequality and size of government. Unionisation has long been associated with distribution of income and is considered to be a valid instrument (Islam, Madsen and Doucouliagos, 2016). Unions are considered to be effective in raising minimum wage which helps in reducing the dispersion of earnings and have a strong redistributive effect. A strong union movement can offer groundwork for electoral activities and offset impact of power and money in campaigns. By direct bargaining and lobbying unions strive to standardise rates across institutions. This helps in improving income of low skilled groups and restrain income of people in the top decile. According to Slichter, Healy and Livernash (1963, p.606) "wage standardization within an industry or local product market is the most widely heralded union wage policy"

Size of government and franchise extension are motivated by the same unobserved country specific factors (Aidt and Jensen, 2013). Moreover, they propose an identification strategy that uses threat of revolution as a time varying instrument for democracy and have constructed it for a period of 1820 to 1938. As the time period in this study is from 1860-2013 we have extended the instrument till 2013 by using (Tilly, 1993; 2004; Encyclopaedia Britannica, 1911; 2009). With less revolutionary events happening in the second half of the twentieth century; Aidt and Jensen (2014, p.13) suggest that franchise extensions in country A can be used as an indirect channel through which information about revolutionary threats can diffuse to country B and be a cause of pre-emptive democratisation.

Linguistically weighted threat of revolution hypothesis suggests that elite offers voting rights to avoid revolution. Revolutionary shocks in neighbouring countries make the elites aware of the

danger of revolution and increases the possibility of pre-emptive suffrage reform. The elite in a country extend the franchise to the broader population when they perceive the risk to be genuinely real. In this perspective; democratisation is pre-emptive democratisation stimulated by threat perceptions.

Russian Revolution in 1917 played a vital role for the reforms occurring at the end of World War I. In her argument of the outcome of war on suffrage reform in Western europe, Collier remarks that 'heightened working-class pressure [in Germany, Belgium, Sweden and Finland] was surely activated as much by the Russian Revolution as by World War I. From the side of the working class, what perhaps changed most was not the greater force of its pro-democratic agitation, but the revolutionary rather than the democratic example of the Russian Revolution' (1999, p. 78). Similarly, Weyland (2010) opposes that fear of bolshevism triggered pre-emptive suffrage reforms in Britain, Sweden, Germany and Finland in the years 1917-19. Another instance is the impact that European revolutions (1848) had in Denmark and Netherlands. During 1830 and 1840 in Denmark the fast-budding bourgeoisie demanded a share in government. This did not materialize until news of the bloody revolutions in France and Germany in 1848 and the attempt by Schleswig and Holstein got combined into the German Confederation being spread to Copenhagen. The King then surrendered to reform demands and granted franchise extension (Collier, 1999).

Using a long panel data set and identification strategies we show that higher inequality in a democratic country may not lead to higher redistribution of government spending. This finding is robust to all three measures of inequality with different model specifications and remains consistent in instrumental regressions.

The rest of the paper is organized as follows. Section 2.2 reviews the literature of the effect of inequality and democracy on social transfers. Section 2.3 presents the empirical model and discusses the identification strategies for both endogenous variables. Data and empirical results are analysed in section 2.4 and 2.5 respectively while extensions and robustness checks are presented in section 2.6. The final section brings all the issues together and discusses the implications of the results found.

2.2. Literature Review

This section reviews literature on the effect of democracy, inequality and their interaction on size of government. The emphasis is on both empirical and theoretical findings that have made a significant contribution in this line of study.

2.2.1 Democracy and Social Transfers

During the twentieth century social transfers are greatly increasing and one of the factors that has contributed to this rise is Democratisation. There are several studies which claim that democracies improve the welfare of the low-income class (see, e.g., Bueno de Mesquita *et al*, 2003; Lake and Baum, 2001; McGuire, 2001; Moon and Dixon, 1985; Przeworski *et al*., 2000; Siegle *et.al*., 2004; Zweifel and Navia, 2000) and they also produce more public goods and redistribute more compared to non-democratic countries.

Lindert (1994) uses panel data consisting of European and North American countries covering a period from 1880-1930. He summarizes his main finding in his book by stating that "There was so little social spending of any kind before the twentieth century mainly because political voice was so restricted" (Lindert, 2004, p.22). Many studies are consistent with Lindert's finding. Huber and Stephens (2012) construct a panel data set for a period of 1970-2000 for Latin America. They measure democracy by the cumulative years a country has been democratic since 1945. The authors find a positive connection between different types of social spending and democracy. Persson and Tabellini (2003) use an extensive set of countries in a panel setup and find evidence that democracy when measured by the Gastil index and Polity score has positive effect on welfare spending and social security spending as percentage of GDP. Acemoglu *et.al* (2013) use a panel of 186 countries from 1960-2010 and construct a dichotomous measure of democracy to reduce the measurement error. They find that democracy increases taxation and government revenues (as percentage of GDP).

Few studies have accounted for female enfranchisement which is a particular measure of democracy. By using historical data from six Western European countries for the period 1869–1960, Aidt and Dallal (2008) find that due to women suffrage social spending out of GDP increase between 0.6% & 1.2% in the short run and three to eight times larger in the long run. Lott and Kenny (1999) show that government expenditure per capita increases by 14% and 28% in the year of female enfranchisement and over the next 45 years respectively. Also, when women join the labour force there is an increase in demand for social services as they need to shift part of their responsibilities e.g. childcare to the state (Cavalcanti and Tavares, 2006). Lindert (1994; 2004, Chap. 7) shows that women's suffrage plays an important role in formation of new social programs in western europe and US prior to World War II, thus paving the way for the expansion of social services that followed in the latter part of the century. Aidt and Jensen (2013) study on the relationship between democracy and social spending is the only one, to our knowledge, that uses an identification strategy to correct the problem of democracy

being endogenous. They use threat of revolutions, measured by revolutionary events in other countries, as reliable instrument for democracy. For a panel of Western European countries between 1820 and 1913, their results show that democracy has a positive impact on government spending relative to GDP. In contrast Mulligan, Gil and Sala-i-Martin (2004) finds that government type (democracy or non-democracy) has no impact on social security expenditures while they control for income level, income inequality and demographics. They use Polity IV measure of democracy which correlates highly with the Gastil index for political rights.

2.2.2 Inequality and Social Transfers

First Hypothesis: Higher Inequality leads to higher Social Transfers

The effect of inequality on social transfers is very critical and there are numerous studies that have discussed the impact of income inequality on social transfers. M&R (1981) suggests that the higher the skewness of income distribution the higher is the redistribution in democratic societies. The amount of redistribution depends on the relationship between mean and median voter's income. When voters have complete information, they show that amount of redistribution is determined by median voter under majority rule. The median voter is the critical voter in determining the income redistributed. Before the spread of the franchise (i.e. in an autocratic regime) the median voter may belong to the rich or upper class but with widespread enfranchisement in the nineteenth and twentieth centuries the number of low income voters has increased. This shifts down the position of median voter and consequently he is able to exert political pressure for redistribution[1]. Hence, in comparison with authoritarian regimes democratic governments are likely to redistribute more.

Theoretical studies on the link between inequality and growth use mechanism of impact on social spending to explain their findings. Alesina and Rodrik (1994) and Persson and Tabellini (1994) in their theoretical growth models show that inequality increases redistribution which subsequently generates disincentives for investments and lowers growth in a country. The median voter is more inclined towards taxing the rich which inhibits growth. Although there is substantial evidence that finds democracy and redistribution move together (M&R, 1983; Tabellini 1992; Acemogolu and Robinson, 2006) there is evidence contrary to above findings.

Second Hypothesis: Higher Inequality leads to lower Social Transfers

[1] Milanovic (2000, p.2) shows that "When individuals are ordered according to their factor (or market) incomes, the median voter (the individual with the median level of income) will be, in more unequal societies, relatively poorer. His or her income will be lower in relation to mean income. If net transfers (government cash transfers minus direct taxes) are progressive, the more unequal is income distribution, the more the median voter has to gain through joint of taxes and transfers, and the more likely he or she is to vote for higher taxes and transfers. Based on the median-voter as decisive, more unequal societies will therefore choose greater redistribution."

The baseline of the median voter theory discussed above is affected by other factors that saturate its effects. Although the median voter desires redistribution but rich are very powerful and possess several advantages over poor in terms of money, organizational resources and social networks. This line of study investigates the redistributive impacts of democratic countries which emphasize on lobbying and power of rich groups who can provide resources to the political parties in exchange of favours. The studies of interest groups go back to (Olson, 1965; Becker, 1983). The influential and the powerful groups can cause a disproportionate allocation of government spending in democracy which results in social spending favouring the rich (Stigler, 1970; Justman and Gradstein, 1999; Lizzeri and Persico, 2004; Ross, 2006).

(Ross, 2006) argues that although social services are funded at higher levels under democracy compared to non-democracies (Kaufman and Segura-Ubiergo, 2001); these funds do not reach the poor in societies nor does it produce better social outcomes. Despite democracies spending more money on health and education benefits are directed towards upper middle and rich class. (Rodriguez, 2004) interprets rise in inequality as transferring resources from poor and impoverished to the rich. If such a transfer results in an increase in the access of the political power by the elite then it also leads to a reduction in the ability of the poor to control the political process. He notes that enhancement in the political power of rich deviates resources from useful or productive activities to unproductive rent-seeking activities. The poor are unable to expropriate rich because they have sufficient power to keep a sizable portion of the pie with themselves (Alesina and Perotti, 1994; 1996). There is considerable evidence that elite participate more in politics in developed countries both in terms of time and money[2]. The elite have mobilizational advantages compared to poor in terms of money, organisational resources and social networks which gets them closer to those who are in power.

There are several papers that look at how social mobility can influence redistribution. Benabou and Ok (2001) show in their paper that under the possibility of upward mobility hypothesis people with income below the mean may oppose redistributive policies as they may expect their incomes to be above the mean in the future. These individuals who oppose redistribution can be the majority of a country. Similarly, Alesina and La Ferrara (2005) take into account the general mobility along with the individual factors that affect demand for redistribution. Their findings suggest that people who believe attaining a higher level in life is solely due to hard work and

[2] (Rosenstone and Hansen 1993, p 43–44) study political mobilization in the United States. They confirm the finding that rich Americans are more likely than the poor to participate in political activities and also find that

merit are not prone towards redistributive policies unlike those who believe that opportunities are unequal.

2.2.3 The effect of Interaction between democracy and inequality on Social Transfers

Boix (2003, p.173) suggests that "The presence of sharp income differential generates strong redistributive pressures that should lead to very high taxes and transfers" but notes that we should observe this effect only in democracies. This means that main approach for the median voter model lies in the interaction between democracy and inequality as the model works under the assumption of majority voting.

There are very few studies that have incorporated the interaction between inequality and democracy in their model. Shelton (2007), as an exception, covers over 100 countries from 1970-2000 and finds that there is a strong positive effect of political rights and inequality on social transfers but interaction term between inequality and democracy is significantly negative. This result indicates that unequal democracies rather than increasing social spending actually reduce it. The author reasons that if a country presents with high inequality enfranchising additional poor voters does not improve income of the median voter as it has very little impact on redistribution because the median voter is already poor. In contrast if there is low inequality enfranchising additional poor voters will shift the median voter from upper middle class to lower middle class; eventually leading to higher taxes and redistribution. Mulligan and Gill (2002) hold constant population over age 65 and GDP per capita and find no evidence that democratic governments spend a larger share of GDP on social programs. Studies by Albertus & Menaldo (2014) and Ansell and Samuel (2010) suggests that the relationship between democracy and size of government depends on the way democracies are born. Under autocracy if the rights of elite are not protected and there is a risk of expropriation of their assets economic elites prefer to transition to democracy. They bargain for a transition on

''the prosperous are two and a half times more likely than the poor to attempt to influence how others vote and over ten times more likely to contribute money to campaigns''

their own terms and use their influence to implement policies after the transition that are favourable towards them. This results in the elites gaming democracy which lowers redistribution. If the elite are politically weak during a transition such as when there is revolutionary pressure or if there is a lower probability of the elite being able to inscribe a constitution after the transition, then there is a positive relation between democracies and redistribution. This is because the masses cause the change to occur (from autocracy to

democracy) and become quite dominant. The political parties represent masses and construct polices in favour of them; thereby increasing redistribution. This idea proposes that democracy is a response to the demands of the growing economic groups. If wealthy trigger democratisation it will lead to lower redistribution and results are reversed in the case with masses.

Spain is a good example of this democratic transition in 1970s and illustrates the above point. Albertus & Menaldo states that "Because the social bases of the left had been undermined by changes in Spain's social structure under Franco, conservative elites became convinced that democracy would not threaten their property rights or safety, inducing them to initiate moves toward democracy in 1976-77" (2014, p.581). Similarly, in Latin America the powerful elites accepted democracy when the conservative parties safeguarded their interest. In western europe during the nineteenth and twentieth century democratisation was intentionally kept slow to pacify the fears of the elite regarding the major political change (Dahl, 1971; Ziblatt, 2006). Acemoglu and Robinson (2008) show that although democratisation allocates *de jure* power to the poorer people of the society, the elite can offset this by increasing their *de facto* power. If the elite's de facto power persists after democratisation they can capture policy making and block redistribution even after the transition. The elite are smaller in number and gain higher expected returns from influencing politics therefore, have a comparative advantage in investing in their *de facto* power (Mosca, 1939; Olson, 1965). To avoid the cost of redistribution elite tends to invest more in their *de facto* power under democracy and capture the political system of the country diverting the resources in their own interests. The rich find it beneficial to incur this cost compared to cost of higher redistribution directed towards the poor.

Acemoglu, Ticchi & Vindigni (2011) present a theory in which states that have an inefficient structure can be used to capture a democracy and the rich can make use of patronage politics. Democracy in such cases can be associated with higher taxes which are used to provide for and benefit the wealthy class in society. An inefficient state is used as an instrument by the elite to form a coalition between themselves and bureaucrats. This may lead to higher taxes to make payments to state employees with no improvement on redistribution and public goods provision. Larcinese (2011) documents that introduction of democratization in 1912 in Italy gave voting power to a large number of people but has no effect on the representation of parties in the legislature; it is captured by old elites. In the south enfranchisement has a negative impact on redistribution mainly in most unequal districts. The author suggests that in some instances inequality can assist the elite in capturing an economy rather than promoting redistribution.

Similarly, Berlinski and Dewan (2011) present evidence that after the 1868 British Reform there is no impact on representation even though there is a significant expansion in the voting rights. If elite are able to block democracies that can be redistributive then we will see no association between democracies and redistribution (Acemoglu *et.al*., 2013).

2.3. The Model

The following specification is used to estimate the impact of inequality and democracy on social transfers. This is a simple OLS regression for twenty OECD countries for a period of 1860-2013.

$$TR_{it} = \propto + \beta_1 Iq_{it} + \beta_2 demo_{it} + \beta_3 demo_{it} * Iq_{it} + z_{it} + \gamma_i + \mu_t + \epsilon_{it}, \qquad (1)$$

where TR is social transfers (percentage of GDP), Iq is income inequality (measured by top income shares) and demo is democracy (measured by voter participation and polity score), z_{it} is a vector of control variables, γ_i is country fixed effect, μ_t is the time fixed effect and ϵ_{it} is an error term. Time and country dummies are incorporated to control for variations caused by characteristics that are common across variables but vary over time and country.

The following control variables are included in vector z_{it}: trade openness, real GDP per capita (Y/Pop) and fraction of population greater than 65. Trade openness influences social transfers positively under the compensation hypothesis (Rodrik, 1998). Countries that are more open to trade also direct taxes in providing more safety nets and protection for workers.

A rise in GDP per capita raises the share of income given to taxes and social transfers and is assumed to have a positive relation with social transfers; an idea known as Wagner's law. The elderly population is a very robust determinant of social transfers. The greater the elderly population the higher will be the demand of government spending. Other things equal; a society with more aged people spends a greater portion of GDP on public pensions and even a greater portion on total social transfers (Lindert, 2004).

2.3.1 Identification Strategy

It is quite essential to instrument both variables of interest specifically inequality and democracy as there is a very high probability of reverse causality/feedback effect from the dependent variable. To overcome the problem of getting inconsistent estimates from OLS regression, due to endogeneity, valid instruments are used.

2.3.1.1 Instrument for Inequality

Unionisation has long been associated with distribution of income and is used as an instrument for inequality in this study. It is considered to be a valid instrument (Islam, Madsen and

Doucouliagos, 2016) because of substantial impact it has on inequality. It improves the bargaining power of labour consequently increasing their labour income share and reducing inequality. Prior to 1970s it was a wide held view that unions tend to increase wage inequality (Friedman, 1962; Rees, 1962; Lewis, 1963). Although there are studies that support this positive relation between unionisation and inequality; contemporary literature is doubtful about outcomes of former studies.

The earnings inequality for male workers in U.S rose with a simultaneous decline in union density in 1980s. The study by Freeman (1991) documents this inverse association and estimates the effect of unionism on inequality. Between 1978 and 1988 standard deviation of log of earnings increased from 0.49 to 0.52 and 0.44 to 0.50 for males under the age group of 25-64 and 25-34 respectively. Simultaneously union density fell during the same period. The organised workforce in the non-agricultural sector fell considerably from (29 to 16) % between 1969 and 1989. This decline was prevalent in private sector as well. Union density fell in all 2 digits and 3 digits SIC code industries and all blue-collar occupations. The union membership in 1989 was only 12% of the private sector workers which was similar to that in 1920s. The author is of the view that declining unionisation is a supporting player in the story of rise in inequality. Card (2001) supports this finding and shows that drop in unionization in 1980s explains 20% increase in wage inequality. Similar results were found by (Gosling and Machlin, 1995).

Union wage policies are in favour of standardised rates defined as uniform piece among similarly skilled employees across establishments and a range of rates in a particular occupational class within establishments. When firms contest in an identical market both employers and employees favour standardised rates. The firms do not desire union contracts that are more expensive than other firms and standardization of union contracts also encourages collective behaviour on behalf of the employees. In principle uniformity across firms “takes wages out of competition” which helps in lowering dispersion of wages. A study by Freeman (1980) examines the effect of trade unionism on dispersion of wages among male employees in U.S. He finds that union standardised rate of wages reduces inequality of wages for organised employees for both within and across establishments. It also narrows the white-collar/ bluecollar differential within establishments.

Prior to unionisation different wages were paid to individuals based not on the nature of the job but on the judgements perceived by the foremen about the worker’s characteristics. With unionisation there is equalisation of pay and reduction of personal differences among similarly skilled workers within institutions. According to Slichter, Healy and Livernash (1963, p.606)

"the influence of unions has clearly been one of minimizing and eliminating judgement-based differences in pay for individuals employed on same job and of removing ability and performance judgements as a factor in individual pay for job performance."

Unionisation leads to compression of earnings both in unionised plants and also between firms (Freeman and Medoff, 1984). One reason is that threat of unionisation makes non-unionised firms match the wages and remuneration process of unionised firms. In many European OECD countries unions affect earnings standards and pay scales in non-unionised firms (Western and Rosenfeld, 2011).

Unions are considered to be very influential in raising minimum wage which compresses the distribution of earnings and have a very strong redistributive effect (Checchi and GarcíaPeñalosa, 2010 and Freeman, 1996). The goal of minimum wage is to redistribute earnings from high-paid to low-paid workers. Also, by increasing relative pay of the unskilled workers unions lower dispersion of wages between skilled and unskilled workers. This will lead to improved standard of living for low income group workers and limit tide of rising earnings inequality.

Unions support social democratic governments which implement policies that reduce inequality (Freeman and Medoff, 1984). A strong union movement can offer groundwork for electoral activities and offset impact of power and money in campaigns. This results in increasing voter participation rates and government policies get directed to a broader segment of the population; not just the elite. Unions contribute to organic solidarities which facilitate greater involvement in broader democratic politics.

Recent literature suggests that unionisation does not only affect the low and middle-income earners but can also influence income share of the top decile. At the macro level top income shares are affected by changes in lower part of income distribution (Volscho and Kelly, 2012; Bivens and Mishel, 2013). De-unionization weakens earnings for average- and lowincome workers and decreases their bargaining power which increases the incomes of corporate managers and shareholders. This explains the surge in the top 10 percent income share from 1980-2010 (Jaumotte and Buitron, 2015).

The exclusion restriction for this identification strategy is satisfied if unionisation affects social transfers only through inequality and is not driven by common factors across countries. To the best of my knowledge these conditions hold. However; if in an event unionisation affects social transfers the results will be biased in the direction opposite to our findings. It will generate an upward bias in the IV regression. Consequently, negative relation between inequality and social transfers is not driven by violation of exclusion restriction.

2.3.1.2. Instrument for Democracy

Aidt and Jensen (2013) emphasize that although controlling for country and time variations can rule out many contaminating factors; there is still a possibility of feedback effect between democracy and size of government as both variables can be driven by same factors. They use measure of threat of Revolution as an instrument for democracy in the 'size of government' equation. This instrument is highly correlated with democracy and is uncorrelated with time varying factors affecting the size of government. It only affects the size of government through the mechanism of democratization.

A very important question in political economics is why do the elite distribute their power to the broader segment of the population? This dilutes their own political standing and lose their own economic rents. The "threat of revolution hypothesis" proposes that the elite offers voting rights to avoid revolution (Acemoglu and Robinson, 2000; 2006). This hypothesis is based on the notion that revolutionary events abroad indicate shocks to information set of elite and prospective revolutionaries; by these two pathways suffrage reform is initiated (Aidt and Jensen, 2014).

Revolutionary shock originating from country A can be diffused to country B by the potential revolutionaries who believe after observing a successful revolution in country A that they will be successful too. People who are interested in a regime change are inspired and motivated by observing revolutionary events in other countries. The old incumbent elites who are in favour of the autocratic regime can evaluate threat of the domestic situation in their country. If this revolutionary shock becomes a credible threat in country B; it makes the elite abandon their power as well as extend voting rights. International diffusion of information on regime contention is one possible way through which threat of revolution can induce pre-emptive democratization.

In Great Britain when electoral reforms were introduced in 1832 Prime Minister Earl Grey said that "The principal of my reform is to prevent the necessity of revolution. I am reforming to preserve, not to overthrow" (Evans, 1983. p.212). Lee (1994) notes that if political power is extended from the elite to the broader segment of the population it is considered to be a success because threat of revolution and unrest is avoided. With electoral reforms of 1832 there was limited franchise depending on the property and wealth of the voters. This changed in 1867 when due to severe economic hardships and slump in business cycle there was an increase in the threat of violence. Lee notes that this threat of violence is a significant factor for instigating the 1867 Reform Act.

Similarly, in Germany democracy stared with 1848 revolution but institutional restrictions inhibited democratization. There was a three-class voting system and regime was controlled by landlords. After 1870s male suffrage was expanded to all those above 25 years of age but in the rural areas voting was still controlled by the landlords. The Weimar Republic in 1919 was the concluding development of democracy which occurred in response to the severe threat of social unrest and revolution generated by collapse of German armies on Western front (Gerschenkron, 1943 and Mommsen, 1981).

In Sweden democracy was introduced through a sequence of continuing franchise extensions starting in 1866 and universal male suffrage was initiated in 1909. Tilton argues that ‘‘neither [of the first two reform acts] passed without strong popular pressure; in 1866 crowds thronged around the chamber while the final vote was taken, and the 1909 reform was stimulated by a broad suffrage movement [and] a demonstration strike” (1974. p. 567). The third Reform in 1918 recognized universal suffrage without major restrictions. Collier explains that ‘‘it was only after the economic crisis of 1918 and ensuing worker protests for democracy led by the Social Democrats that the Reform Act was passed. Indeed, in November 1918 labour protests reached such a point as to be perceived as a revolutionary threat by Sweden’s Conservative party and upper classes’’ (1999. Chapter 3, p. 9). Tilton summarizes the consensus view of historians succinctly; ‘‘Swedish democracy had triumphed without a revolution—but not without the threat of a revolution’’ (1974. p. 568).

Revolutionary events are defined as “those instances when for a month or more at least two blocs of people backed by armed force and receiving support from a substantial part of the general population exercised control over important segments of the state organization” (Tilly, 2004. p. 73). The data constructed on threat of revolution in Aidt and Jensen (2014) is for a period of 1820-1938 and we extend it till year 2013. The data sources used to extend the threat of revolution data are (Tilly 1993; 2004; Todd, 1998; Hobsbawn; 1962) and supplemented with information from (Encyclopaedia Britannica, 1911; 2009).

As there are fewer revolutions in the second half of the twentieth century we use franchise extensions as an indirect measure of revolutionary threats. Aidt and Jensen (2014) propose that franchise extension in country A triggers a franchise extension in country B. The reason is that pre-emptive suffrage reform in country A alerts country B that they must act to escape a revolution. Major franchise extensions are considered to be major revolutionary events and are included in the threat of revolution data. The data on franchise extensions is constructed for a period of 1820-1938. We extend it to year 2013 by using (Flora et.al., 1983; Encyclopaedia

Britannica, 1911; 2009; Seymour and Frary, 1918). Major revolutionary events and franchise extensions are enclosed in appendix- B & C. The threat of revolution is constructed as follows:

$$TR_{it} = W_{ij}R_{jt}$$

R_{jt} is the number of major[3] revolutionary events in country j in year t and W_{ij} is the linguistic weight attached to the revolutionary event in country i for country j. As discussed above revolutionary shocks are diffusible and one channel of transmission is linguistic proximity. If there is common language between two countries it will increase the chance of diffusion of revolutionary event. Linguistic distance is used to define the weights.

Revolutionary events within a country are not included; these events can activate the diffusion process but are not a result of the process. Besides, the revolutionary events occurring in countries included in this sample; we have included the events occurring in Balkans and Russia.

2.4. Data and Trend

Social transfers (as percentage of GDP) measures the size of government expenditures. They are non-contributory, funded from tax revenues and are concentrated on low income groups. In late eighteenth century social transfers increase haltingly over a period of hundred years, accelerate between 1880 and World War II and boom till 1980s (Lindert 1994; 2004). After 1980s they tend to slow down. The most noticeable trend in social transfers is their rapid rise over the twentieth century; particularly the 1960s and 1970s. There are many different forces contributing to this rise which include: a) democratisation b) income inequality c) trade openness d) income per capita and e) population aging which are discussed below.

Democratisation is composed of two measures. One is the democratic index from (Vanhanen, 2003) which covers a period of 1810-2014. Lindert (1996) suggests that higher voter turnout tilts policies towards higher redistribution because voter turnout is more elastic towards redistribution amid low earning voters. The other is Polity IV measure of democracy which covers regime authority range on a 21-point scale. It lies between -10 (hereditary monarchy) and +10 (consolidated democracy). It covers all independent states and spans over a time period of 1800-2015. Polity IV measures the degree of democracy and autocracy separately and combines the two into one measure, “Polity2”, which entails both democratic and nondemocratic aspects. By merging these two different regime structures together does not remain a very sensitive index and is seen to bunch up at a few points (mostly-7 and +10). It

[3] Major revolutionary events are considered to be those which have an extensive coverage in Tilly (1993, 2004) and encyclopaedia Britannica (1911, 2009) and are likely to make an impact abroad.

fluctuates greatly with inconsistent electoral situations and does not measure anything which is permanent or durable (Glaeser, 2004). In addition, polity IV measurements do not consider the evolution of franchise extension; the account of extending the franchise from the very few to all adult citizens is ignored. This has caused severe inaccuracies. Schmidt (2016) notes that "According to Polity IV, the U.S has been a respectable institutionalized democracy since 1810. But that is a historical misrepresentation, since in early 19th century only a small proportion of adults in the United States were eligible to vote". Moreover, polity score is a product of six component measures that record qualities of executive recruitment, constraints on executive authority, political competition and institutionalized qualities of governing authority these are well explained in their manual (Marshall and Jaguers, 2007). It is difficult to code these components with consistency in particular circumstances and the extent of uniformity with which the overall score for a specific country in a given year is formed is questionable. There are inter-coder reliability tests conducted while forming the polity score which requires hands on training for coders. This suggests that all coders may not get the same accuracy in their results only by reading Polity's coding manual; leading to problem of conceptual validity-where key concepts may not be connected with real data (Coppedge *et.al*, 2011). Also, countries that have similar polity scores may have very different quality of democratic regimes because underlying components can vary between countries. Polity score is unable to capture this important difference. In essence reliability of indices is very low; countries with higher polity scores may not actually be more democratic. Moreover, Polity and Freedom House neglect citizen participation (Jaggers and Gurr, 1995; Freedom House, 2002). However, this is taken into account by voter participation and analyses how many voters participate in voting each year. Still, voter participation does not cover may other aspects of a democratic country. To avoid this problem of validity and reliability and to get a more precise measure for democracy we use Principle Component Analysis (PCA).

The statistical technique of PCA is used as data reduction method that identifies pattern which highlights the data's similarities and differences. It is useful when there is data on more than one variable which is correlated with one another; probably because these variables are determining the same concept. In this study PCA is applied on polity score and democratic index; they both measure evolution of democracy in a country over a period of time. With PCA correlated observed variables can be reduced to smaller number of uncorrelated variables called principal components; these account for most of the variance in observed variables. A principal component is a linear combination of optimally-weighted observed variables. The number of components extracted is equal to number of variables being used in the study. Before

conducting PCA data is standardized to a variance of one and each observed variable contributes only one unit of variance to the total variance in the data set. Therefore, total variance will always be equal to the number of variables in the analysis.

The correlation matrix is used to conduct PCA as variables measured here are on different scales. The components that are extracted divide this total variance and first principle component accounts for maximum amount of total variance in observed variables while second component accounts for remaining variability. For this study only first, principal component is used.

The score for each component is calculated by multiplying values of normalized variables with principle component. This is done separately for both variables and then a composite indicator is formed. A composite indicator is above all sum of its parts and this is used in regression analysis as a measure for democracy.

The main differences in social spending between non-democracies (no voting rights), fuller democracies (all classes can vote) and elite democracies (voting based on property requirements) can be observed in historical settings; such a period is from 1880s to 1930s. Figure 2.1 shows average of social transfers for 20 OECD countries. For graph between voter participation and social transfers average is taken across all countries. However, data is standardised to have a variance of 1 and mean of zero for graph between PCA and social transfers. The countries that are included in sample are the following (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Netherland, New Zealand, Norway, Portugal, Spain, Sweden, U.K, U.S).

Referring to figure 2.1 with onset of democratization in 1880s; initially the hereditary elite were enfranchised and later on broader propertied with low empathy to poor thereby not leading to a dramatic rise in social transfers. The elite democracies (Britain, Netherlands, Norway, and Sweden) where men are kept from voting because of property requirements were quite similar to nondemocracies (Austria, Latin America, Japan) in their implementation of social programs and use of taxes. With time democratization occurred on massive scale and social transfers started to rise at an increasing rate. In the last pre-war decade's (1880-1910) universal male suffrage was in progress in europe. The voting share surged from (40 – 70) % which eventually raised social transfers, public pensions, spending on primary school teachers and income tax. Women gained their voting rights in early twentieth century which was accompanied by a jump in social transfers along with introduction of progressive taxes. Societies in which males are in favour of social spending are more inclined to grant women their voting rights. Lott and Kenny (1999) find that with women suffrage social spending started to increase with greater magnitude. After World War

II all OECD countries became electoral democracies except for Greece and women were enfranchised except Switzerland (1972 – year of enfranchisement). When voter turnout increases, specifically, when it increases from (70 to 85) % of eligible voters it significantly increases pensions, health care, social transfers and education spending (Lindert, 2004). In the 20th century in voting shares across countries reflect people's willingness to use their votes but not differences in their right to vote. In Switzerland and U.S less than half of eligible voters actually vote; this weakens the rise in social transfers and taxes relative to countries where 85% of eligible voters actually vote. The differences in willingness to vote and the belief that their vote matters can explain why some countries have more social transfers than U.S and Switzerland where half of voters stay home on voting day.

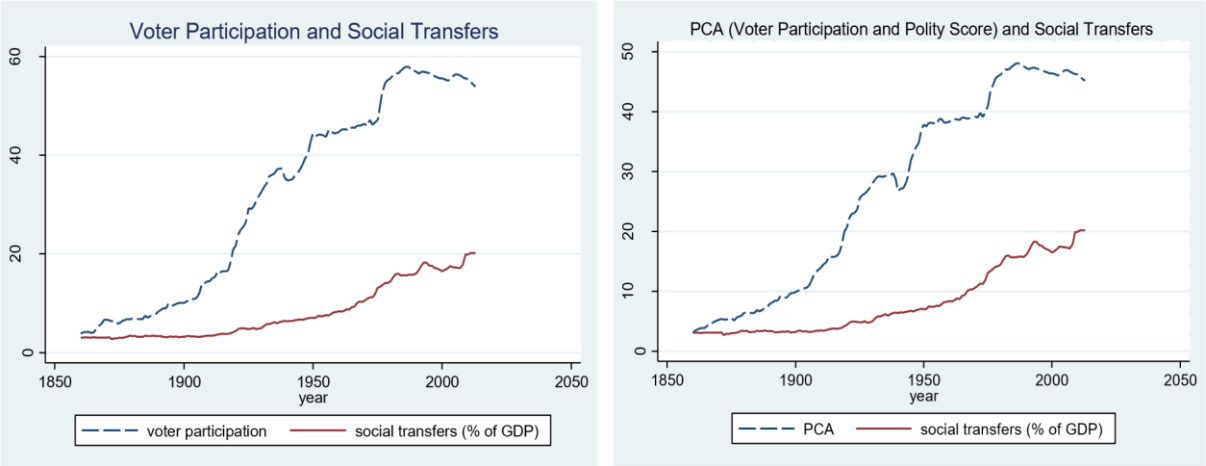


Figure 2. 1- Relation between Democracy & Social Transfers

Top income shares are used as measures of inequality in this study. Leigh (2007) suggests that top income shares fulfil four basic criteria that any measure of inequality should satisfy. First is anonymity, top income shares are only affected by one feature of the population which is income. Second is scale independence, income inequality measure is unaffected by proportional changes. Third is population principle, in income top shares are unaffected even if population is replicated identically. Fourth is transfer principle, it is only weakly satisfied as it requires that an income transfer from rich to a poor person should decrease inequality or at least not increase it. In this case if transfer is between two individuals who belong to the same group the measure remains unchanged. Top income shares are calculated by constructing shares of total personal income earned by different fractiles of whole (tax) population.

For analysis top 0.1%, 1% and 5% income shares are used as measures of inequality. The overall picture that emerges after looking at figure 2.1 is that there is an inverse relation between income inequality and social transfers. The top shares hover around a high level until

First World War and decline over twentieth century until 1980. After 1980 they start to rise or flatten out.

The top income earners are defined as everyone in the top decile (P90-100). Piketty (2001) shows that top decile is very heterogeneous. The share of top percentile (P99-100) is quite volatile unlike bottom nine percentile (P90-99) which were quite stable over past century. The top 1% primarily compose of both labour and capital incomes while high wage earners dominate bottom nine percentile. Therefore, variation in top income shares is mostly due to changes in capital incomes Piketty (2001). These include returns to owning capital, coupon yields, rental payments, interest earnings, capital gains etc.

There are similarities seen in trends across top income shares. They exhibit a sharp decline over twentieth century starting from World War I. They were badly hit by Wold War I, recover during 1920s economic boom and again start declining during Great Depression and World War II. Wartime shocks appear to have a substantial impact on top income shares. They drop from around 20% of total personal income in 1900 to 5% around 1980 (Roine & Waldenström, 2014).

Although wars affect everyone but events like factory bombings and specific surtaxes on top incomes and wealth particularly affect top income holders. The top shares are unable to recover immediately after exposure to these shocks because of imposition of progressive taxes for restoration of economies.

From 1980s and onwards top shares start to increase in most of developed economies. The top income shares in Anglo Saxon countries starts increasing; in Nordic countries it is more modest while it tends to remain stable in Continental European countries and Japan. Although decline over the twentieth century is due to shocks to capital incomes upturn in top shares after 1980 is mainly due to rise in top wages and salaries but capital is also now making a return. The study of Kennickell (2009) and Cowell (2013) suggests that financial assets with rich class are increasing considerably. Housing dominates the portfolio of broader population while financial assets dominate portfolio of rich.

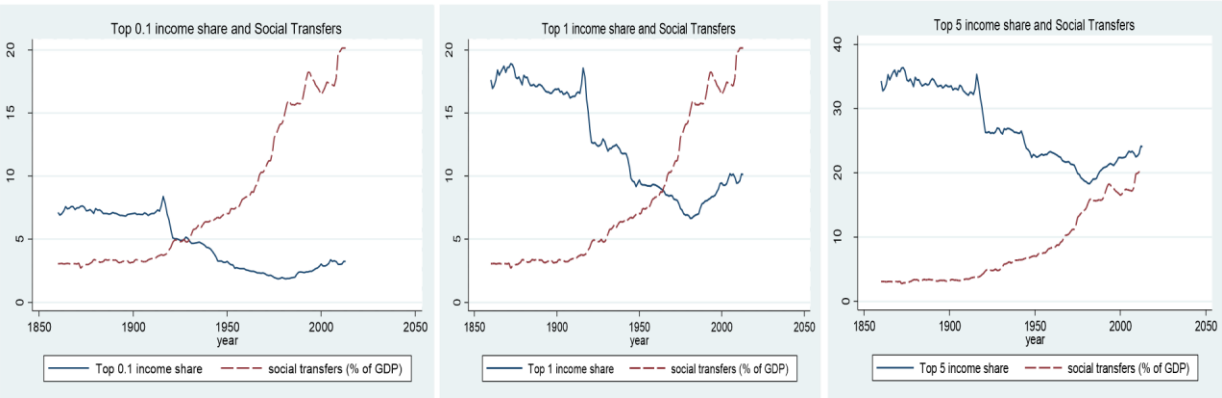


Figure 2. 2- Relation between income inequality & Social Transfers

Openness to trade shapes rise and boom of social transfers. It is share of imports in GDP at current prices. Vital to this literature is the discussion over whether globalization responds to social policies that are concerned towards cutting costs (efficiency) or protecting people's welfare (compensation) (Avelino, Brown & Hunter, 2005). Recent studies show that there is strong positive connection between trade openness and social transfers. Rodrik (1998) raises idea that with trade comes vulnerability to trade shocks and safety nets must be provided to those who are affected by international competition e.g. unemployment compensation etc. Level of economic development is measured by per capita income which is defined as real GDP divided by population. The rise of social spending with ongoing economic development is a generally established stylized fact. An era beginning from 1880s is of higher incomes and higher social transfers. This idea is known as Wagner's Law. He postulates that with industrialization working class suffer high job turnover and as a country grows it simultaneously becomes more complex. This gives rise to a need of regulatory and protective action by state for smooth functioning of a modern economy. Through the course of economic development, share of government spending in national income tends to grow. Demographic variable refers to fraction of population over 65 years of age. The drift of populations getting older shifts policies towards the needs of the elderly (Lindert, 2004). Demographic transition towards smaller families and long life initiated since 1880 is currently ongoing. During the 1880-1930 period having a greater share of elderly population increased total social transfers other than pensions per old person. Apart from this the effect on total transfers was larger and stronger than impact on programs to which only the elderly was entitled. These effects are supported by "gray power" motif which suggests that aged people tipped social feelings and political policies in favour of conceding certainty of income and health. Lindert notes that effect of an aging population is evident across different types of social spending. Galasso and Profeta (2004) suggest two effects of ageing on size of social welfare. First, with ageing median voter

becomes older which eventually leads to a rise in demand for social welfare. Second; there is a rise in taxes for people not in dependency ratio to meet the needs of elderly.
All these factors contribute to the increase in social spending but for rise in transfers across Great Depression and post war period, less emphasis is given to democracy as countries got strongly democratic by 1930. The main factors that contribute to increase in social transfers post World War II are significant roles of population aging, globalization and income growth.

2.5. Results & Analysis

2.5.1 Summary Statistics

Table 2.1 reports descriptive statistics for variables used in this study. The overall standard deviation is calculated using total number of observations which is 3080 while between variation uses number of panels (20) in this case. The between standard deviation captures variance of the variable between countries whereas within standard deviation covers variance within country over the years. Table 2.1 shows that overall variation among variables is shared between both time and across countries; implying that identifying variation comes almost equally from within and between variation in data when country dummies are not included in estimates.

Table 2.1- Summary Statistics

Variable		Voter Participation	Polity Score	Social transfers	Social transfers/ Govt Transfers	Top 0.1 income share	Top 1 income share
Mean		32.22	5.82	8.08	0.26	4.72	12.61
Std. Dev	overall	22.51	5.94	6.82	0.13	2.92	6.09
	Between	6.33	2.98	3.29	0.08	1.27	3.07
	Within	21.64	5.18	6.01	0.09	2.64	5.30
Observations		*N*=3080	*N*=3080	*N* =3080	*N* =3080	*N* =3080	*N* =3080

Variable		Top 5 income share	ln Real GDP/capita (Y/Pop)	Fraction of pop>65	Trade	Govt transfers	TR (Linguistically weighted)	Union Influence (Linguistically weighted)
Mean		27.20	8.55	8.73	0.24	29.82	75.03	18.66
Std. Dev	Overall	9.79	.90	4.13	0.25	18.59	39.02	13.66
	Between	5.49	.29	1.29	0.19	6.79	10.08	1.67
	Within	8.19	.85	3.94	0.17	17.37	37.76	13.57
Observations		*N*=3080	*N* =3080	*N* =3080	*N* =3080	*N* =3080	*N*=3080	*N*=3080

Note: The time period is 1860-2013 for 20 OECD countries. TR=Threat of Revolution

2.5.2 Graphical Analysis

Figure 2.3 demonstrates an overall inverse relationship between income inequality (measured by top 1% income share) and union influence. The correlation for whole period is -0.63 which indicates that union influence is strongly correlated with Top 1% to act as an effective and strong instrument. The increase in earnings inequality in post-1980 period is accompanied with the fall of unionisation in U.S (Freeman, 1980).

Figure 2.4 displays a strong positive relationship between threat of revolution and democracy. The correlation for whole period is 0.83 which points out that threat of revolution is an appropriate measure to instrument democracy. The threat of revolution hypothesis by Acemoglu and Robinson suggests that voting rights were offered to avoid a revolution. The positive relation between threat of revolution and measure of democracy in figure 4 supports their hypothesis.

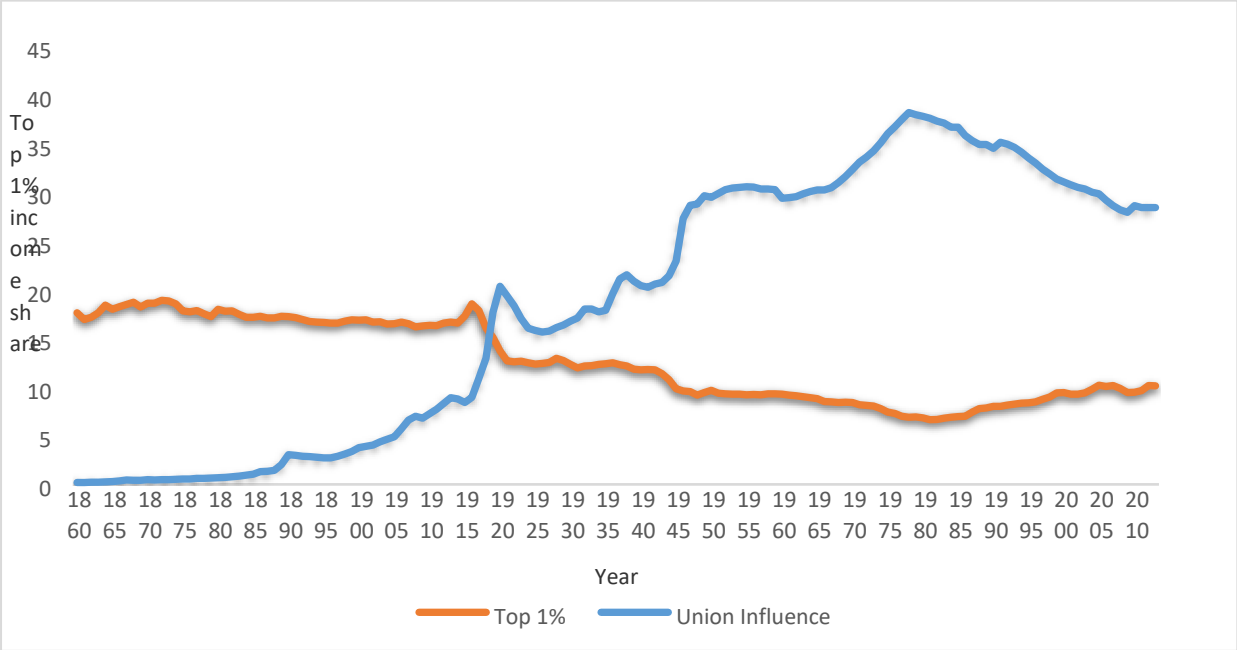


Figure 2. 3- Trends in Top 1 Income share versus linguistic proximity weighted Union Influence

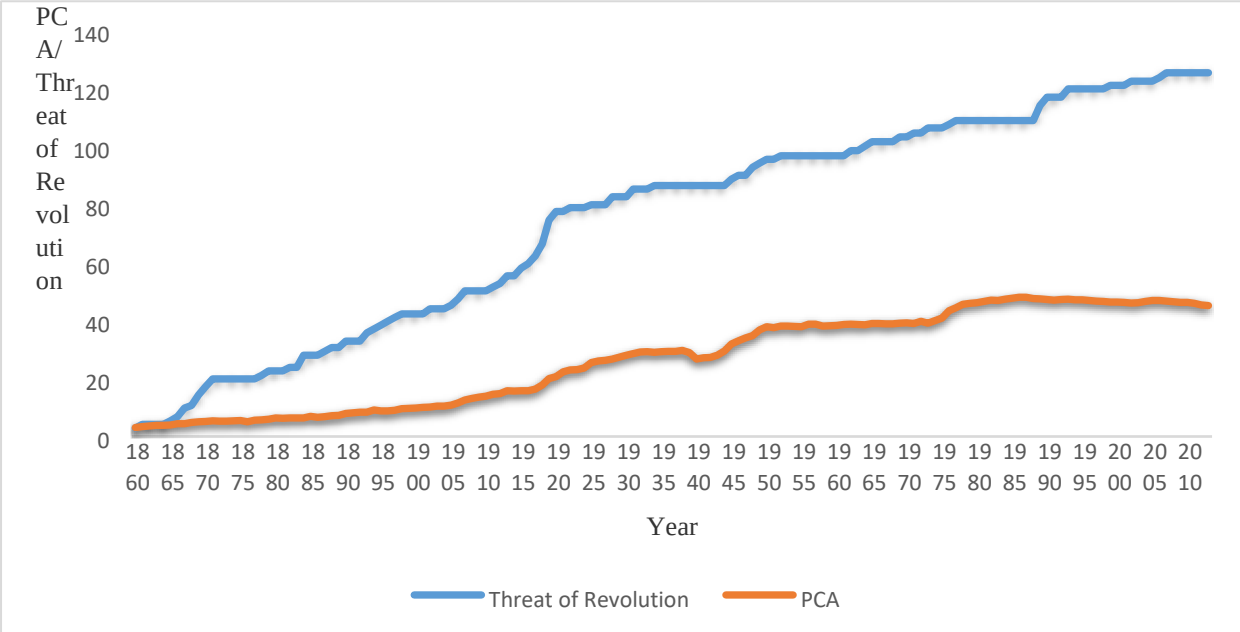


Figure 2. 4- Trends in PCA (between Voter participation & Polity score) versus linguistic proximity weighted Threat of Revolution

2.5.3 Results

Table 2.2, 2.3 &2.4 present mains results of impact on social transfers (as percentage of GDP) of inequality measured by three different income shares (top 0.1%, 1% and 5%) and democracy (measured by PCA between polity score and voter participation).

Table 2.2- Effect of Inequality (top 0.1 income share) and Democracy on Social Transfers *(% of GDP)*

	(1)	(2)	(3)	(4)	(5)
Panel- A	***OLS***	***OLS***	***OLS***	***OLS***	***IV-2SLS 2nd stage***
Top 0.1%	.33***	.28***	.28***	.31***	.23**
	(.03)	(.03)	(.03)	(.03)	(.12)
PCA	.11***	.08***	.09***	.09***	.26***
	(.01)	(.01)	(.01)	(.00)	(.05)
Top0.1%*PCA	-.012***	-.01***	-.01***	-.01***	-.02***
	(.00)	(.00)	(.00)	(.00)	(.01)
Fraction of pop>65		.52***	.51***	.53***	.3
		(.05)	(.05)	(.05)	(.07)
ln (Y/Pop)			-1.07**	-1.08**	-.22***
			(.27)	(.27)	(.34)
Trade				2.00***	1.99***
				(.25)	(.31)
Year dummy	Y	Y	Y	Y	Y
Country dummy	Y	Y	Y	Y	Y
Observations	3080	3080	3080	3080	3080
R-squared	0.88	0.89	0.89	0.89	0.87
Panel- B					***IV-2SLS 1st stage***
Instrumented				**PCA**	***Top 0.1%***
Threat of Revolution				0.29***	
				(.07)	
Union Influence					-0.51***
					(.046)
F-test (p-values)				(0.00)	(0.00)
Endog (p-values)				(0.00)	(0.00)

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. If the p-value is less than 0.05 we would reject the null hypothesis and variables are indeed endogenous.

Table 2.3- Effect of Inequality (top 1 income share) and Democracy on Social Transfers *(% of GDP)*

	(1)	(2)	(3)	(4)	(5)
Panel- A	***OLS***	***OLS***	***OLS***	***OLS***	***IV-2SLS 2nd stage***
Top 1%	.09***	.083***	.07***	.07***	.05
	(.02)	(.016)	(.02)	(.02)	(.05)
PCA	.15***	.116***	.12***	.12***	.26***
	(.01)	(.012)	(.01)	(.01)	(.05)
Top 1%*PCA	-.01***	-.01***	-.01***	-.01***	-.01***
	(.00)	(.00)	(.00)	(.00)	(.00)
Fraction of pop>65		.5***	.5***	.5***	.27***
		(.05)	(.05)	(.05)	(.09)
ln (Y/ Pop)			-.88	-.88	-1.9***
			(.28)	(.28)	(.46)
Trade				1.8***	1.88***
				(.24)	(.28)
Year dummy	Y	Y	Y	Y	Y
Country dummy	Y	Y	Y	Y	Y
Observations	3080	3080	3080	3080	3080
R-squared	.88	0.9	0.89	0.89	0.88
Panel- B					***IV-2SLS 1st stage***
Instrumented				***PCA***	***Top 1%***
Threat of Revolution				0.29***	
				(.07)	
Union Influence					-.42***
					(.1)
F-test (p-value)				(0.00)	(0.00)
Endog (p-value)				(0.00)	(0.00)

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. If the p-value is less than 0.05 we would reject the null hypothesis and variables are indeed endogenous.

Table 2.4- Effect of Inequality (top 5 income share) and Democracy on Social Transfers *(% of GDP)*

	(1)	(2)	(3)	(4)	(5)
Panel- A	***OLS***	***OLS***	***OLS***	***OLS***	***IV-2SLS 1ST stage***
Panel -A	.00	.00	-.00	-.00	.09
	(.01)	(.01)	(.01)	(.01)	(.04)
PCA	.16***	.12***	.13***	.13***	.33***
	(.02)	(.01)	(.02)	(.02)	(.07)
Top 5%*PCA	-.00***	-.00***	-.00***	-.00***	-.01***
	(.00)	(.00)	(.00)	(.00)	(.00)
Fraction of pop>65		.50***	.49***	.5***	.32**
		(.05)	(.05)	(.05)	(.07)
ln (Y/Pop)			-1.14**	-1.14**	-1.87***
			(.27)	(.27)	(.36)
Trade				1.79***	1.91***
				(.24)	(.28)
Year dummy	Y	Y	Y	Y	Y
Country dummy	Y	Y	Y	Y	Y
Observations	3080	3080	3080	3080	3080
R-squared	0.88	0.89	0.89	0.89	0.88

Panel- B	***IV-2SLS 1st stage***	
Instrumented	***PCA***	***Top5%***
Threat of Revolution	.29***	
	(.07)	
Union Influence		-1.35***
		(.17)
F-test (p-value)	(0.00)	(0.00)
Endog (p-value)	(0.00)	(0.00)

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. *If the p-value is less than 0.05 we would reject the null hypothesis and variables are indeed endogenous.*

2.5.4 Analysis

OLS bivariate results of equation 2.1 are presented in panel A of Table 2.2, 2.3 and 2.4. The effect of inequality (measured by top income shares), democracy (measured by PCA between voter participation and polity score) and their interaction on social transfers (as percentage of GDP) is seen to be significant and signs of the coefficients are consistent across estimates. Inequality and democracy (the main variables of interest) are positively related with social transfers while their interaction holds a negative relationship. The interaction term suggests that as inequality increases in democratic country there is decrease in social transfers spending. The OLS results show that coefficients of the regressors are inflated in majority of the cases when control variables are omitted (columns 1-3) compared to column 4 where all regressors are

considered. Therefore, it is quite essential to control for demographic and economic factors or else the results will be overstated. The parameter estimates remain unchanged when control variables are incorporated in regressions (column 5). Trade and elderly population are statistically significant and of right signs. In table 2.2 (column 4) one standard deviation increase in trade leads to a 0.07 standard deviation increase in social transfers. Table 2.3 & 2.4 (column 4) show same positive association between social transfers and trade. This result is in line with many studies (see, e.g., Swank, 1992; Garrett, 1998; Rudra and Haggard, 2001; Adsera and Boix, 2002) which suggest that there are clear political incentives to welfare expansion in response to globalisation. Moreover; it is argued that this relationship is stronger in political regimes that have become more democratic and have higher market integration as there are greater motives of reducing inequalities and risk (Adsera and Boix, 2001)[4]. Results of table 2.2, 2.3 & 2.4 show that as proportion of people getting older in a country increases; social spending is directed towards the needs of the elderly. From column 4 in table 2.2 one standard deviation increase in fraction of aged population results in 0.32 standard deviation increase in social transfers. For most OECD countries an increase in proportion of the elderly is continuously leading to an increase in share of GDP spent by the government on total social transfers. In 1800 New Zealand and Australia had 2.5% and 3.1% adults above sixty-five respectively. By 1900 both countries elderly share raised to 7.3%. New Zealand passed the first non-contributory pension law in 1898 followed by Australia in 1908. This shows that elderly started to gain strength and influence very early in high income countries. Since World War II the elderly are becoming a much larger part of adult population and are expected to increase till 2050. By 1980s some of the older European countries were pushing hard to provide higher pensions and social transfers; and were resistant in cutting social transfers. The level of economic development measured by its GDP per capita shows contrary result to Wagner's law. Column 4 of tables 2.2, 2.3 & 2.4 show negative relation between social transfers and economic development. The relation between social transfers and economic growth can be described by expanding role of governments associated with differences in the structure of the economy. As noted by Lindert (1996) post 1970s the relation between income and social spending is growing weak.

Although OLS results are quite consistent; economic studies suggest that size of government, inequality and democracy can be driven by same unobserved country-specific dynamic forces. These potential endogeneity problems can occur due to various causes including reverse

[4] The correlation between GDP per capita and trade is 0.11 which is quite low and will have a very insignificant effect on the results

causality, omitted variables bias, measurement error etc. Therefore, there is need to instrument both variables of interest.

The results from first stage regressions are presented in panel –B of tables 2.2, 2.3 &2.4 while structural estimates are presented in panel –A. The first stage regression coefficients of instruments are significant and F-test for excluded instruments are significant which suggests that instruments are suitable from a statistical point of view.

Union influence shows a negative relation with inequality and threat of revolution shows a positive association with democracy as expected in first-stage. In Table 2.2 and (2.3) one standard deviation change in union influence results in 2.39 (0.94) standard deviation decrease in top 0.1% (top 1%) income share, and one standard deviation change in linguistically weighted threat of revolution results in 0.6 standard deviation increase in democracy. Looking at structural regression in panel-A of tables 2.2, 2.3 &2.4 there are not large variations in the results obtained from OLS estimates. Comparing OLS regression column (4) with IV regression column (5) the absolute value of coefficient of interaction term increases. In table 2.2 and 2.3 coefficient of interaction term increases by 109% and 66.7%.

This confirms that it is quite important to deal with endogeneity.

Overall results from OLS and IV regressions show that unequal democracies rather than increasing social spending actually reduce it. This finding stands in contrast to M&R (1981) redistributive model which states that when there is income inequality and political power is extended to the poorer segment of society median voter will vote towards higher redistribution. Although income distribution is skewed to the right all over the world there are several studies which suggest that redistribution to the poor is not higher in democracies compared to autocracies (see, e.g., Ross, 2006; Scheve and Stasavage, 2011; Ansell and Samuels, 2010; Freeman and Quinn, 2012; Haggard and Kaufman, 2012). Therefore, at very high levels of inequality we do not see democracies being associated with high redistribution (Perotti, 1996). The relationship between inequality, democracy and redistribution depends on the way democracies are born. If elite are at risk of expropriation under autocracy they tend to opt for democratic structure which protects their rights and wealth. When elite are strong during the transition process (such as there is no revolutionary event occurring and the elite can inscribe their own constitution in the new democracy) they are able to bargain for rules or institutions that increase likelihood of politicians to be less hostile towards their interest. Moreover, they may shape democratic institutions in a way that can induce gridlock. Elites can also make ties with military allies. The military involvement can stop elected politicians from dismantling

institutions that block redistribution and protect property rights and interests of the wealthy. This will produce elite-biased or gamed democracies, with policies that are less redistributive. The influential and powerful groups can cause disproportionate allocation of government spending in democracies which results in it being favourable towards rich (Lizzeri and Persico, 2004; Ross, 2006).

With the elite making investments in improving their *de facto*[5] power they can capture the political system of a country and control its political agenda leading to a "captured democracy[6]". If elite can block democratizations that are highly redistributive, then we will see no correlation between democracies and increased taxation or redistribution (Acemoglu *et.al*., 2013).

2.5.5 Quantitative Effects

One shortcoming of parameter estimates presented in tables 2.2, 2.3 & 2.4 is that it is very hard to infer economic significance of the coefficients of democracy and its interaction with inequality. To streamline the explanation of the parameter estimates, figure 2.5, shows implied effects of inequality and democracy from column 5 of regression tables.

Estimates suggest that a one percentage point increase in top 0.1% income share at tenth percentile level of democracy is associated with 0.24 percentage point rise in social transfers. Similarly, at the 75th percentile level of democracy a one percentage point increase in inequality (top 0.1 income share) leads to a fall of 0.79 points in social transfers. In essence as countries become more democratic marginal effect of inequality (all 3 measures) turns negative; illustrated graphically in figure 2.5. Similarly, at 10th percentile of top 0.1% (1%) measure of inequality a ten-percentage point rise in democratisation results in 22(20) percentage points rise in social transfers. As inequality soars the implied effect of democratisation on social transfers reduces; shown graphically in figure 2.5.

This study's result is consistent with studies on power of elite in democratic countries where elite are able to capture political agenda of a country and divert resources in their own vested economic interests. In a study on U.S McCarty, Poole & Rosenthal (2003) suggest that political bias has risen markedly over last half of the century and has become more stratified by income. The authors postulate that "richer voters represented by both parties are less likely to favour

[5] Defacto power emerges from the ability to engage in collective action or use brute force or other channels such as lobbying or bribery Acemoglu and Robinson (2006)

[6] Captured democracy refers to a democratic regime which chooses economic institutions favouring the elite Acemoglu and Robinson (2008)

redistribution and social insurance than were the counterparts of these voters a half-century earlier". Similarly, Bartels (2002) show that constituents at 75th percentile of income distribution have three time as much influence on U.S voting patterns than those at 25th percentile.

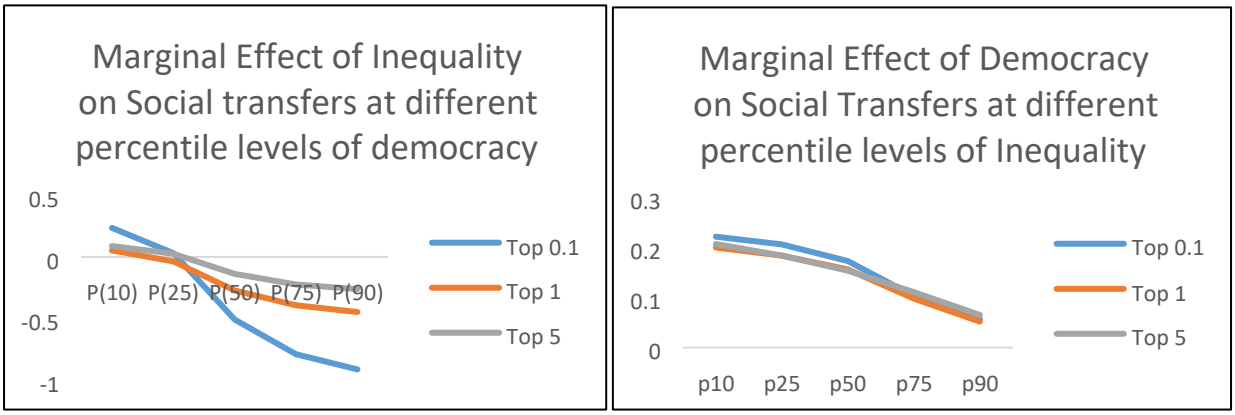


Figure 2. 5- Marginal effect of Inequality and Democracy on Social Transfers

2.6. Extensions and Robustness tests

This section tests same question by looking at composition of social transfers and also decomposes the democracy variable for clarity.

2.6.1 Extension- Composition of Government Transfers

For further illustration this study looks at composition of government transfers. It is precisely expressed in terms of social transfers as fraction of total government spending. Table 2.5 below shows results with top 1% income share[7]. Incorporating this outcome measure supports main results in section 2.5. The findings found earlier remain robust in both OLS and IV regressions of table 2.5. Inequality and democracy are positively related with this new measure of transfers; their impact when interacted is negative. This shows that in a democratic country rise in inequality reduces the proportion of social transfers to government transfers. The results of OLS regression in column 4 of table 2.5 is quite similar to results in section 2.5 with the exception for trade.

Trade is seen to have negative relation with composition of social transfers. An increase in government expenditure related with more trade openness is not associated with specific

[7] The results stay consistent when other two income shares (top 0.1% & top5%) and are included as measures of inequality (see appendix – A)

category of spending but is simply a higher level across board (Shelton, 2007). Rickard (2008) suggests that as trade increases share of government spending devoted to social welfare reduces as these welfare cuts are used to fund rise in spending on other sectors. One explanation for this cut is that politically powerful sector groups lose their rents that they receive with trade barriers. To compensate for this loss in rents due to openness government spends more on sector spending and less on social welfare. Sector spending programs keep powerful constituents safe from the costs of openness. Studies also show that in industrialized countries the need to spend on infrastructure, transportation, wages and social security at the state and local level rises.

Table 2.5 - Effect on Social Transfers as a proportion of Government Transfers of Inequality (top 1%) & Democracy

	(1)	(2)	(3)	(4)	(5)
Panel – A	***OLS***	***OLS***	***OLS***	***OLS***	***IV-2SLS 2nd stage***
Top 1%	.01***	.01***	.01***	.00***	.01***
	(.00)	(.00)	(.00)	(.00)	(.00)
PCA	.01***	.00***	.00***	.00***	.02***
	(.00)	(.00)	(.00)	(.00)	(.00)
Top1%*PCA	-.00***	-.00***	-.00***	-.00***	-.00***
	(.00)	(.00)	(.00)	(.00)	(.00)
Fraction of pop>65		.01	.01***	.00***	-.01**
		(.00)	(.00)	(.00)	(.00)
ln (Y/Pop)			-.02**	-.02**	-.04**
			(.01)	(.01)	(.02)
Trade				-.03**	-.04**
				(.01)	(.01)
Year dummy	Y	Y	Y	Y	Y
Country dummy	Y	Y	Y	Y	Y
Observations	3080	3080	3080	3080	3080
R-squared	0.65	0.65	0.66	0.66	0.39
Panel - B					***IV-2SLS 1st stage***
Instrumented				***PCA***	***Top 1%***
Threat of Revolution				.29***	
				(.07)	
Union Influence					-.42***
					(.1)
F-test (p-value)				(.00)	(.00)
Endog (p-value)				(.00)	(.00)

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. *If the p-value is less than 0.05 we would reject the null hypothesis and variables are indeed endogenous.*

2.6.2 Robustness Test- Voter Participation and Polity Score

The two measures of democracy are analysed separately in following regressions. It is seen that both polity score and voter participation have same outcomes as when they are taken together under PCA in section 2.5. OLS regressions controlling for both time and country fixed effects

show negative association between interaction term and size of government thus, highlighting the results found in section 2.5. The control variables also support main results as elderly population, government expenditure and openness all have positive relation with social transfers unlike economic development. Table 2.6 below reports results with different measures of income shares for both measures of democracy.

Table 2.6- Effect on Social Transfers of (Voter Participation and Polity Score)

Dep. Variable: ln social	(1)	(2)	(3)	(1)	(2)	(3)
Transfers		***Panel -A***			***Panel -B***	
OLS	***Voter Participation***	***Voter Participation***	***Voter Participation***	***Polity Score***	***Polity Score***	***Polity Score***
ln Iq	.72***	.7***	1.13***	-0.10***	-0.17***	-0.17***
	(.09)	(.09)	(0.11)	(0.0262)	(0.04)	(0.05)
ln Dem	.49***	.87***	1.57***	0.42***	0.51***	1.29***
	(.05)	(.07)	(0.12)	(0.06)	(0.12)	(0.20)
ln Iq*ln dem	-.24***	-.29***	-0.43***	-0.23***	-0.17***	-0.36***
	(.03)	(.03)	(0.03)	(0.04)	(0.05)	(0.06)
ln Fraction of pop>65	.51**	.50***	0.53***	0.50***	0.5***	0.51***
	(.07)	(.07)	(0.07)	(0.07)	(0.07)	(0.07)
ln (Y/Pop)	-.40***	-.34***	-0.40***	-0.39***	-0.39***	-0.38***
	(.04)	(.05)	(0.05)	(0.04)	(0.05)	(0.04)
ln Trade	.10***	.09***	0.09***	0.09***	0.09***	0.08***
	(.02)	(.02)	(0.02)	(0.02)	(0.02)	(0.02)
Year dummy	Y	Y	Y	Y	Y	Y
Country dummy	Y	Y	Y	Y	Y	Y
Observations	3080	3080	3080	3080	3080	3080
R-squared	0.85	0.85	0.85	0.84	0.84	0.84

Note: Columns 1, 2 and 3 denote Top 0.1%, 1% and 5% income shares respectively as measures of inequality. Panel- A and Panel-B denote voter participation and Polity score respectively as measures of democracy. The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and*. All variables are expressed in logs.

2.7. Conclusion

Using a panel data set of 20 OECD countries for period of over 150 years the hypothesis presented in this study proposes that high level of income inequality reduces redistributive government spending in democratic setting. This finding is in contrast to M&R outcome which suggests that with universal suffrage and majority rule, median voter is decisive voter. His/her preferences dictate the policies that are chosen and implemented. The larger gap between the median and mean incomes, larger is scale of redistributive income transfers.

Our results suggest that as top income earners become distant from middle and lower classes they are more inclined towards policies that are not in favour of redistribution. Hence greater

inequality of income produces lower level of spending that fosters greater equality of incomes, opportunities and upward mobility. These results are robust to all three measures of inequality (top0.1%, 1% and 5%), two democracy variables (polity score and voter participation), size (social transfers as % of GDP) and composition of government spending (social transfers as a fraction of government transfers) and instrumental variable regressions.

M&R model is considered to be one-dimensional as it does not account for maldistribution of political influence. Greater income in top percentiles of income distribution inhibits higher redistribution. Economic studies suggest that relationship between redistribution, inequality and democracy depends on the way democracy emerges. If elites are very strong on eve of transition process they will construct constitutions that are favourable to them after the transition. Such policies will aid in building an elite-biased democratic structure that represents the powerful and wealthy citizens, thereby reducing size of government. Moreover, even after transition, elite can circumvent democratisations by improving their *defacto* power; which helps them to capture democratic institutions and inhibit redistribution. The elite have mobilizational advantages compared to poor in terms of money, organisational resources and social networks which gets them closer to those who are in power. Although government spending increases in many countries it does not improve welfare of the masses because elite diverts these resources in their own vested interests. The poor and middle-income earners do not have political power, voice and access to legitimize their claims and are unable to 'soak the rich'. This shows that democracy may not threaten elite even under high inequality.

Economic literature suggests that size of government, inequality and democracy are driven by same unobserved country-specific dynamic forces. To deal with this problem of endogeneity we use identification strategy. Union influence and threat of revolution are used as time varying instruments for inequality and democracy respectively. Furthermore, inequality is interacted with democratic measures to gain insight into effect of inequality under democracy on size of government.

As pointed out in other studies political institutions vary greatly in democratic countries and these may not be a major determinant of size and composition of government spending. Economic, demographic and openness variables can be considered as much more important in determining size and composition of government spending.

It will also be worth looking into different categories of government spending to gain more information and insight of the role of inequality and democracy in determining them and will help us to get a more complete and thorough picture.

References

Acemoglu, D., & Robinson, J. A. (2008). Persistence of power, elites, and institutions. *The American Economic Review*, *98*(1), 267-293.

Acemoglu, D., and Robinson J.A. 2006. "De Facto Political Power and Institutional Persistence." *American Economic Review*, 96(2): 325-330.

Acemoglu, D., & Robinson, J. A. (2000). Why did the West extend the franchise? Democracy, inequality, and growth in historical perspective. *The Quarterly Journal of Economics*, *115*(4), 1167-1199.

Acemoglu, D., Naidu, S., Restrepo, P., & Robinson, J. A. (2013).*Democracy, redistribution and inequality* (No. w19746). National Bureau of Economic Research.

Acemoglu, D., Ticchi, D., & Vindigni, A. (2011). Emergence and persistence of inefficient states. *Journal of the European Economic Association*, *9*(2), 177-208.

Aidt, T. S., & Dallal, B. (2008). Female voting power: the contribution of women's suffrage to the growth of social spending in Western europe (1869–1960). *Public Choice*, *134*(3-4), 391417.

Aidt, T. S., & Jensen, P. S. (2013). Democratization and the size of government: evidence from the long 19th century. *Public Choice*, *157*(3-4), 511-542.

Aidt, T. S., & Jensen, P. S. (2014). Workers of the world, unite! Franchise extensions and the threat of revolution in europe, 1820–1938. *European Economic Review*, *72*, 52-75.

Albertus, M., & Menaldo, V. (2014). Gaming democracy: elite dominance during transition and the prospects for redistribution. *British Journal of Political Science*, *44*(3), 575-603. Alesina, A., & La Ferrara, E. (2005). Preferences for redistribution in the land of opportunities. *Journal of Public Economics*, *89*(5), 897-931.

Alesina, A., & Perotti, R. (1994). The political economy of growth: a critical survey of the recent literature. *The World Bank Economic Review*, *8*(3), 351-371.

Alesina, A., & Perotti, R. (1996). Income distribution, political instability, and investment. *European Economic Review*, *40*(6), 1203-1228.

Alesina, A., & Rodrik, D. (1994). Distributive Politics and Economic Growth. *The Quarterly Journal of Economics*, *109*(2), 465-490.

Ansell, B. W., & Samuels, D. J. (2010). Democracy and Redistribution, 1880-1930: Reassessing the Evidence. In *APSA 2010 Annual Meeting Paper*.

Ansell, B., & Samuels, D. (2010). Inequality and democratization: A contractarian approach. *Comparative Political Studies*.

Avelino, G., Brown, D. S., & Hunter, W. (2005). The effects of capital mobility, trade openness, and democracy on social spending in Latin America, 1980–1999. *American Journal of Political Science*, *49*(3), 625-641.

Bartels, L. M. (2009). Economic inequality and political representation. *The unsustainable American state*, 167-96.

Becker, G. S. (1983). A theory of competition among pressure groups for political influence. *The Quarterly Journal of Economics*, 371-400.

Benabou, R., & Ok, E. A. (2001). *Mobility as progressivity: ranking income processes according to equality of opportunity* (No. w8431). National Bureau of Economic Research.

Berlinski, S., & Dewan, T. (2011). The Political Consequences of Franchise Extension:

Evidence from the Second Reform Act. *Quarterly Journal of Political Science*, *6*(34), 329-376.
Boix, C. (2003). *Democracy and redistribution*. Cambridge University Press.
Cavalcanti, T., & Tavares, J. (2007). The output cost of gender discrimination: A model-based macroeconomic estimate.
Card, D. (2001). The effect of unions on wage inequality in the US labor market. *Industrial & Labor Relations Review*, *54*(2), 296-315.
Card, D., Lemieux, T., & Riddell, W. C. (2004). Unions and wage inequality. *Journal of Labor Research*, *25*(4), 519-559.
Checché, D., & García-PeñalosaJ, C. (2010). Labour Market Institutions and the Personal Distribution of Income in the OECD. *Economica*, *77*, 413-450.
Coppedge, M., Gerring, J., Altman, D., Bernhard, M., Fish, S., Hicken, A., & Semetko, H. A. (2011). Conceptualizing and measuring democracy: A new approach. *Perspectives on Politics*, *9*(02), 247-267.
Corcoran, S., & Evans, W. N. (2010). *Income inequality, the median voter, and the support for public education* (No. w16097). National Bureau of Economic Research.
Downs, A. (1957). An economic theory of political action in a democracy. *The Journal of political economy*, 135-150.
Freeman, R. B. (1980). Unionism and the Dispersion of Wages. *Industrial & Labor Relations Review*, *34*(1), 3-23.
Freeman, R. B. (1993). Labor markets and institutions in economic development. *The American Economic Review*, *83*(2), 403-408.
Freeman, R. B. (1991). How much has de-unionisation contributed to the rise in male earnings inequality? (No. w3826). *National Bureau of Economic Research*.
Freeman, R. B., & Medoff, J. L. (1984). What do unions do. *Indus. & Lab. Rel. Rev.*, *38*, 244.
Friedman, M. (1962). 1982, Capitalism and Freedom.
Gonzalez-Eiras, M., & Niepelt, D. (2007). Population ageing, government budgets, and productivity growth in politico-economic equilibrium.
Garrett, G., & Mitchell, D. (2001). Globalization, government spending and taxation in the OECD. *European Journal of Political Research*, *39*(2), 145-177.
Garrett, G. and D. Nickerson (2005), "Globalisation, Democratization and Government Spending in Middle-Income Countries" in Globalization and the Future of the Welfare State, ed. Miguel Glatzer and Dietrich Rueschemeyer, Pittsburgh, PA: University of Pittsburgh Press.
Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do institutions cause growth?. *Journal of Economic Growth*, *9*(3), 271-303.
Huberman, M., & Lewchuk, W. (2003). European economic integration and the labour compact, 1850–1913. *European Review of Economic History*, *7*(1), 3-41.
Huber, E., Mustillo, T., & Stephens, J. D. (2004). Determinants of social spending in Latin America. *Society for the Advancement of Socio-Economics, Washington, DC*. Jaumotte, F., & Buitron, C. O. (2015). *Inequality and Labor Market Institutions. Staff Discussion Notes*. SDN/14/15. International Monetary Fund. Washington DC. July. Kaufman, R. R., & Segura-Ubiergo, A. (2001). Globalization, domestic politics, and social spending in Latin America: a time-series cross-section analysis, 1973–97. *World Politics*, *53*(04), 553-587.
Larcinese, V. (2011). Enfranchisement and representation: Italy 1909-1913.

Leigh, A. (2007). How closely do top income shares track other measures of inequality?. *The Economic Journal*, *117*(524), F619-F633.
Lewis, H. Gregg. (1963) *Unionism and Relative Wages in the United States: an empirical inquiry*. University of Chicago Press
Lindert, P. H. (1994). The rise of social spending, 1880-1930. *Explorations in Economic History*, *31*(1), 1-37.
Lindert, P. H. (1996). What limits social spending? *Explorations in Economic History*, *33*(1), 134.
Lindert, P. H. (2004). *Growing public: Volume 1, the story: Social spending and economic growth since the eighteenth century* (Vol. 1). Cambridge University Press.
Lott, J. and L. Kenny. 1999. "Did Women's Suffrage Change the Size and Scope of Government?" *Journal of Political Economy* 107(6): 1163-1198.
Islam, M. R., Madsen, J. B., & Doucouliagos, H. (2018). Does inequality constrain the power to tax? Evidence from the OECD. *European Journal of Political Economy*, *52*, 1-17. Martinez-Vazquez, J., Moreno-Dodson, B., & Vulovic, V. (2012). The impact of tax and expenditure policies on income distribution: Evidence from a large panel of countries. *Andrew Young School of Policy Studies Research Paper Series*, (12-30).
McCarty, N., Poole, K. T., & Rosenthal, H. (2003). Political polarization and income inequality. *Available at SSRN 1154098*.
Meinhard, S., & Potrafke, N. (2012). The globalization–welfare state nexus reconsidered. *Review of International Economics*, *20*(2), 271-287.
Meltzer, A. H., & Richard, S. F. (1981). A rational theory of the size of government. *The Journal of Political Economy*, 914-927.
Milanovic, B. (2000). The median-voter hypothesis, income inequality, and income redistribution: an empirical test with the required data. *European Journal of Political Economy*, *16*(3), 367-410.
Mosca, G. (1939). The Ruling Class, trans. *HD Kahn, (New York, 1939)*.
Mulligan, C. B., & Gil, R. (2002). Social spending and democracy: some evidence from South America.
Mulligan, C. B., Gil, R., & Sala-i-Martin, X. (2004). Do democracies have different public policies than nondemocracies?. *The Journal of Economic Perspectives*, *18*(1), 51-74.
Niehues, J. (2010). Social spending generosity and income inequality: A dynamic panel approach.
Nooruddin, I., & Simmons, J. W. (2009). Openness, uncertainty, and social spending: Implications for the globalization—welfare state debate. *International Studies Quarterly*, *53*(3), 841-866.
Olson, M. (1993). Dictatorship, Democracy, and Development. *American Political Science Review*, *87*(03), 567-576.
Olson, M. (2007). The Logic of Collective Action [1965]. *Contemporary Sociological Theory*, *2*, 111.
Persson, T., & Tabellini, G. (1994). Is inequality harmful for growth?. *The American Economic Review*, 600-621.
Persson, T., & Tabellini, G. E. (2003). *Do electoral cycles differ across political systems?*. Innocenzo Gasparini Institute for Economic Research.

Piketty, T., & Saez, E. (2001). *Income inequality in the United States, 1913-1998 (series updated to 2000 available)* (No. w8467). National bureau of economic research.
Przeworski, A. (2004). Democracy and economic development. *Mansfield & R. Sisson (Eds.), The evolution of political knowledge. democracy, autonomy, and conflict in comparative and international politics*, 300-324.
Rees, Albert. *The Economics of Trade Unions*. Chicago: University of Chicago Press, 1962.
Rickard, S. J. (2008, November). Trade Openness and the Composition of Government Spending: Further Disentangling the Ties that Bind. In *Annual Meeting of the International Political Economy Society, Philadelphia, Penn., November* (Vol. 1415).
Rodrigiuez, F. C. (1999). Does distributional skewness lead to redistribution? Evidence from the United States. *Economics & Politics*, *11*(2), 171-199.
Rodriguez, F. (2004). Inequality, Redistribution, and Rent-Seeking. *Economics & Politics*, *16*(3), 287-320.
Rodrik, D. (1997). *Trade, social insurance, and the limits to globalization* (No. w5905). National bureau of economic research.
Rodrik, D. (1998). Why do more open economies have bigger governments?. *Journal of Political Economy*, *106*(5), 997-1032.
Roine, J., & Waldenström, D. (2014). Long-run trends in the distribution of income and wealth.
Ross, M. (2006). Is democracy good for the poor?. *American Journal of Political Science*, *50*(4), 860-874.
Sanz, I., & Velázquez, F. J. (2007). The role of ageing in the growth of government and social welfare spending in the OECD. *European Journal of Political Economy*, *23*(4), 917-931.
Schmidt, M. G. (2016). Measuring democracy and autocracy. *Handbook of Political Science Methods, London: Routledge (forthcoming)*.
Schwabish, J. A., Smeeding, T. M., & Osberg, L. (2006). *Income distribution and social expenditures* (pp. 247-288). Palgrave Macmillan UK.
Shelton, C. A. (2007). The size and composition of government expenditure. *Journal of Public Economics*, *91*(11), 2230-2260.
Slichter, S. H., Healy, J., & Livernash, E. R. (1960). The impact of collective bargaining on management (Washington, DC; Brookings Institution).*Chapter20 of this volume includes findings relevant to rate ranges*.
Vanhanen, T. (2003). Measures of democracy 1810-2002. *Finnish Social Science Data Archive*.
Wagner, R. E., & Weber, W. E. (1977). Wagner's law, fiscal institutions, and the growth of government. *National Tax Journal*, 59-68.
Western, B., & Rosenfeld, J. (2011). Unions, norms, and the rise in US wage inequality. *American Sociological Review*, *76*(4), 513-537.
Wagner R.E. and W.E. Weber (1977), "Wagner's Law, Fiscal Institutions, and the Growth of Government", *National Tax Journal* 30(1), pp. 59–68.

Appendices

Appendix-A

Table 2.7- Effect on Social Transfers as a proportion of Government Transfers

	(1)	(2)	(3)	(4)	(5)
	OLS	***OLS***	***OLS***	***OLS***	***IV-2SLS 2nd stage***
Top 0.1%	.01***	.01***	.01***	.01***	.04***
	(.00)	(.00)	(.00)	(.00)	(.01)
PCA	.00***	.00***	.00***	.00***	.02***
	(.00)	(.00)	(.00)	(.00)	(.00)
Top0.1%*PCA	-.00***	-.00***	-.00***	-.00***	-.00***
	(.00)	(.00)	(.00)	(.00)	(.00)
Fraction of pop>65		.01***	.01***	.00***	-.02***
		(.00)	(.00)	(.00)	(.00)
ln (Y/Pop)			-.03***	-.03***	-.12***
			(.01)	(.01)	(.02)
Trade				-.02**	.00
				(.01)	(.02)
Year dummy	Y	Y	Y	Y	Y
Country dummy	Y	Y	Y	Y	Y
Observations	3080	3080	3080	3080	3080
R-squared	0.65	0.65	0.65	0.65	0.53
					IV-2SLS 1st stage
Instrumented				***PCA***	***Top 0.1%***
Threat of Revolution				.29***	
				(.07)	
Union Influence					-.51***
					(.05)
F-test (p-values)				(.00)	(.00)
Endog (p-values)				(.00)	(.00)

Table 2.8- Effect on Social Transfers as a proportion of Government Transfers

	(1)	(2)	(3)	(4)	(5)
Panel- A	***OLS***	***OLS***	***OLS***	***OLS***	***IV-2SLS 2nd stage***
Top 5%	.00***	.00***	.00***	.00***	.02***
	(.00)	(.00)	(.00)	(.00)	(.00)
PCA	.01***	.00***	.00***	.00***	.03***
	(.00)	(.00)	(.00)	(.00)	(.00)
Top5%*PCA	-.00***	-.00***	-.000***	-.00***	-.00***
	(.00)	(.00)	(.00)	(.00)	(.00)
Fraction of pop>65		.01***	.01***	.01***	-.01**
		(.00)	(.00)	(.00)	(.00)
ln (Y/Pop)			-.03***	-.03***	-.07***
			(.01)	(.01)	(.02)
Trade				-.02***	-.03**
				(.01)	(.01)
Year dummy	Y	Y	Y	Y	Y
Country dummy	Y	Y	Y	Y	Y
Observations	3080	3080	3080	3080	3080
R-squared	0.6462	0.6487	0.6507	0.6516	0.1845
Panel- B					***IV-2SLS 1st stage***
Instrumented				***PCA***	***Top 0.1%***
Threat of Revolution				.29***	
				(.07)	
Union Influence					-.14***
					(.17)
F-test (p-values)				(.00)	(.00)
Endog (p-values)				(.00)	(.00)

Appendix –B

Revolutionary Events (1860-2013)

Table 2. 9- Major Revolutionary Events

Events	**Region**	**Year**
Intermittent guerrilla warfare in Northern Ireland	British Isles	1969-1992
Separation of republics from Soviet union	Russian states	1990-91
The Second Chechen Rebellion against Russia.	Russian states	1999
Overturning of Communist regimes in Albania, Bulgaria, and Romania.	Balkans	1989-91

Overturning of Communist regime in Germany	Germany	1989-91
Red River Rebellion	Canada	1869-70
The Meiji Restoration and modernization revolution in Japan	Japan	1868

Table 2. 10- Minor Revolutionary Events.

Events	**Region**	**Year**
Anti-fascist resistance in Yugoslavia,elsewhere	Balkans	1943-45
Regime liberalization terminated by Soviet intervention in Chechoslovakia	Balkans	1968
The 1997 Rebellion in Albania sparked by Ponzi Scheme	Balkans	1997
The Kosovo Rebellion against Yugoslavia.	Balkans	1997
Resistance and Liberation	French States	1944-5
Failed republican revolutions against British rule in Canada.	Canada	1837–38
Haymarket Riot	U.S	1886
Agrarian revolt	U.S	1887
The Battle of Blair Mountain ten to fifteen thousand coal miners rebel in West VirGinia assaulting mountain-top lines of trenches established by the coal companies and local sheriff's forces in the largest armed, organized uprising in American labor history.	U.S	1921

American Indian movementactivists and Oglala Lakota besiege the small town of Wounded Knee in protest of government policies towards Native Americans and the corrupt Wilson Regime. Part of the Red Power movement.	U.S	1973
First Taranaki War started when Gore Browne accepted an offer to sell land from Taranki subchief despite a veto imposed by the paramount chief. This led to a decade of Wars.	New Zealand	1860
Italian Resistance Movement against the Fascist Italian Social Republic.	Italy	1943-45
Kirghiz vs Russia	Russian States	1916

Table 2. 11- Other Revolutionary Events.

Events	**Region**	**Year**
Civil war in Cyprus	Balkans	1963-1964
Turko-Cypriot war, including guerrilla warfare in Cyprus	Balkans	1974
Civil war in Croatia, BosniaHerzegovina	Balkans	1991
The log Revolution in Croatia starts, triggering the Croatian War of Independence	Balkans	1990-95
Bosnian War of Independence	Balkans	1992–1995
Coup d'etat in Portugal	Iberia/Portugal	1974
Attempted coup in Spain	Iberia/Spain	1981
Civil war in Ireland, Irish independence	British Isles	1919-23
Greek Civil war	Balkans	1944-9
Winnipeg General Strike	Canada	1919
Quiet Revolution	Canada	1960-70
American Civil War	America	1861-65
Invasion of Waikato	New Zealand	1863

East Cape War	New Zealand	1865
Te Kooti's and Titokowaru's War	New Zealand	1868
Finland civil war	Finland	1918
Austria civil war	Austria	1934
German Revolution/civil war	Germany	1918-19
Russian Revolutions	Russian States	1917-21
Polish Rebellion	Russian States	1863-64

Appendix-C

Franchise Extensions

Table 2. 12- Franchise Extensions Australia

Year	Franchise extensions/contractions	Other features
1856	Men over 21 years allowed to vote in Victoria	Secret Ballot was introduced in Victoria, Tasmania and South Australia
1857	Men over 21 years allowed to vote in South Australia.	
1858	Men over 21 years allowed to vote in New South Wales	Secret Ballot introduced in New South Wales
1859		Secret Ballot introduced in Queensland
1872	Men over 21 years allowed to vote in Queensland	
1893	Men over 21 years allowed to vote in Western Australia	Secret Ballot introduced in Western Australia
1895	Women and indigenous people over 21 years allowed to vote in South Australia	
1896	Men over 21 years allowed to vote in Tasmania	
1899	Women over 21 years allowed to vote in Western Australia	
1901		Federation occurred. Enrolment and voting was voluntary in all States.
1902	Commonwealth Parliament passed the Commonwealth Franchise Act 1902 which granted universal adult suffrage for most Men and Women over 21 years of age.	Commonwealth Franchise Act 1902 stripped voting rights from indigenous people unless they had voting rights by their State governments.
1915		Compulsory voting was introduced for state elections in Queensland.
1921		First Woman elected to Australian Parliament

1962	Commonwealth Electoral Act 1962 permitted indigenous people of Australia the right to vote	
1973	Age for enrolment, voting and candidature for commonwealth elections was lowered from 21 to 18 years of age.	The first national election for indigenous people was held to elect members from the National Aboriginal Consultative Committee. Many indigenous people voted
1989		ACT granted self government.
2007	Prisoners serving a full time sentence of less than 3 years were entitled to vote	

Table 2. 13- Franchise Extensions Austria

Year	**Franchise extensions/contractions**	**Other features**
1945	Unchanged	
1968	Voting age reduced to 19	
1992	Voting age reduce to 18	
2007	Voting age reduce to 16	

Table 2. 14- Franchise Extensions Belgium

Year	**Franchise extensions/contractions**	**Other features**
1981	Voting age reduced to 18 years of age	

Year	Franchise	Other features
	extensions/contractions	
1758-1866	Affluent men were granted the right to vote.	
1874		First secret Ballot in Canada
1918	Women over 21 allowed to vote but aboriginal women were excluded.	
1920	Right to vote became universal with the 1920 Dominion Elections Act but discrimination remained. Aboriginal people and people of Chinese origin were unable to vote.	
1921		First woman elected to parliament
1948	Asian Canadians were allowed to vote	
1950	Inuit were given the right to vote	
1970	Voting age lowered from 21 to 18 years of age	
1993	Federal judges and people with mental disabilities can vote.	

2002	People serving federal jail time given the right to vote	

Table 2. 15- Franchise Extensions Canada

Table 2. 16- Franchise Extensions Denmark

Year	Franchise extensions/contractions	Other features
1952	Voting age reduced to 23.	
1961	Voting age reduced to 21.	
1971	Voting age reduced to 20.	
1978	Voting age reduced to 18.	

Table 2. 17- Franchise Extensions Finland

Year	Franchise extension/contractions	Other features
1945	Voting age reduced to 21 years	
1969	Voting age reduced to 20 years	
1972	Voting age reduced to 18 years	

Table 2. 18- Franchise Extensions France

Year	Franchise extensions/contractions	Other features
1975	Voting age reduced to 18	

Table 2. 19- Franchise Extensions Germany

Year	Franchise extension/contractions	Other features
1949	Universal and equal adult suffrage for all citizens of 21 years and over.	
1970		Voting age reduced to 18 years

Table 2. 20- Franchise Extensions Greece

Year	Franchise extension/contractions	Other features
1952	Women obtained the right to vote and stand as candidates in legislative and municipal elections.	New constitution was passed stating that Greece was a parliamentary democracy with a monarch as the head of state.
1974		Third Hellenic Republic. After another referendum Greece was finally able to permanently abolish the monarchy and form a democracy.
1981	Voting age reduce to 18 years	
1983		New family Law

Table 2. 21- Franchise Extensions Ireland

Year	Franchise extensions/contractions	Other features
1793	Catholics and male property holders of over 40 shillings were allowed to vote for the Irish	

	Parliament; only protestants could hold office.	
1829	With catholic emancipation the property qualification for right to vote increased from 40 shillings to ₤ 10 income per year	
1832	Representation of the People Act slightly extended the franchise by including ₤10 freeholders, those who held leases for life and leaseholders of atleast 60 years.	
1850	Reform Act gave the right to vote to every man with total property of ₤12	
1872		Secret Ballot was introduced
1884	Representation of the People Act lowered the property threshold and there was an increase in the percentage of the adult male population that could vote.	
1898	Franchise in local governments was extended so that all householders and occupants of a portion of a house could vote in local elections.	
1918	Vote was extended to all males over 21 and women over 30 with some property requirements.	
1928	Vote was extended to all women over 21 and the remaining property requirements were eradicated.	
1973	Vote was extended to all adults over 18 years of age.	
2006	The Electoral (Amendment) Act 2006 was passed to allow postal voting by all prisoners.	

Table 2. 22- Franchise Extensions Italy

Year	Franchise extensions/contractions	Other features
1975	Voting age reduced to 18 years except in senatorial elections, where minimum age is 25.	

Table 2. 23- Franchise Extensions Japan

Year	Franchise extensions/contractions	Other features
1868		Japan was dominated by the Meiji Oligarchy who viewed popular democracy and party politics with suspicion.

1890	Under the Meiji constitution men over 25 years of age who paid more than 15yen a year in annual taxes were given the right to vote.	

1925	General Election Law was passed in Taisho period which extended Universal male suffrage to all men aged 25 or over.	
1941		Japanese navy launched a surprise attack on American fleet at Pearl Harbor.
1945	Voting age lowered to 20 from 25 and women were granted the right to vote	U.S dropped an atomic bomb over Hiroshima and Nagasaki.
1946		Japan holds first election
1952		U.S returns Japan to independence
1956		Japan became a member of UN.
2015	Voting age reduced to 18	

Table 2. 24- Franchise Extensions Netherlands

Year	Franchise extensions/contractions	Other features
1945	Voting age reduced to 23 years	
1965	Voting age reduced to 21 years	
1972	Voting age reduce to 18 years	

Table 2. 25- Franchise Extensions Norway

Year	Franchise extensions/contractions	Other features
1946	Voting age reduced to 21 years	

Table 2. 26- Franchise Extensions New Zealand

Year	Franchise extensions/contractions	Other features
1853	Males aged 21 or over who owned property and were British subjects had the right to vote	First election held in 1853
1860	New Zealand government passed a law that men who have miner's right (a license which cost £1 a year) were permitted to vote.	
1867	Government created four Maori electorates which covered the whole country. Maori men aged 21 or over could vote for these Maori seats	
1879	All adult men were given the right to vote as long as they were British subjects.	
1893	New Zealand became the first country where women were granted the right to vote in National Elections	
1969	Voting age lowered from 21 to 20 years of age	
1974	Voting age lowered to 18 years of age.	
1975	People who are permanent residents can vote but only citizens can become members of the parliament.	
1993	The Electoral Act 1993 allowed for a limited prisoner franchise, though those serving a life sentence, preventative detention or a sentence of three years or more could not vote.	
2010	From 2010 no prisoner imprisoned after 16 December of that year could vote.	

Table 2. 27- Franchise Extensions Portugal

Year	Franchise extensions/contractions	Other features
1931	Women were given the right to vote and stand for election, with the restriction that they had to have completed secondary or higher education (men only had to know how to read and write).	
1934	All citizens who were literate were granted the right to vote and stand for election in 1934.	
1955		Portugal joins UN
1976	Universal suffrage with no restrictions for any gender.	

Table 2. 28- Franchise Extensions Spain

Year	Franchise extensions/contractions	Other features
1976		Spanish parliament chooses democracy
1977	Spanish electoral system gave both active and passive voting rights to all citizens who were over 18 years of age.	

Table 2. 29- Franchise Extensions Sweden

Year	Franchise extensions/contractions	Other features
1945	Voting age reduced to 23 years	
1965	Voting age reduced to 21 years	
1972	Voting age reduce to 18 years	

Table 2. 30- Franchise Extensions Switzerland

Year	Franchise extensions/contractions	Other features
1991	Voting age reduced to 18 years of age	

Table 2. 31- Franchise Extensions United Kingdom

Year	Franchise extensions/contractions	Other features
1948	University seats and all 'plural voting' abolished	
1969	Voting age reduced to 18 years	
1983	Representation of the Peoples Act prohibited prisoners from voting	

2011	In response to the ECHR proposition UK stated that the prisoners will not be given the right to vote.	

Table 2. 32- Franchise Extensions United States

Year	Franchise extensions/contractions	Other features
1850	All white males, rich or poor had the right to vote	
1870	15th Amendment. Right of citizens of U.S to vote shall not be denied by U.S on account of race, colour or previous condition of servitude	
1920	19th Amendment Women Suffrage. Women finally got the right to vote.	
1964	24th Amendment The right of citizens to vote in any primary or other elections shall not be denied by the United States by reason of failure to pay any poll tax or other tax.	
1965	African Americans and other minority groups could freely vote.	
1971	26th Amendment. Voting age reduced to 18 years of age.	
1990	Disabilities Act was passed guaranteeing access to all Americans.	

Appendix –D: Data Sources

Per capita real GDP

General Note: The principal data source is the OECD.Stat's Real Gross Domestic Product (GDP) (http://stats.oecd.org/index.aspx?), accessed on 10/07/2012. The data are backdated by splicing figures from different sources as mentioned below:

Australia, 1800-1819 Snooks, Graeme D., 1994. *Portrait of the Family within the Total Economy-A Study in Long-run Dynamics, Australia 1788-1990*, Cambridge University Press; 1820-1958 Maddison, A. 2010, Historical Statistics on World Population, GDP and Per Capita
GDP, Accessed on 10/07/2012 (http://www.ggdc.net/MADDISON/oriindex.htm); 1959-2010 OECD.Stat, **Belgium**, 1820-1969 Maddison, A. 2010, *op.cit.*; 1970-2011 OECD.Stat, **Canada**, 1820-1969 Maddison, A. 2010, *op.cit.*; 1970-2010 OECD.Stat, **Denmark**, 1818-1819 Hansen, S. A., 1972. *Økonomisk vækst i Danmark Bind II : 1914-1970*, 2nd Ed., Universitetsforlaget**,** Copenhagen; 1820-1965 Maddison, A. 2010, *op.cit.*; 1966-2011

OECD.Stat, **Finland**, 18201969 Maddison, A. 2010, *op.cit.*; 1970-2011 OECD.Stat, **Germany**, 1820-1969 Maddison, A.
2010, *op.cit.*; 1970-2011 OECD.Stat, **Greece**, 1820-1959 Maddison, A. 2010, *op.cit.*; 19602011 OECD.Stat, **Ireland**, 1270-1819 Broadberry, S. Campbell, Klein, Overton and van Leeuwen, 2011. *British Economic Growth, 1270-1870: An Output-Based Approach*, School of Economics Discussion Papers, KDPE1203, University of Kent; 1820-1999 Maddison, A. 2010, *op.cit.*; 2000-2010 OECD.Stat, **Italy**, 1310-1819 Malanima, P., 2011. The Long Decline of a Leading Economy: GDP in Central and Northern Italy, 1300-1913, *European Review of Economic History*, 15, pp. 169-219; 1820-1969 Maddison, A. 2010, *op.cit.*; 1970-2011
OECD.Stat, **Netherlands**, 1510-1806 Zanden, J. L.V. and Leeuwen, B. V., 2012. Persistent but not Consistent: The Growth of National Income in Holland 1347-1807, *Explorations in Economic History*, 49(2), pp.119-130; 1807-1819 Centraal Bureau voor de Statistiek, 2001. *Tweehonderd jaar statistiek in tijdreeksen, 1800-1999*, Voorburg; 1820-1968 Maddison, A. 2010, *op.cit.*; 1969-2011 OECD.Stat, **Norway**, 1820-1969 Maddison, A. 2010, *op.cit.*; 19702011 OECD.Stat, **Sweden**, 1665-1819 Edvinsson, R., 2011. *New Estimates of Swedish GDP by Activity, 1665-2010*, Stockholm Papers in Economic History No. 12, Stockholm University, pp. 55-61; 1820-1949 Maddison, A. 2010, *op.cit.*; 1950-2011 OECD.Stat, **Switzerland**, 18201979 Maddison, A. 2010, *op.cit.*; 1980-2010 OECD.Stat, **United Kingdom,** 1270-1819 Broadberry et al., 2011, *op.cit.*; 1871-1947 Mitchell, 1988, *op.cit.*; 1820-1969 Maddison, A.
2010, *op.cit.*; 1970-2011 OECD.Stat, **United States of America**, 1790-1819 Johnston, L. and Williamson, S. H., 2011. *What Was the U.S. GDP Then? MeasuringWorth*, accessed on 18/07/2012, (http://www.measuringworth.com/); 1820-1969 Maddison, A. 2010, *op.cit.*; 19702010 OECD.Stat.

Table 2. 33- Other Data Sources

Data	**Source**
Social Transfers	Madsen, J. B. (2009), "Trade Barriers, Openness, and Economic Growth." *Southern Economic Journal*, 76(2), 397-418.
Government Expenditure	Madsen, J. B. (2009), "Trade Barriers, Openness, and Economic Growth." *Southern Economic Journal*, 76(2), 397-418.
Voter Participation	Vanhanen, T. (2003). Measures of democracy 1810-2002. *Finnish Social Science Data Archive*.
Polity score	Available at: http://www.systemicpeace.org/polityproject.html
Age distribution of population	Madsen, J. B. (forthcoming, 2018), "Health-Led Growth in the OECD since 1800," *Macroeconomic Dynamics*.
Trade	Madsen, J. B. (2009), "Trade Barriers, Openness, and Economic Growth." *Southern Economic Journal*, 76(2), 397-418.
Union Influence	Madsen, J. B., Islam, M. R., & Doucouliagos, H. (2018). Inequality, financial development and economic growth in the OECD, 1870–2011. *European Economic Review*, *101*, 605-624.
Linguistic distance	Madsen, J. B., Islam, M. R., & Doucouliagos, H. (2018). Inequality, financial development and economic growth in the OECD, 1870–2011. *European Economic Review*, *101*, 605-624.

Table 2.34 – Eigen Values and Principle components

id=1

Principal components/correlation Number of obs = 154
Number of comp. = 2
Trace = 2
Rotation: (unrotated = principal) Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.35256	.705122	0.6763	0.6763
Comp2	.647439	.	0.3237	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Unexplained
lnpolity20	0.7071	0.7071	0
lndemo1	0.7071	-0.7071	0

-> id = 2

Principal components/correlation Number of obs = 154
Number of comp. = 2
Trace = 2
Rotation: (unrotated = principal) Rho = 1.0000

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.73988	1.47976	0.8699	0.8699
Comp2	.260122	.	0.1301	1.0000

Principal components (eigenvectors)

Variable	Comp1	Comp2	Unexplained
lnpolity20	0.7071	0.7071	0

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 3

Principal components/correlation         Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)        Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.53411      1.06821                0.7671       0.7671
Comp2 |      .465893            .                0.2329       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
lndemo1 |   0.7071   -0.7071 |          0
----------------------------------------------

-> id = 4

Principal components/correlation         Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)        Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.87223      1.74446                0.9361       0.9361
Comp2 |       .12777            .                0.0639       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 5

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.87079      1.74159                0.9354       0.9354
Comp2 |      .129207            .                0.0646       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
lndemo1 |   0.7071   -0.7071 |          0
----------------------------------------------

-> id = 6

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.92404      1.84807                0.9620       0.9620
Comp2 |     .0759625            .                0.0380       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 7

Principal components/correlation         Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)        Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.16267      .325333                0.5813       0.5813
Comp2 |      .837333            .                0.4187       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
lndemo1 |   0.7071   -0.7071 |          0
----------------------------------------------

-> id = 8

Principal components/correlation         Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)        Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.39477      .789537                0.6974       0.6974
Comp2 |      .605232            .                0.3026       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 9

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.09201      .184012                0.5460       0.5460
Comp2 |      .907994            .                 0.4540       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

---------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |  -0.7071    0.7071 |          0
lndemo1 |   0.7071    0.7071 |          0
---------------------------------------------

-> id = 10

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.86512      1.73024                0.9326       0.9326
Comp2 |      .134881            .                 0.0674       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

---------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 11

Principal components/correlation         Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)        Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.54683      1.09366              0.7734       0.7734
Comp2 |      .453169            .              0.2266       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
lndemo1 |   0.7071   -0.7071 |          0
----------------------------------------------

-> id = 12

Principal components/correlation         Number of obs    =  154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)        Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.82861      1.65723              0.9143       0.9143
Comp2 |      .171387            .              0.0857       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 13

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.92185      1.84371              0.9609       0.9609
Comp2 |     .0781456            .              0.0391       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

---------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
lndemo1 |   0.7071   -0.7071 |          0
---------------------------------------------

-> id = 14

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.88415      1.76831              0.9421       0.9421
Comp2 |      .115847            .              0.0579       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

---------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 15

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.26076      .521523              0.6304       0.6304
Comp2 |      .739238            .              0.3696       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
lndemo1 |   0.7071   -0.7071 |          0
----------------------------------------------

-> id = 16

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.59561      1.19121              0.7978       0.7978
Comp2 |      .404394            .              0.2022       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 17

Principal components/correlation         Number of obs    =  154
Number of comp.  =  2
Trace            =   2
Rotation: (unrotated = principal)        Rho              =    1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
------------+-------------------------------------------------------------
Comp1 |      1.08333      .166666                 0.5417       0.5417
Comp2 |      .916667            .                 0.4583       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

-----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |  -0.7071    0.7071 |          0
lndemo1 |   0.7071    0.7071 |          0
-----------------------------------------------

-> id = 18

Principal components/correlation         Number of obs    = 154
Number of comp.  =  2
Trace            =   2
Rotation: (unrotated = principal)        Rho              =    1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
------------+-------------------------------------------------------------
Comp1 |      1.97305      1.94609                 0.9865       0.9865
Comp2 |      .026954            .                 0.0135       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

-----------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
-------------+--------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

```
lndemo1 |   0.7071   -0.7071 |          0
    ----------------------------------------------

-> id = 20

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.90437      1.80873                0.9522       0.9522
Comp2 |     .0956334            .                0.0478       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

---------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
lndemo1 |   0.7071   -0.7071 |          0
---------------------------------------------

-> id = 21

Principal components/correlation          Number of obs    = 154
Number of comp.  =  2
Trace            =  2
Rotation: (unrotated = principal)         Rho              =  1.0000

--------------------------------------------------------------------------
Component |   Eigenvalue   Difference        Proportion   Cumulative
----------+---------------------------------------------------------------
Comp1 |      1.46612      .932244                0.7331       0.7331
Comp2 |      .533878            .                0.2669       1.0000
--------------------------------------------------------------------------

Principal components (eigenvectors)

---------------------------------------------
Variable |    Comp1     Comp2 | Unexplained
----------+-------------------+-------------
lnpolity20 |   0.7071    0.7071 |          0
```

Chapter 3

Homicide in the West, 1800-2016: The impact of Alcohol, Drugs and Deterrence[8]

Zeresh Errol [a], Jakob B. Madsen [a], Solmaz Moslehi and Holger Strulik [b]

[a] Department of Economics, Monash University [b]
Department of Economics, University of Gottingen

Abstract

This paper constructs a unique dataset containing homicide, alcohol consumption, deterrence and several other variables for 14 advanced countries over the period 1800-2016 and examines determinants of national homicide rates over time. To guide the empirical analysis, a simple model is developed in which criminality is jointly determined by severity of punishment and alcohol consumption, where alcohol and drug intoxication lower self-control and promote criminal behavior. The empirical results show that alcohol and drug consumption as well as crime deterrence are significant determinants of homicide in the West over the last two centuries. Furthermore, we find that the marked increasing homicide rates during the 1960s and 1970s and the subsequent decline is consistent with the path in alcohol consumption.

JEL Classification: K42
Key words: crime, alcohol; drugs; deterrence; OECD; historical trends

[8] Helpful comments and suggestions from seminar participants at Monash University, Yves Zenou, and the participants in the Australasian Public Choice Conference at Deakin University December 2017 and the Association for Social Economics Meeting (ASE) in Denver June 2018 are gratefully acknowledged. Jakob Madsen acknowledges financial support from the Australian Research Council, grants DP110101871 and DP150100061.

3.1 Introduction

Following the seminal paper of Becker (1968), crime has long been examined in terms of cost benefit analysis of a criminal activity of criminals, and Becker (1968) has long been considered to be the workhorse model of crime among economists (Ehrlich, 1996, 2010; Freeman 1999; Dills *et al*., 2010; Levitt, 2017). Although criminologists have long argued that alcohol and drug abuse are the key factors driving violent criminal behavior (see, e.g., Eisner, 2014), the influence of alcohol on the offence rate is neglected in the economics literature. Indeed, alcohol is even not mentioned as a contributing factor for crime in the surveys on crime by Freeman (1999), Ehrlich (2006, 2010), Dills *et al*. (2010), and Levitt (2017).

In this paper, we develop a simple model in which criminality is jointly determined by the severity of punishment and consumption of alcohol and drugs. Following Becker (1968) would-be criminals take into account the costs and benefits of participating in illegitimate activities. Alcohol intoxication reduces the levels of self-control and judgment of unacceptable behavior and, consequently, increases the propensity to commit crimes, including homicide. There is robust scientific evidence that alcohol and drug intoxication promote crime. Alcohol and drug intoxication lower self-control and foster aggression, violence and uncontrollable behavior as it removes inhibitions (Uihlein 1994; Bartholow *et.al*, 2012), have weakening effects on self-awareness (Hull, 1981), and act as a mediator of violent crime (Felson *et al*., 2008). Physiologically, alcohol dulls the "alarm signals" in the brain that notify people that they are making errors (see, e.g., Bartholow *et al*., 2012). Different areas of the brain are controlled by short-run (impulsive) behavior and long-run (planned) behavior (McClure *et al*., 2004; Bechara, 2005; Hare *et al*., 2009). Affective states are triggered by the evolutionary older limbic system, which responds to stimuli without accounting for long term consequences. Abstract thinking and long-term planning are located in the prefrontal cortex, the evolutionary newest area of the brain. The extent to which processes in the prefrontal cortex inhibit and override processes of the limbic system is called self-control or willpower and it is person specific (i.e. brain-specific).

There is also statistical evidence of a strong link between violent behavior and alcohol and drug intoxication. Based on a comprehensive analysis of the crime-alcohol/drug connection using a large sample of data for the U.S, Greenfield (1998) finds that 41% of violent male inmates in jails confess to being under the influence of alcohol at the time of the offense.

Pernanen (1991) and Roizen (1997) find that more than half of all violent crimes (homicide and aggravated assaults) occur while the offender is under the influence of alcohol. While this evidence does not uncover causality, it nevertheless indicates that crime is often associated with intoxication and, as such, is a potentially important determinant of homicide. While high alcohol and drug consumption by the individual criminal may be a cultural trait of the criminal environment, crucially, a potential feedback effect from crime to intoxication washes out at the aggregate level. While alcohol consumption data is the average of the entire population, wouldbe murderers are a small fraction of the population, suggesting that per capita alcohol and drug consumption are, at least to a first approximation; strictly exogenous.

To test the impact of intoxication and deterrence on homicide rates we collect a unique annual dataset on alcohol consumption, homicide and, from 1950, also drug convictions, covering more than two centuries for 14 advanced countries. Furthermore, we construct data on capital punishment, prison population, crime deterrence, divorces, urbanization, per capita income, and the share of population in the 15-29 year age group to allow for confounding factors that the crime literature considers important (see, e.g., see Glaeser and Sacerdote, 1999; Freeman, 1999; Kelly, 2000; Fajnzylber *et.al*, 2002a, 2002b; Ehrlich, 2006, 2010; Dills *et al*., 2010; Levitt, 2017). Thus, we go beyond the conventional analyses in which the estimation period typically commences after 1960; including a few criminological studies analyzing the crime-alcohol nexus (see Parker *et al.*, 2011; Kuhns *et al*., 2014; Hockin *et al.*, 2017). The long data across countries provides substantially more information on long waves in criminality than post-1960 data, increases the efficiency and consistency of the estimates, and allows for long lags in the regressions. Furthermore, the long historical panel data allow us to test for the deterrent effects of executions, since capital punishment has been, apart from the US, predominantly a pre-1900 affair in the countries considered here.

The paper is organized as follows. Section 2 introduces a simple theoretical framework in which the nexus between crime, alcohol and deterrence is established. Section 3 discusses the data and provides graphical evidence, while Section 4 presents the empirical results. Section 5 provides discussion and conclusions.

3.2. Theoretical model

To guide our empirical study we develop a simple model to illustrate the effects of alcohol consumption and deterrence on crime. Subsection 2.1 discusses a simple economic model of the self-control theory of crime, also known as the “general theory of crime” (Gottfredson

and Hirschi, 1990), which emphasizes individual differences in self-control as the main explanation for criminal behavior. Subsection 2.2 combines self-control with alcohol consumption to study the effect of self-control on crime. The general self-control model is empirically well supported in the economics of impulsive consumption literature (Shiv and Fedorikhin, 1999; Baumeister, 2002; Ameriks *et al*., 2007). Specifically related to our research question in the literature on the diminishing effect of alcohol on self-awareness (Hull, 1981) and the literature on alcohol as a mediator for violent crime (e.g. Felson *et al*., 2008). The physiological foundation of the analysis below rests particularly on Bartholow *et al*. (2012) who find that alcohol dulls the brain signals that warn people when they are making a mistake, ultimately reducing selfcontrol.

3.2.1. Self-control and crime

This subsection develops a simple model that applies the dual-self model of Thaler and Shefrin (1981) and Fudenberg and Levine (2006) to the economics of crime. The dual-self model formalizes the notion that humans are neither mere "cold" long-run planners nor mere "hot" affective persons by considering a dual-self consisting of a rational long-run self who partly controls the impulsive actions of a short-run self. Self-control comes at a utility cost arising from not giving in to the urges of the affective short-run self.

The central idea of the dual-self model is the existence of multiple simultaneouslyoperating brain systems. The approach takes into account insights from psychology and neuroscience showing that different areas of the brain control short-run (impulsive) behavior and long-run (planned) behavior (McClure *et al*., 2004; Bechara, 2005; Hare *et al*., 2009). Affective states are triggered by the evolutionary older limbic system, which responds to stimuli without accounting for long term consequences. Abstract thinking and long-term planning are located in the prefrontal cortex, the evolutionary newest area of the brain. The extent to which processes in the prefrontal cortex inhibit and override the processes of the limbic system is called self-control or willpower and it is person-specific (i.e. brain-specific). These features seem to be quite suitable for a self-control explanation of criminal behavior, in particular when it comes to violent crime performed in a "hot" affective state.

Consider an individual whose remaining life expectancy is T years. If the individual commits a crime, s/he is immediately caught and punished with probability p. As a free person, the individual experiences period utility u. If caught, s/he loses u and experiences a cost, c, beyond the loss of u for the length of the punishment period, $L \leq T$. Committing a crime provides utility, u_c, (independently of being caught or not). For simplicity (and in order to

obtain an analytic solution) we assume no discounting of future utility. Then, the lifetime utility of committing the crime is given by

$$u_c + (1 - \mathrm{p})\mathrm{T} - \mathrm{pc}\min\{\mathrm{L}, \mathrm{T}\} + \mathrm{p}u\,(T - \min\{L, T\}) \qquad (1)$$

If punishment is less than life-long, this simplifies to $+\ u\mathrm{T}\ -\ \mathrm{p}(\mathrm{c}\ +\ u)$. For simplicity, we focus on this case. Without the crime (and any self-control problem), lifetime utility is simply $u\mathrm{T}$ such that the net utility of committing the crime is

$$u_c - \mathrm{p}(\mathrm{c} + u) \equiv U_N. \qquad (2)$$

A rational planner commits the crime if $U_N > 0$. From this, as established in the existing literature, it follows that the severity, c, and length, L, of punishment deter crime and, ceteris paribus, rich individuals, for whom u is large, commit less crime. The interesting case for us is where individuals with perfect self-control would not commit the crime, i.e. the case where $U_N < 0$.

Following Fudenberg and Levine (2006), the individual is conceptualized as a dual self. The short run self is driven by impulses and neglects the long-run consequences of the crime. The short-run self just experiences the utility, u_c. The long-run self thus faces a self-control problem and experiences utility

$$uT - \gamma\, u_c, \qquad (3)$$

when s/he does not commit the crime. Here, γ is the cost of self-control, i.e. the "pain" that the individual experiences when s/he does not give in to the desires of the impulsive short-run self. For $\gamma = 0$, we would have perfect self-control (or willpower) and the model is reduced to a standard rational planner model. The case without any self-control can be conceptualized as $\gamma \to \infty$.

Equation (3) can be motivated by the axiomatically derived temptation utility of Gul and Pesendorfer (2001), where γ is the so-called temptation parameter.

The utility of committing the crime is still given by (2) for the long-run self, such that the net utility of committing the crime is given by the difference between (2) and (3), which is

$$(1 + \gamma)u_c - \mathrm{p}(\mathrm{c} + u) \equiv U_S. \qquad (4)$$

For perfect self-control ($\gamma = 0$), U_S reduces to U_N, i.e., the utility with no self-control problem (2). Generally, is increasing in the cost of self-control: the higher the self-control problem,

the less weight gets the utility loss from punishment relative to the utility from fulfilling the impulsive desire to commit the crime. This means that there exists a level of γ where the impulsive individual commits the crime while the individual with perfect self-control does not, $< 0 < U_S$. If we consider a distribution of γ in the population, we get the prediction that individuals with less self-control (with higher γ) are more likely to commit crime. Notice that the predictions from the standard model still apply: more severe punishment (higher c) and better law enforcement (higher) deter crime and rich individuals, i.e. those who experience high utility from consumption, are less inclined to commit crime.

3.2.2. Alcohol, Self-control, and crime

The empirical literature supports that drinking alcohol reduces self-control, i.e. an increase in γ in this model (see Lehti and Kivivouri, 2005, for a detailed discussion and the references related to the medical literature). If we would assume that individuals are immature in the sense that they do not take into account that their alcohol consumption influences their propensity to commit a crime, the exogenous impact of alcohol consumption on gamma is sufficient to motivate a positive alcohol-crime nexus. Sophisticated individuals, however, may take into account that the assumed quantity of alcohol affects their self-control and thus their propensity to commit a crime. In order to implement this idea in a very stylized way, we assume that sober individuals have perfect self-control. Let a denote the amount of alcohol consumed and p_a the associated price. Without (taking into account) the self-control problem, the net utility from drinking is thus $u_a(a) - p_a a$ with $u_a(0) = 0$ and $u_a' > 0$; at least for some levels of a.

With alcohol consumption, self-control declines. Let (a) denote the probability that the individual loses self-control and commits a crime, with $(0) = 0$. The probability is increasing with alcohol assumption $\pi' > 0$. Sophisticated individuals take this fact into account and maximize expected utility from drinking, $u_a(a) - p_a a - (a)[u_c - p(c+u)L]$.

The first order condition for optimal alcohol consumption is:

$$u'_a(a) - p_a - \pi'(a)[u_c - p(c+u)L] = 0. \qquad (5)$$

Sufficient, but not necessary conditions for a solution to exist are $u''_a < 0$ and $\pi'' > 0$. These conditions are also plausible. From implicitly differentiating (5) we obtain the comparative statics summarized by the following proposition:

Proposition 1. *The probability of committing a crime is increasing in (the marginal utility of) alcohol consumption, declining in the price of alcohol, declining in the severity of punishment, declining in the probability of being convicted of the crime and declining in income (i.e.*
experienced utility from consumption).

If we consider a whole population, the probability becomes the prevalence of crime and Proposition 1 implies that average alcohol consumption per person is positively associated with crime prevalence.

3.3. Data and graphical evidence

3.3.1 Data

The data cover the period 1800-2016 for Australia, Belgium, Canada, Denmark, Finland, Germany, Ireland, Italy, the Netherlands, Norway, Sweden, Switzerland, the UK and the US, where the data sample is dictated by data availability. The historical data are collected from various national historical sources, often thematic books, statistical yearbooks and bulletins, and updated from 1960 mostly using international sources (see the Data Appendix for detailed data sources). Since the historical data on age distribution and divorce rates are often from censuses before 1950, they are annualized by linear interpolation; typically in 10-year intervals. The homicide data include only intended manslaughter and murder. Some countries only report data for reported homicides while other countries only provide data on convictions; however, the data are consistently either reported or convictions for each individual country over the period 1800-2016.

Alcohol consumption is measured as the sum of the consumption of beer, wine and spirits in pure alcohol units per capita. We use the following pure alcohol contents to calculate total alcohol consumption: beer, 5%, wine, 12%, and spirits, 40%. During the 19th century, alcohol consumption is often computed as net imports of alcohol plus domestic alcohol production. While the statistics on alcohol consumption are fairly accurate over most of the period covered in the estimates, the data are inaccurate in periods during which the sale of alcohol was prohibited or severely restricted. Prohibition and sales restrictions will affect the results to the extent that illegal alcohol sales and home production is a perfect substitute for licit alcohol sales. There is strong evidence for the US that indicates that the illicit alcohol trade and home production flourished during the period in which alcohol sales was prohibited; however, it is impossible to say by how much. Based on various indicators of alcoholism

during the Finnish alcohol prohibition period 1919-1932, for example, Wuorinen concludes that alcoholism "showed alarming signs of becoming more frequent" (1932. p. 201). If the data for alcohol is unavailable for the whole prohibition period then it is interpolated for the full period, which is the case for the U.S. However, for Finland and Norway, data on alcohol is partly missing for the prohibited period and is therefore only partially interpolated (See the Data Appendix for details on alcohol prohibition).[9]

As a proxy for drug consumption we use the number of drug related offences per 100,000 population due to the unavailability of drug consumption data. Drug related offences usually refer to crimes of possessions, manufacture, or distributing of drugs classified as having a potential for abuse, such as cocaine, heroin, morphine, amphetamines, cannabis and barbiturates; however, since the law on drug offenses have varied substantially over time and across countries, our drug consumption proxy is tenuous. Furthermore, convictions for petty drug-related crimes have the same count in the statistics as convictions for large drug trafficking offenses. Despite these reservations, the evidence for Canada, for which long continuous survey data on cannabis consumption is available, suggests that drug related offenses are potentially good proxies for cannabis consumption.[10]

As measures of deterrence, we use the capital punishment-homicide ratio, the capital punishment-population ratio, the number of capital punishments, the prison populationhomicide ratio, the prison population-population ratio, and the prison population. To encapsulate the expected punishment and to alleviate potential feedback effects from the outcome variable we take a 15-year weighted moving average, lagged 1-15 years, of these deterrence variables with geometrically 15% declining weights. [11] Feedback effects, particularly, may be problematic for the capital punishment-homicide and the prison

[9] Alcohol sales was prohibited in some states, territories, and municipalities but not in all in the US from the 1890s; however it was first from 1919 to 1933 that alcohol was uniformly prohibited across all US states (Heron, 2003). Sales of alcohol were never completely prohibited in the Scandinavian countries; however, sales of alcoholic beverages were prohibited in Norway, with large time-variations in the types of alcoholic beverages that were covered by the prohibition over the period 1917-1927 (Johansen, 2013). Alcohol sales were prohibited in Finland over the period 1919-1932 (Johansen, 2013).

[10] Correlating the log of drug related offences per 100,000 population and the log of the prevalence of cannabis consumption of the 15+ population over the period 1960-2015 yields a correlation coefficient of 0.97 (the cannabis consumption data are available from Macdonald and Roterman, 2017). Correlating the data (again in logs) in 5year overlapping differences over the period 1965-2015 yields a correlation coefficient of 0.79; thus, again, suggesting that drug related offences are likely to be good proxies for drug consumption.

[11] The prison population median prison sentence in the US over the period 1923-1981 was, on average, 59.5 months (Cahalan, 1986). This is approximately the median number created by an annual depreciation rate of 15%.

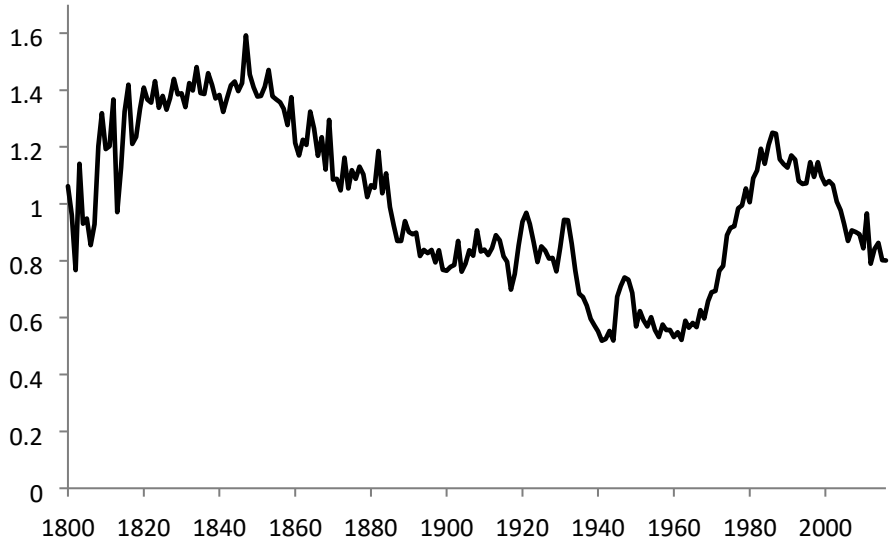
population-homicide ratios because of a direct correspondence between the dependent variables and the denominator of these ratios.

The prison population-homicide ratio deters homicide because it is increasing in the likelihood of being convicted and the expected length of prison terms. The downside of this measure is that not all inmates are homicide convicts and it does not discriminate between different types of prison penalties (food quantity and quality, health insults, heating, isolation etc.). As it is often brutal, capital punishment is a potentially much stronger and more welldefined homicide deterrent (Chambliss, 2011) than imprisonment, and it is dominated by homicide convictions and, to a large extent, captures the likelihood of being executed for the homicide. However, since would-be murderers are unlikely to know this ratio they are likely to pay more attention to the number of public executions, which tended to be widely publicized during the 19th century.

3.3.2 Graphical evidence

Figure 3.1 shows the evolution of the homicide rate on average for the 14 countries in the sample. The increasing trend up until the mid-19th century is consistent with Eisner's (2014) finding of an upward trend from the 1770s to the 1840s for England, Scotland, Ireland, Sweden, Norway, Denmark and Finland. The marked decline in homicide over the approximate period 1840-1960 is, according to Eisner (2014) and Elias (1978), a result of European modernity, as signified by increasing urbanization, individualization and state building. The modernization was an outcome on a 'civilizing process' in which European societies experienced enhanced self-control, standards of decency and disgust for open displays of cruelty –a result of increasing government involvement in the state-of-affairs and an extension of the market economy that created self-disciplinary habits (Elias, 1978).

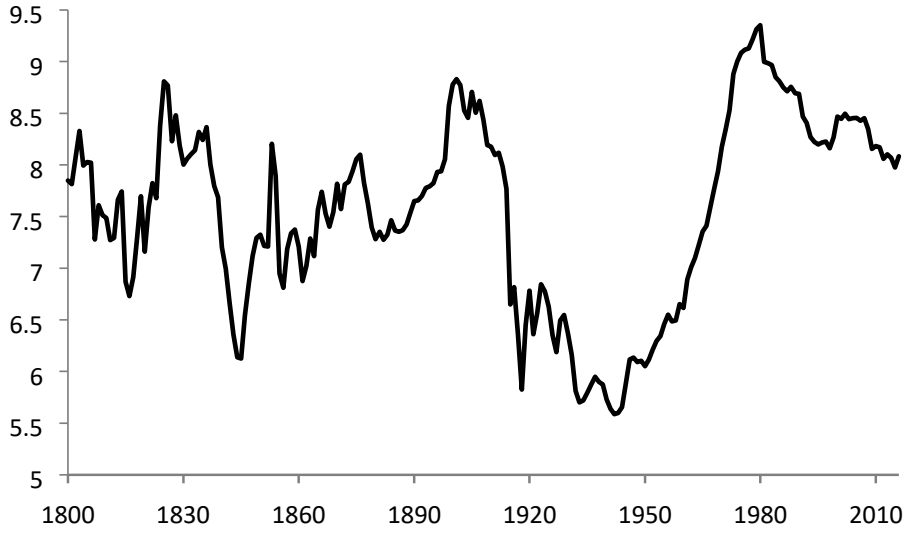
Figure 3. 1- Homicide Rate



Notes. Homicide rate per 100,000 is measured as an unweighted average for the 14 countries included in this study. The data are standardized such that each country has an average of 1 over the period 1800-2016.

The homicide rate increases markedly over the period 1960-1990 and, according to Levitt (2017), why it increased so much remains a mystery. Pinker (2011, p. 106) argues that the increase was caused by a loss of self-control induced by alcohol and drug abuse of the youth culture. The decline after 1990 was, according to Pinker (2011), driven by a 'recivilizing' process in which self-control became central to crime prevention programs and increasing condemnation of uncontrolled behavior. Similarly, Garland (2001) suggests that the post-1990 decline is an outcome of a more punitive justice system and more intensive control of antisocial behavior. Levitt (2004) argues that the increasing prison population was responsible for most of the decline in homicide rates in the US from the 1990s.

Figure 3. 2- Alcohol Consumption

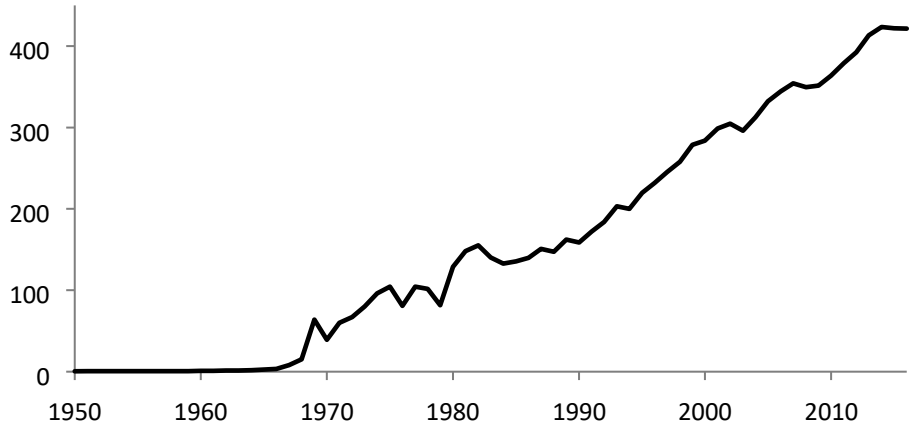


Notes. Per capita consumption of liters of pure alcohol per year measured as an unweighted average for the 14 countries included in this study.

The per capita alcohol consumption path for the 14-country sample is displayed in Figure 3.2. Alcohol consumption fluctuates around a relatively constant level of 7.5 liters per year per capita during the period 1800-1880, increases over the next two decades and shows a sharp drop to a lower level over the period 1902-1915. The criminology/sociology literature attributes the post 1900-decline to increasing self-control as a result of a wider effort to promote self-discipline, responsibility, perseverance, and honesty (Eisner, 2014). Excise taxes probably also played a role. The sharpest fall in alcohol consumption at the onset of WWI, 1913-1914, was associated with escalating taxes on alcohol consumption to assist financing the war efforts since government revenue from import duties, which were a primary source of taxes at that time, shrank along with declining foreign trade (Bentzen and Smith, 2005). Alcohol consumption remained relatively low over the period 1914-1960, partly a result of high alcohol taxes and increasingly restricted access to alcohol purchase, including war rationing, and excise taxes on alcohol sales were elevated; perhaps induced by the emerging cultural change (Bentzen and Smith, 2005).

According to Eisner (2014) the increase in alcohol consumption during the 1960s and 1970s is attributed to a cultural change. Investigating the language used in English-language books, Eisner (2014) finds that sex, drugs and narcissistic self-interest became increasingly popular subjects from the early 1960s to the 1990s, when they started to decline in use. Similarly, Fukuyama (1999) argues that the rise in individualism and the weakening of social controls

had an enormous effect on family life, sexual behavior and criminal activity. **Figure 3. 3-Drug Consumption**

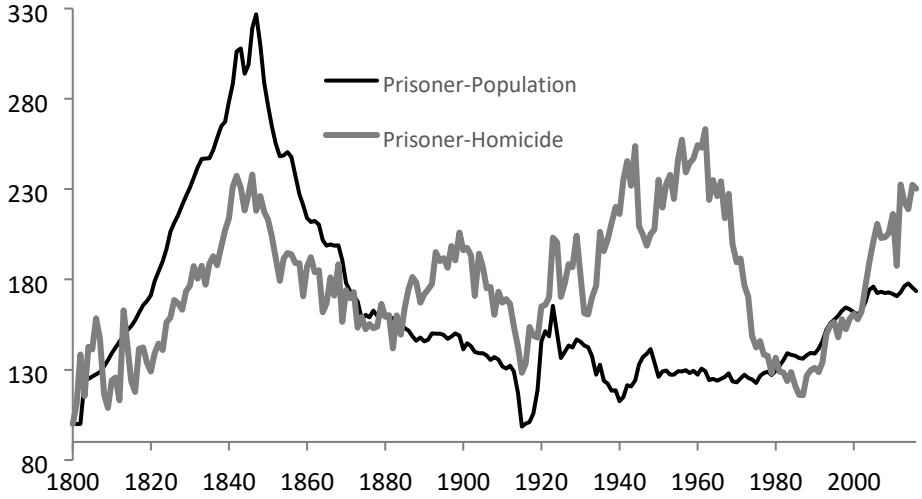


Notes. Number of drug offenses per 100,000 population is measured as an unweighted average for the 14 countries included in this study.

Figure 3.3 shows that the average number of drug offences per 100,000 has been trending upwards since the middle of 20th century; particularly after the late 1960s. This upturn may have been related to the increasingly popularity of sex, drugs and narcissistic self-interest, as discussed by Eisner (2014). Cicero et al. (2014) argues that the increasing drug consumption after the 1960s was perpetuated by the increasing availability of drugs and lower prices of drugs. In real terms the price of cocaine in the US market, for example, declined by approximately two-thirds over the period of analysis, 1981-2007 (Fries et al., 2008) and, as such, is consistent with the theory in Section 3.2 that addiction is inversely related to prices of the drugs.

Figure 3.4 displays prison deterrence rates based on the prison population relative to total population and relative to number of homicides. Common for both curves is that prison deterrence declined markedly over the period 1846-1915. Coupled with a marked decline in the homicide rate over the same period, this path suggests that jail sentences did not deter homicide. The evolution of the prisoner-homicide rate during the past century is more consistent with the inverse homicide path; however, the close inverse relationship between imprisonment and crime disappears if deterrence is measured by the prisoner-population ratio, except for the post-1980 period. These visual impressions, however, need not entirely rule out any deterrence effects from imprisonment, as discussed above, because not all inmates are jailed for homicide. In addition, in 19th and in the early 20th centuries, jails were gradually

introduced as substitutes for executions, whipping and banishment (see Miller, 1974). **Figure 3. 4- Prisoner- Population and Prisoner-Homicide ratios, Index 1800=100**



3.4. Empirical Analysis

3.4.1 Model specification and estimation method

The following log-linear model is estimated using annual data over the period 1815-2016 for 14 OECD countries, where the sample period starts in 1815 to cater for the lagged effects of deterrence:

$$\ln HC_{it} = \lambda_0 + \lambda_1 \ln Alc_{it} + \lambda_2 \ln Drug_{it} + \lambda_3 \ln \text{deterrence}_{it} + Z'\xi + CD_i + TD_t + TT_i + \varepsilon_{it} \quad (6)$$

where *HC* is homicide per 100,000 population; *Alc* is per capita liters of alcohol consumption; *Drug* is the per 100,000 population drug related offences, as a proxy for per capita drug consumption; *Z* is a vector of controls; *CD* is country dummies; *TD* is time-dummies; *TT* is country-specific time trends, and ε is a stochastic error term. Country-specific time-trends are included in the regressions to prevent the coefficients of trended variables being driven by country-specific time-trends. Due to data availability, the number of countries is restricted to nine in the estimates in which deterrence is based on the number of executions.

3.4.2 Identification issues

The estimated coefficients may be biased because of reverse causality and because of omitted variables that simultaneously impact on the dependent and independent variables. As stated

above, we do not use instruments for alcohol consumption per 100,000 population because it is difficult to imagine how crime can affect the alcohol consumption of the average person. Increasing criminal activity may be associated with increasing alcohol abuse in criminal circles. However, alcohol consumption in these circles is caused by factors other than crime, such as gang culture; thus being an omitted variable problem. Furthermore, the number of homicides is far too small a fraction of the population to affect the alcohol consumption of the average person.

Conversely, *det* is unlikely to be exogenous when it is measured as capital punishmenthomicide and prison population-homicide ratios for three reasons. First, the capital punishment-homicide and prison population-homicide ratios may be biased downward because of the negative correlation between the outcome variable and the denominators in these ratios. Note, however, since the outcome variable is homicides per 100,000 population while the denominator of the ratios is the *absolute* number of homicides, the population size creates a wedge between these variable and attenuates the feedback effects from the outcome variable. Second, the coefficients of all the deterrence variables used in this paper are upward biased because increasing homicide rates are likely to be associated with popular demand for increasing deterrence. Third, the coefficient of the prison population-homicide ratio is biased downward because imprisoned would-be serial killers are prevented from committing offenses outside the jail.

In sum, the coefficients of the capital punishment-homicide and prison populationhomicide ratios are highly to be likely downward biased, while the coefficients of number of executions and the capital punishment-population and prison population-population ratios are likely biased towards plus one. Although not eliminated, the bias is attenuated because the deterrence variables are constructed as lagged deterrence rates with geometrically declining weights.

3.4.3 Regression results

The results of regressing Eq. (6) are shown in Table 3.1. The considered estimation periods are 1915-2016, 1815-1930, and 1930-2016, where 1930 is chosen as the break point because most countries in our sample outlawed capital punishment in the 1920s (See table 9.4 in Weier, 2006). The coefficients of drugs are mostly significantly positive; however, their significance and signs are sensitive to which deterrence measurement is used. Alcohol consumption, by contrast, is consistently a statistically highly significantly positive determinant of crime regardless of estimation period and deterrence measure applied. The

coefficients of alcohol consumption are also economically significant. Based on the average of the coefficients in the first row in Table 3.1, a one standard deviation increase in per capita alcohol consumption is associated with an 0.30% increase in the homicide rate and, remarkably, the increasing alcohol consumption over the period 1942 to 1980 resulted in a 36.0% increase in the homicide rate; thus explaining more than a third of the increase in homicide rates over the same period. Conversely, the declining alcohol consumption over the period 1980-2016 has resulted in a 7.8% reduction in homicides.

The interpretation of the deterrence effects on homicide is complicated by measurement errors and endogeneity. The coefficients of det^{PH} (prison population/homicides) are highly significantly negative (columns (1), (3), (4)); probably strongly downward biased by their negative correlation with the dependent variable. The significance of the coefficients of deterrence declines substantially when the prison population is divided by the population, det^{PP}, (columns (2) and (6)); though they remain statistically significant at the 1% level. Since the coefficients of det^{PP} are likely to be biased upwards, their negative significance indicates that imprisonment deters homicide by increasing the likelihood of being caught and the expected length of imprisonment.

Turning to capital punishment, in the estimates over the period 1815-2016, the coefficient of of det^{CP} (executions/population) is significantly positive, though only with a *t*value of 1.80, while it is highly significantly negative for det^{CH} (executions/homicide); however, both coefficients are negative at the 1% significance levels in the more relevant pre1930 regressions. Although the deterrence elasticities of homicide are low they have a large economic significance. For the pre-1930 period the average det^{CH} is 1.78%, which implies that a 1000% increase in the number of executions per homicide reduces the homicide rate by 40% (column (9)) or 90% (column (10)).

Table 3. 1- Homicide regressions, Eq. (6)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
$\ln Alc_t$	0.31***	0.54***	0.27***	0.50***	0.89***	0.82***	0.81***	0.38***	0.41***	0.44***	0.5***	0.23***
	(8.65)	(11.9)	(5.69)	(10.0)	(11.1)	(11.4)	(11.4)	(3.49)	(3.72)	(3.97)	(4.57)	(4.2)
$\ln Drug_t$	0.01	0.07***	0.03**	-0.06***	0.04	0.07**	0.07**	NA	NA	NA	NA	0.03***
	(0.66)	(2.95)	(2.37)	(2.78)	(1.41)	(2.13)	(2.20)					(2.93)
$\ln Det_t^{PH}$	-0.53***		-0.4***	-0.60***								
	(20.1)		(14.0)	(21.6)								
$\ln Det_t^{PP}$		-0.12***			-0.26***						0.46***	-0.12***
		(2.86)			(4.39)						(4.57)	(2.66)
$\ln Det_t^{CP}$						0.01**			-0.04***		-0.04***	-0.01***
						(1.80)			(3.24)		(3.46)	(1.41)
$\ln Det_t^{CH}$							-0.02***			-0.09***		
							(3.47)			(4.70)		
$\ln Det_t^{C}$								-0.15***				
								(4.18)				

Observations	2828	2828	1218	1726	1726	1726	1726	952	952	952	952	783
No. Countries	14	14	14	9	9	9	9	9	9	9	9	9
Est. Period	1815-2016	1815-2016	1930-2016	1815-2016	1815-2016	1815-2016	1815-2016	1815-1930	1815-1930	1815-1930	1315-1930	1930-2016

Notes. The dependent variable is the log of homicides per 100,000 population. The numbers in parentheses are absolute *t*-statistics based on serial correlation and heteroscedasticity consistent standard errors. Constant terms, time dummies, country-specific time-trends, and country dummies are included in the regressions.; *Alc* = alcohol consumption per capita; *Drugs* = number of drug related crimes per 100,000 population. *: Significant at 10%; **: Significant at 5%; and ***: Significant at 1%. det^{PH} = prison population divided by number of homicides; det^{PP} = prison population divided by population; det^{CP} = capital punishment divided by population; det^{CH} = capital punishment divided by number of homicides; det^{C} = number of capital punishments; det^{P} = prison population.

The regressions in the last two columns in Table 3.1 show the joint effect of the number of prisoners per capita, det^{PP}, and number of executions, det^{C}, on homicide over the periods 1815-1930 and 1930-2016. The coefficient of per capita prisoners is significantly positive in the pre-1930 regression, which is, perhaps, not surprising given that the number of prisoners was declining simultaneously with the declining homicide rate over the approximate period 1840-1930. The coefficient is certainly not positive because prison deterrence gives would-be murderers perverse incentives, but is likely upward biased because jailed murderers are prevented from re-offending. For the post-1930 period, the coefficient of per capita prisoners is significantly negative, suggesting that imprisonment has been an effective deterrence over the past century.

Turning to capital punishment, the coefficient of the execution rate, det^{CP}, is significantly negative in the pre-1930 regression, which, in conjunction with the positive coefficient of the imprisonment rate, det^{PP}, suggests that executions were effective deterrence instruments. In the post-1930 regressions, the coefficient of det^{CP} remains negative; however, only significant at the 16% level, which probably does not suggest that executions have become blunt deterrence instruments but that the extremely low identifying variation in executions for the non-US countries has reduced the efficiency of the estimates. Finally, we get the same principal results if the prison population and executions are normalized by homicide (the results are not shown).

3.4.4. Inclusion of confounding factors

The crime literature has stressed a range of variables that influence homicide such as demographic structure, economic development, and family structure. If these variables are correlated with the explanatory variables included in our baseline regressions and, at the same time, are significant determinants of homicide, the parameter estimates will be biased. We include the following variables that are often considered to be potentially important

determinants of homicide: the share of the population in the 15-29 year age group, $Pop^{15\text{-}29}$; the divorce rate, *Div*; the urbanization rate, *Urb*; and income per capita, *Y*/*Pop*, where *Y* is real GDP and *Pop* is population. deterrence is measured as the unweighted average of the prison population divided by population, det^{PP}, and the prison population divided by the number of homicides, det^{PH}; i.e. det^{PP+PH}. Although the coefficient of det^{PP+PH} is not unbiased, it accounts for the fact that the coefficients of det^{PP} and det^{PH} are biased in opposite directions: the coefficient of det^{PP} is biased towards zero while the coefficient of det^{PH} is biased towards minus one.

The share of the 15-29 year age group in total population is included in the estimates because it is the age group in which the highest fraction of offenders are usually assumed to belong (see, e.g. Cooper *et al.*, 2011). Historically, this variable is potentially important because it has varied significantly over the past two centuries along with the fertility and the epidemiological transitions. In line with the literature that looks at the so-called 'social disorganization theory', we control for the structural characteristics of a community such as degree of family disruption and urbanization.[12] The divorce rate, *Div*, measured as the number of divorces divided by the number of marriages, is included as a proxy for the disintegration of family ties. Family disruptions weaken the formal and informal controls that a family can impose on its members. (see, e.g. Blau and Blau, 1982). The divorce rate may also proxy family values and attitudes toward alcohol consumption. The U-shaped alcohol consumption path during the 20th century may have been shaped by changing values of the society in general, as reflected in divorce rates, which simultaneously impacted on homicide and alcohol consumption.

The urbanization rate is included because it is often assumed to be associated with increasing crime because close family ties are being dissolved through a migration from small communities in the countryside to big impersonal cities that may also lead to more intense competition for resources (see, e.g. Glaeser and Sacerdote, 1999). Conversely, Eisner (2014) and Elias (1978) argue that urbanization, at least historically, represents a modernization process that reduced criminality. Per capita income is included as a confounding variable to cater for the thesis that economic development is associated with a more civilized society (see Fajnzylber *et.al*, 2002a, 2002b). Although per capita income is supposed to capture economic development it is not clear from the literature which dimensions of economic development

[12] According to the 'social disorganization theory', the neighborhood is an important factor shaping the probability that a person will become involved in criminal activities.

are associated with higher income and per capita income may not capture the factors of economic development that reduce the homicide rate.

The results of including the control variables in the baseline regressions are presented in Table 3.2, where the estimation period is 1815-2016 except for the pre-1930 and post-1930 regressions in the last two columns. The coefficients of $Pop^{15\text{-}29}$ are significantly positive in the regressions covering the entire period (columns (1), (6)); however, they become insignificant in the sub-period estimates (columns (7) and (8)). Thus, $Pop^{15\text{-}29}$ is not a robust determinant of homicide, which is consistent with the suggestion of Pampel and Gartner (1995) that while the effect of $Pop_{15\text{-}29}$ is positive in some countries, such as the US, this cannot easily be generalized across all countries and over time: the presence or absence of certain types of institutional arrangements will mitigate or strengthen the age effect on homicides in any given country.

Table 3. 2- Controls included, Eq. (6)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
$\ln Alc_t$	0.43***	0.42***	0.44***	0.44***	0.43***	0.43***	0.44***	0.26***
	(10.5)	(10.6)	(10.8)	(10.9)	(10.8)	(10.7)	(7.31)	(3.04)
$\ln Drug_t$	0.06***	0.05**	0.04*	0.04**	0.04**	0.05***	0.03*	NA
	(4.14)	(2.34)	(1.84)	(2.36)	(2.32)	(2.56)	(1.85)	
$\ln Det_t^{PP+PH}$	-0.49***	-0.47***	-0.47***	-0.49***	-0.47***	-0.48***	-0.39***	-0.56***
	(13.7)	(12.6)	(13.3)	(13.3)	(12.9)	(13.6)	(8.52)	(5.95)
$\ln Pop_t^{15-29}$	0.68***					0.72***	-0.12	-0.25
	(4.14)					(4.31)	(0.72)	(0.70)
$\ln Div_t$		0.01						
		(0.54)						
$\ln Div_{t-20}$			0.05***			0.04**	0.11***	-0.03
			(3.13)			(2.09)	(3.29)	(1.46)
$\ln Urb_t$				-0.06		-0.10**	0.43***	-0.34***
				(1.40)		(2.09)	(2.87)	(3.96)
$\ln(Y/Pop)_t$					0.04	0.08	-0.35***	0.30**
					(0.65)	(1.06)	(4.26)	(2.24)
Observations	2828	2828	2758	2828	2828	2758	1218	1554
Est Period	1815-2016	1815-2016	1820-2016	1815-2016	1815-2016	1820-2016	1930-2016	1820-1930

Notes: Homicides per 100,000 population is the dependent variable. Constant terms, time dummies, countryspecific time-trends, and country dummies are included in the regressions. *Alc* = alcohol consumption per capita; *Drugs* = number of drug related crimes per 100,000 population; det^{PH+PP} = unweighted average of det^{PH} (prison population divided by number of homicides) and det^{PP} (prison population divided by population); *Div* = number of divorces per marriage; *Urb* = urbanization rate (fraction of the population living in cities over 50,00 or 100,000 inhabitants); *Y*/*Pop* = per capital income.

The coefficient of divorce, Div_t, is insignificant in the regression in column (2). However, if upbringing is the dominating effect for crime propensity, then we would expect the coefficients of divorce rates lagged 10-20 years to be more important for homicide than contemporaneous divorce rates. The coefficient of the divorce rate lagged 20 years is significantly positive (column (3)) and remains significantly positive when all controls are

included in the regression and in the post-1930 estimate (columns (6) and (7)), suggesting that criminal behavior is affected significantly by upbringing. However, Div_t, is insignificant in the pre-1930 regression, possibly reflecting that divorces were heavily restricted, strongly discouraged, or simply outlawed in the 19th century, suggesting that the pre-1930 results should not overrule the results of the other regressions that lagged divorce rates do affect homicide.[13]

The coefficients of urbanization and per capita income give mixed signals about their effects on homicide[14]. The coefficient of urbanization is significantly positive in the post-1930 regressions; otherwise negative and statistically significant in two of the three cases. The negativity of urbanization in the pre-1930 regression is consistent with Eisner's (2014) and Elias's (1978) claims and that historically, urbanization represents a modernization process that reduces criminality. Conversely, during the past century urbanization has often been associated with the formation of criminal gangs, as the control and supervision of peer-groups urban communities is more difficult than in rural communities (Sampson and Groves, 1989). The coefficient of per capita income is positive before 1930, while it has turned negative thereafter; however, the coefficients of per capita income are not that significant and the results may well reflect some spuriosity, suggesting that homicide is not strongly affected by economic progress. Turning to the variables from the baseline regressions, alcohol, drug offenses, and deterrence remain significant and of the expected signs in all the regressions in Table 3.2. Furthermore, the sizes of their coefficients are remarkably constant across the regressions in Table 3.2; thus ruling out that the focus variables have captured the effects of the confounding variables considered here. Reconsidering the results in Table 3.1, it is clear that the coefficients of deterrence are highly sensitive to estimation period, regardless of how deterrence is measured; however, the coefficient of deterrence is very robust to estimation period in the estimates in Table 3.2, suggesting that det^{PP+PH} is a superior proxy for deterrence over det^{PP} and det^{PH}.

[13] In most countries in our sample, divorce was available on the grounds of guilt or by private acts of parliament or by royal decree in 19th century but was rate. Divorce on the grounds of marital breakdown or by mutual consent after a certain period of legal separation was introduced in 20th century; see Flora (1987, Ch. 2 pp. 145148).

[14] High income lowers crime while higher urbanisation increases crime. So, if urbanisation is driven by high income one wants to factor out the effect of income on urbanisation. Therefore, it is quite critical to control both variables in regression equation so as to rule out any omitted variable problems.

Table 3. 3- Model simulations. Homicide explained (%).

	1	**2**	**3**	**4**	**5**	**6**
	ln HC_{it}	ln Alc_t	ln $Drug_t$	ln Det_{tPP+PH}	ln Pop_t^{15-29}	Predicted
1950/60-1980/2000	74.3	21.6	34.1	30.6	3.47	89.8
1980/2000-2016	-35.9	-1.3	4.7	-9.4	-12.7	-18.7

Notes. 1950/60 = average over the period 1950-1960; 1980/2000 = average over the period 1980-2000; 'Predicted' = sum of the predictions of the explanatory variables (columns (2)-(5)); lnHC_{it} = actual relative increase in homicide. The simulations are based on the average variables across countries and the coefficient estimates in the first column in Table 3.2. The figures are relative changes over the corresponding periods; *not* annualized figures. The figures are un-weighted averages for all countries.

Addressing economic significance, the focus variables explain the evolution of the homicide rate since WWII well. Based on the regression in the first column in Table 3.2, Table3.3 displays simulated effects of the evolution of the explanatory variables on the homicide rate. Considering the first row in Table 3.3, the simulation over the periods 1950/60 and 1980/2000 predicts an increase in the homicide rate of 89.8 percent, slightly beyond the actual increase of 74.3%. Of the homicide rate increase, alcohol explains 24 percent, drugs 34.1 percent, deterrence 30.6 percent, and the population in the 15-29 year age group 4 percent. An interesting aspect of the simulation in the first row is that alcohol and drug have jointly contributed more than 50 percent of the increase in the homicide rate in this period. Following the social and cultural changes of the 1960s, drug use and alcohol consumption increased substantially in the countries in our sample (see, e.g., 2010; Eisner, 2014).

Turning to the simulations over the period 1980/2000-2016 in the last row in Table 3.3, the 35.9% decline in the homicide rate, the declining share of the population in the 15-29 year age group explains most of the decline (12.7%) followed by deterrence (9.4%) and reduced alcohol consumption (1.3%), while drug use contributed positively to the homicide path (4.7%). Thus, the declining alcohol consumption marginally contributed to the decline in the homicide rate; however, it was essentially increasing deterrence and a reduced fraction of the population in the 15-29 year age group, triggered by the declining fertility in the post-1970 period, that explain the lion's share of the decline.

3.5. Conclusion

Extending Becker's (1968) analysis we show that crime, in addition to deterrence, is influenced by alcohol and drug intoxication because of their effects on brain signals that warn people when they are making a mistake; thus ultimately reducing self-control. deterrence

reduces homicide by reinforcing internal controls by vicarious external experiences. Using two centuries of data for 14 advanced countries we find that alcohol consumption, particularly, deterrence, and drug consumption are significant determinants of homicide rates. Divorce rates and the fraction of the population in the 15-29 year age group are also generally positive determinants of homicides; however, their significances are sensitive to estimation period and inclusion of other confounding variables.

While the coefficients of deterrence rates are consistently negative in the homicide regressions we are unable to determine their precise economic significance, predominantly because there is no conclusive way of measuring deterrence and because it is subject to biases. Exploiting the various directions of biases for different deterrence proxies, we are able to cautiously conclude that deterrence matters for homicide and it has done so over at least the past two centuries. Furthermore, while deterrence has contributed to the homicide path since WWII, it did not contribute to the declining homicide rate over the period from the 1840s to approximately WWI regardless of how we measure deterrence, suggesting that declining alcohol consumption along with other factors, was responsible for the decline.

Our results give the following insights into the economics of homicide. First, deterrence and alcohol consumption have been significant determinants of homicide in both the 19th and the 20th centuries. Since there have been ups and downs in homicide rates over the past two centuries these results suggest that our findings are not driven by a trend in homicide, which could easily have been the case had short run data been used. Second, the sharp upturn in alcohol consumption over the period 1960 to 1980 and the subsequent decline is consistent with the time-profile in homicide, suggesting that movements in alcohol consumption has contributed significantly to this path and, as such, sheds light on Levitt's (2017, p 1924) statement that, "it remains a mystery, for instance, why crime rose so much in the 1960s. We continue to have relatively little insight into the question of why some individuals become criminals and others do not." Third, reduced alcohol consumption during the period 1914-1950 relative to the ultra-long trend is, to some extent, consistent with the alcohol hypothesis that low crime is associated with low alcohol consumption.

While we have been relatively successful in explaining the movements in homicide during the past century, we have been less successful in explaining the waves up to WWI. We are, particularly, disappointed by the inability of our focus variables in explaining the decline in homicide over the approximate period 1850-1914. Although declining, alcohol consumption did not show a clear downward trend over the period 1850-1914 and deterrence was not increasing during this period. Since this homicide trend was common across countries, this

trend was, to some extent, captured by the time-dummies and country-specific trends and, as such, they have prevented the parameter estimates from being biased due to spurious joint trends – a great advantage of the panel approach. However, what exactly explains the downward homicide trend over the period 1850-1914 needs to be explained by future research. Reduced alcohol consumption certainly contributed to the decline; however, with a sufficiently large force to explain the entire decline.

References

Ameriks, J., Caplin, A., Leahy, J. and Tyler, T. (2007). Measuring self-control problems. *American Economic Review*, 97(3), 966-972.

Bartholow, B. D., Henry, E. A., Lust, S. A., Saults, J. S. and Wood, P. K. (2012). Alcohol effects on performance monitoring and adjustment: Affect modulation and impairment of evaluative cognitive control. *Journal of Abnormal Psychology*, 121(1), 173-86.

Baumeister, R. F. (2002). Yielding to temptation: Self-control failure, impulsive purchasing, and consumer behavior. *Journal of Consumer Research*, 28(4), 670-676.

Becker, G. S. (1968). crime and punishment: An economic approach. In Fielding, N. G., Clarke, A. and Witt, R. (eds), *The Economic Dimensions of crime*, (pp. 13-68). London: Palgrave Macmillan.

Bechara, A. (2005). Decision making, impulse control and loss of willpower to resist drugs: A neurocognitive perspective. *Nature Neuroscience*, 8(11), 1458-1463.

Bentzen, J. and Smith, V (2005). Short-run and long-run relationships in the consumption of alcohol in the Scandinavian countries. *Nationaløkonomisk Tidsskrift*, 143, 65-80.

Blau, J. R. and Blau, P. M. (1982). The cost of inequality: Metropolitan structure and violent crime. *American Sociological Review*, 114-129.

Wood, W. R (2011). Capital Punishment/Death Penalty. In, Chambliss, W. J. (ed.), Corrections (*Key Issues in crime and Punishment),* (pp. 1-11). Thousand Oaks, CA: Sage Publications.

Cahalan, M. W., and Parsons, L. A. (1987). *Historical corrections statistics in the United States, 1850-1984*. US Department of Justice, Bureau of Justice Statistics.

Cicero, T. J., Ellis, M. S., Surratt, H. L., and Kurtz, S. P. (2014). The changing face of heroin use in the United States: a retrospective analysis of the past 50 years. *JAMA psychiatry*, 71(7), 821-826.

Cooper, A., Smith, E.L. and BJS Statisticians. (2011). Homicide Trends in the United States, 1980-2008. Bureau of Justice Statistics November NCJ 236018, Washington DC: U.S. Department of Justice. https://www.bjs.gov/content/pub/pdf/htus8008.pdf

Dills, A.K., Miron, J.A. and Summers, G., (2010). What do economists know about crime? In Di Tella, R. Edwards, S. and Schargrodsky, E. (eds), *The Economics of crime: Lessons For and From Latin America*, (pp. 269-302). Chicago: University of Chicago Press.

Ehrlich, I. (1996). crime, punishment, and the market for offenses. *Journal of Economic Perspectives*, 10(1), 43-67.

Ehrlich, I. (2010). The market model of crime: A short review and new directions. In Benson, B. L. and Zimmernam, P. R. (eds), *Handbook on the Economics of crime*, (pp. 3-23), Portland, OR: Edward Elgar Publishing.

Eisner, M. (2014). From swords to words: Does macro-level change in self-control predict long-term variation in levels of homicide? *crime and Justice*, 43(1), 65-134.

Elias, N. and Jephcott, E. (1978). *The Civilizing Process, Vol. 1, The History of Manners*. Oxford: Blackwell.

Fajnzylber, P., Lederman, D., and Loayza, N. (2002a). What causes violent crime? *European Economic Review*, 46(7), 1323-1357.

Fajnzylber, P., Lederman, D. and Loayza, N. (2002b). Inequality and violent crime. *The Journal of Law and Economics*, 45(1), 1-39.

Felson, R., Savolainen, J., Aaltonen, M. and Moustgaard, H. (2008). Is the association between alcohol use and delinquency causal or spurious? *Criminology*, 46(3), 785-808.

Flora, P. Kraus, F. and Pfenning, W. (1987). *State, economy, and Society in Western europe 1815-1975 A Data Handbook Volume II: The Growth of Industrial Societies and Capitalist Economics.* Campus Verlag GmbH, Frankfurt am Main.

Freeman, R. B., (1999). The economics of crime. In Ashenfelder, O. and Card, D. (eds.), *Handbook of Labor Economics*, Vol. 3 Part C, (pp. 3529-3571). Amsterdam: Elsevier Science B.V.

Fries, A., Anthony, R. W., Cseko Jr, A., Gaither, C. C., and Schulman, E. (2008). *Technical report for the price and purity of illicit drugs: 1981-2007*. (No. IDA/HQ-P-4370). Institute for defense analyses Alexandria, VA.

Fudenberg, D. and Levine, D. K. (2006). A dual-self model of impulse control. *American Economic Review* 96(5), 1449-1476.

Fukuyama, F. (1999). *The great disruption: human nature and the Reconstruction of Social Order*. New York: Free Press.

Garland, D. (2001). *The culture of control: crime and social order in contemporary society*. Oxford: Oxford University Press

Glaeser, E. L. and Sacerdote, B. (1999). Why is there more crime in cities? *Journal of Political Economy*, 107(S6), S225-S258.

Gottfredson, M. R. and Hirschi, T. (1990). *A general theory of crime*. California: Stanford University Press.

Greenfield, L. A. (1998). Alcohol and crime: An analysis of national data on the prevalence of alcohol involvement in crime. Bureau of Justice Statistics, April, NCJ-168632, Washington DC: US Department of Justice.

Gul, F. and Pesendorfer, W. (2001). Temptation and self-control, *Econometrica*, 69, 14031435.

Hare, T.A., Camerer, C.F. and Rangel, A. (2009). Self-control in decision-making involves modulation of the vmPFC valuation system. *Science*, 324(5927), 646-648.

Heron, C. (2003). *Booze: a distilled history.* Between the Lines, Toronto, Canada.

Hockin, S., Rogers, M. L. and Pridemore, W. A. (2017). Population-level alcohol consumption and national homicide rates. *European Journal of Criminology*, 15(2), 235-252.

Hull, J. G. (1981). A self-awareness model of the causes and effects of alcohol consumption. *Journal of Abnormal Psychology*, 90(6), 586-600.

Johansen, P. O. (2013). The Norwegian alcohol prohibition; a failure. *Journal of Scandinavian Studies in Criminology and crime Prevention*, 14(sup1), 46-63.

Kelly, M. (2000). Inequality and crime. *Review of Economics and Statistics*, 82(4), 530-539.

Kuhns, J. B., Exum, M. L., Clodfelter, T. A. and Bottia, M. C. (2014). The prevalence of alcohol-involved homicide offending: a meta-analytic review. *Homicide Studies*, 18(3), 251-270.

Lehti, M. and Kivivuor, J. (2005). Alcohol-related violence as an explanation for the difference between homicide rates in Finland and the other Nordic Countries. *Nordisk Alkohol & Narkotikatidskrift*, 22(1) English Supplement, 7-24.

Levitt, S. D. (2004). Understanding why crime fell in the 1990s: Four factors that explain the decline and six that do not. *Journal of Economic Perspectives*, 18(1), 163-190.

Levitt, S. D. (2017). The economics of crime. *Journal of Political Economy*, 125(6), 19201925.

Macdonald, R. and Rotermann, M. (2017). Experimental estimates of cannabis consumption in Canada, 1960 to 2015. Economic Insights No. 77, Statistics Canada. https://www150.statcan.gc.ca/n1/pub/11-626-x/11-626-x2017077-eng.htm

McClure, S. M., Laibson, D. I., Loewenstein, G. and Cohen, J. D. (2004). Separate neural systems value immediate and delayed monetary rewards. *Science*, 306(5695), 503-507.

Miller, M. B. (1974). At hard labor: Rediscovering the 19th century prison. *Issues Criminology*, 9, 91.

Pampel, F. C. and Gartner, R. (1995). Age structure, socio-political institutions, and national homicide rates. *European Sociological Review*, 11(3), 243-260.

Parker, R. N., Williams, K. R., McCaffree, K. J., Acensio, E. K., Browne, A., Strom, K. J., and

Barrick, K. (2011). Alcohol availability and youth homicide in the 91 largest US cities, 1984–2006. *Drug and alcohol review*, 30(5), 505-514

Pernanen, K. (1991). *Alcohol in Human Violence*. New York: Guilford Press.

Pinker, S. (2011). *The Better Angels of Our Nature: The Decline of Violence in History and Its causes*. London: Penguin UK.

Roizen, J. (1997). Epidemiological issues in alcohol-related violence. In Galanter, M. (ed.), *Recent Developments in Alcoholism*, Vol. 13, (pp. 37-41). New York, NY: Plenum Press.

Sampson, R. J., and Groves, W. B. (1989). Community structure and crime: Testing socialdisorganization theory. *American Journal of Sociology*, 94(4), 774-802.

Shiv, B. and Fedorikhin, A. (1999). Heart and mind in conflict: The interplay of affect and cognition in consumer decision making. *Journal of Consumer Research* 26(3), 278-292.

Thaler, R. H., and Shefrin, H. M. (1981). An economic theory of self-control. *Journal of Political Economy*, 89(2), 392-406.

Uihlein, C. (1994). Drugs and alcohol. In Hirschi, T. and Cottgredson, M. R. (eds), *The Generality of Deviance*, (pp. 149–157). New Brunswick, NJ: Transaction Publishers Weier, J. W. (2006). *Capital Punishment: Cruel and Unusual*? Detroit, MI: Gale Group.

Wuorinen, J. H. (1932). Finland's prohibition experiment. *The Annals of the American Academy of Political and Social Science*, 163(1), 216-226.

Appendices: Data Sources

Homicide

Belgium.1825-1869, Chapter 8, Personal Security Since 1820, Baten, J., W. Bierman and J.L. van Zanden in *How Was Life? Global Well-being Since 1820* (van Zanden, J., *et al*., 2014), OECD, Paris; 1870-1992, *Annuaire statistique de la belgique* (1881-1995); 1993-2012, Lehti, M. (2013) NRILP Comparative Homicide Time Series, *National Research Institute of Legal Policy*, Helsinki. **Australia.** 1870-1902, CJ 52-67, Offences Heard and determined at Magistrate's Courts, Australia, Vamplew, W. (1987), *Australian Historical Statistics*; 19031972, Table CJ 18-31, Selected crimes reported and cleared, Archer, D., and Gartner, R. (1987) *Violence and crime in cross-national perspective*. Yale University Press; 2010-2016, Table 22, Victims of Homicide, *Australia Bureau of Statistics*. **Canada.** 1879-1925, Series Y61-66, Murder: charges, dispositions, commutations and executions, Canada, 1879-1960, Urquhart M.C. (1965) *Historical Statistics of Canada*; 1926-1965, Section Z: Justice Series Z21. Number of criminal homicide deaths, Canada, 1926 to 1975, *Statistics Canada*; 1961-2016, Table 253-0001, Homicide Survey, Canadian Centre for Justice Statistics, *Statistics Canada*. **Denmark.** 1833-1836, *Statistisk Tabelværk Ny Række, Tyvende Bind detalierede Kriminaltabeller for Kongeriget Danmark* (1841-1885); 1859-1885, *Oversigt over den kriminelle retspleje: sammendrag af statistiske oplysninger* (1880-1896); 1886-1999, Antal af domfældte for egentlige forbrydelser og for offentlige politiforseelser, *Statistisk Årbog* (18971999); 2000-2016, Lehti, M. (2013) NRILP Comparative Homicide Time Series, *National Research Institute of Legal Policy, Helsinki*. **Finland** 1877-2016, Nombre des personnes condamnees pour les infractions, *Tilastollinen Vuosikirja* (1879-2014). **Germany.** 1803-1853, Chapter 8, Personal Security Since 1820, Baten, J., W. Bierman and J.L. van Zanden in *How Was Life? Global Well-being Since 1820* (van Zanden, J., *et al*., 2014), OECD, Paris; 18542012, Datentabelle 9.2 x0433 Verurteilte - Mord und Totschlag. **Ireland**, **Italy**, **Sweden** and **Switzerland.** 1800-1950, Chapter 8, Personal Security Since 1820, Baten, J., W. Bierman and J.L. van Zanden in *How Was Life? Global Well-being Since 1820* (van Zanden, J., *et al*., 2014), OECD, Paris; 1950-2016, Lehti, M. (2013) NRILP Comparative Homicide Time Series, *National Research Institute of Legal Policy, Helsinki*. **Netherland.** 1852-1972, Franke, H. (1994). Violent crime in the Netherlands. A Historical-sociological Analysis. *crime, law and social change*, 21(1), pp. 73-100; 1900-1972, Archer, D., and Gartner, R. (1987) *Violence and crime in cross-national perspective*. Yale University Press; 1992-2009, Ganpat, S. M., and Liem, M. C. (2012) Homicide in the Netherlands. in *Handbook of European Homicide Research* (pp. 329-341). Springer, New York; 2010-2016, Lehti, M. (2013) NRILP Comparative Homicide Time Series, *National Research Institute of Legal Policy, Helsinki*. **Norway.** 1846-1902, Opgave over Antallet af de for justitsforbrydelser hvert af Aaerne (18461885), *Norges officielle statistik*,1863; 1903-1970, Archer, D., and Gartner, R. (1987) *Violence and crime in cross-national perspective*. Yale University Press; 1971-2016, Lehti, M. (2013) NRILP Comparative Homicide Time Series, *National Research Institute of Legal Policy, Helsinki*. **United Kingdom.** 1800-1897, London and Liverpool homicide rates, Monkkonen. E. (2005) Available at: https://cjrc.osu.edu/research/interdisciplinary/hvd/europe/london, Accessed on 12/02/17; 1898-2016, Available at: https://www.gov.uk/government/statistics/historical-crime-data, Accessed on 12/02/17. **United States.** 1839-1997, Table Ec 237-241 and Table Ec190-198, Carter, S. B., Gartner, S.

S., Haines, M. R., Olmstead, A. L., Sutch, R., and Wright, G. (2006) Historical Statistics of the United States: Millennial Edition; 1998-2012, Lehti, M. (2013) NRILP Comparative Homicide Time Series, *National Research Institute of Legal Policy, Helsinki*.

Prison Population

Australia. 1860-1899, CJ116-129, Daily Average of Prisoners by Jurisdiction, *Australians Historical Statistics*; 1900-1999, C8.11, Prisoners, Daily Average Number and Rates per 100,000
Population 1900-1999, Mukherjee, S. K., Scandia, A., Dagger, D., and Matthews, W (1998), *Source Book of Australian Criminal and Social Statistics*, Canberra: Australian Institute of Criminology.; 2006-2016, Table 2 Prisoners, selected characteristics, *Australian Bureau of Statistics*, Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/detailsPage/4517.02017?OpenDocument, Accessed on 4/02/18. **Belgium.** 1835-1992, Inculpes condamnes a l'emprisonnement, *Annuaire Statistique de la Belgique* (1870-1995). **Canada.** 1886-1951, Series Z85-93, Sentences for indictable offenses, Canada, 1886-1951; 1952-1972, Series Z94-102 Sentences of persons convicted for indictable offenses, Canada, 1952-1972; 1950-2016, Prison population, Available at: http://www.prisonstudies.org/country/canada, Accessed on 5/02/18. **Denmark**. 1810-1965, Number of persons imprisoned per 100,000 of the population in Denmark, Christie, N. (1968) Changes in penal values. *Scandinavian Studies in Criminology*, 2, pp. 161-172; 1966-2016, Offences against the penal code by type of penalty, *Statistisk Årbog* (1960-2016). **Finland**. 1886-1965, Number of persons imprisoned per 100,000 of the population in Finland, Christie, N. (1968). Changes in penal values. *Scandinavian Studies in Criminology*, 2, pp. 161-172; 1966-2016, Number of people sentenced to imprisonment in courts of first instance, *Tilastollinen Vuosikirja* (1960-2016). **Germany.** 1882-2016, Table X0443 and X0444, Rahlf, T. , *Dokumentation zum Zeitreihendatensatz für Deutschland, 1834-2012*. **Ireland.** 1851-1980, Total criminal prisoners convicted, Available at *Microfiche Thom's directory of Ireland* (1885-1980); 2001-2016, Sentenced prisoners in custody by length of sentence and sex, *Statistics Ireland* (2002-2012); 2012-2016, Available at: http://www.prisonstudies.org/country/ireland, Accessed on 4/02/18. **Italy.** 1890-2016, Tavola 6.21 Condannati per delitto con sentenza irrevocabile secondo la pena, il sesso,l'eta e il paese di nascita-Anni 1890-2009, *Sommario di statistiche storiche 1861-2010*. **Netherlands.** 18372005, Figure 3, Tonry, M., and Bijleveld, C. (2007). crime, criminal justice, and criminology in the Netherlands. *crime and justice*, 35(1), p.1-30; 2006-2016, Prison population trend, Available at: http://www.prisonstudies.org/country/netherlands, Accessed on 10/01/2018. **Norway.** 1810-1966, Number of persons imprisoned per 100,000 of the population in Norway, Christie, N. (1968). Changes in penal values. *Scandinavian Studies in Criminology*, *2*, pp. 161-172; 1967-2016, Prison population trend, Available at: http://www.prisonstudies.org/country/norway. Accessed on 10/01/2018. **Sweden.** 1810-1966, Number of persons imprisoned per 100,000 of the population in Sweden, Christie, N. (1968) Changes in penal values. *Scandinavian Studies in Criminology*, 2, pp. 161-172; 1967-1993, Number of people sentenced to imprisonment in the courts of first instance *Statistical Yearbook of Sweden* (1967-1993); 1994-2016, Tabell 5.3, Persons sentenced to imprisonment and admitted to prison, by principal offence, 1994–2016, Available at https://www.bra.se/bra-inenglish/home/crime-and-statistics/crime-statistics/the-prison-and-probation-service.html; Accessed on 10/02/2018. **Switzerland**. 1890-1986, Verurteilte Gefangene, *Statistisches*

Jahrbuch der Schweiz (1932-1988); 1987-2012, Federal office of statistics, Switzerland. Available at: https://www.bfs.admin.ch/bfs/de/home/statistiken/kriminalitaetstrafrecht/strafjustiz/sanktionen-untersuchungshaft.assetdetail.334019.html, Accessed on 12/01/2018. **United Kingdom.** 1900-2016, Table 1a: Prison population annual average by gender, England and Wales, 1900-2016, Allen, G. and Watson, C. (2017) Prisons and Courts Statistics, England and Wales, *House of Commons Library*, WP Number CBP7892. **United States** 1925-2016, Table 6.28.2012, Number and rate (per 100,000 resident population in each group) of sentenced prisoners under jurisdiction of State and Federal correctional authorities on December 31, by sex, United States, *Sourcebook of Criminal Justice Statistics*, Available at: https://www.albany.edu/sourcebook/tost_6.html, Accessed on 10/02/2018.

Capital Punishment

Australia. 1820-1870, Vamplew, W. (1987), *Australian historical statistics*, Fairfax, Syme and Weldon. p. 313; 1870-1967, The resource site for the history of death penalty in Britain, Capital punishment worldwide, Available at: http://www.capitalpunishmentuk.org/aus1900.html, Accessed on 10/07/2018. **Canada**. 18791960, Table Z103-108, Section Z, *Statistics Canada*. **Germany**. 1834-2012, Table X0448, *Dokumentation zum Zeitreihendatensatz für Deutschland, 1834-2012*. **Ireland**. 1835-1961,
The resource site for the history of death penalty in Britain, Capital punishment worldwide, Available at: http://www.capitalpunishmentuk.org/ir1835.html, http://www.capitalpunishmentuk.org/nirish.html, and http://www.capitalpunishmentuk.org/ireland.html, Accessed on 10/07/2018. **Norway.** 18001876, Available at: http://www.ondskap.org/de-henrettede-1772-1876.html, Accessed on 10/07/2018. **Sweden**. 1800-1910, Available at: https://sv.wikipedia.org/wiki/D%C3%B6dsstraff_i_Sverige , Accessed on 10/07/2018. **Switzerland.** 1800-1944, The resource site for the history of death penalty in Britain, Capital punishment worldwide, Available at: http://www.capitalpunishmentuk.org/Switzerland.html, Accessed on 10/07/2018. **United Kingdom.** 1800-1827, The resource site for the history of death penalty in Britain, Available at: http://www.capitalpunishmentuk.org/1800.html, Accessed on 10/07/2018; 1828-1836; The resource site for the history of death penalty in Britain, Available at: http://www.capitalpunishmentuk.org/1828.html, Accessed on 10/07/2018; 1837-1867; The resource site for the history of death penalty in Britain, Available at: http://www.capitalpunishmentuk.org/1837.html, Accessed on 10/07/2018; 1868-1899; The resource site for the history of death penalty in Britain, Available at: http://www.capitalpunishmentuk.org/1868.html, Accessed on 10/07/2018; 1900-1931; The resource site for the history of death penalty in Britain, Available at: http://www.capitalpunishmentuk.org/hanged1.html, Accessed on 10/07/2018; 1932-64; The resource site for the history of death penalty in Britain, Available at: http://www.capitalpunishmentuk.org/hanged2.html, Accessed on 10/07/2018. **United States**. 1800-1929, The resource site for the history of executions in America, Available at: http://web.archive.org/web/20080518161424/users.bestweb.net/~rg/execution.htm, Accessed on 10/07/2018; 1930-1998, Table Ec343-357, Carter, S. B., Gartner, S. S., Haines, M. R., Olmstead, A. L., Sutch, R., and Wright, G. (2006) Historical Statistics of the United States: Millennial Edition; 1999-2016, Death penalty information centre, Available at: https://deathpenaltyinfo.org/number-executions-state-and-region-1976, Accessed on 10/07/2018.

Alcohol consumption

Australia. 1843-2012, Anderson, K., V. Pinilla (2017) Annual Database of Global Wine Markets, 1835 to 2016, *Wine Economics Research Centre*, University of Adelaide, Available at www.adelaide.edu.au/wine-econ/databases, Accessed on 12/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Belgium.** 1838-1958, Reuss, C. (1960) L'évolution de la consommation de boissons alcoolisées en Belgique 1900–1958, *Recherches Économiques de Louvain*, 26(2), pp. 85-123; 1960-2012, Recorded Alcohol per Capita Consumption, Global Health Observatory Data Repository, *WHO*, Available at: http://apps.who.int/gho/data/node.main.A1022?lang=en, Accessed on 10/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Canada.** 1888-1950, Anderson, K., V. Pinilla (2017) Annual Database of Global Wine Markets, 1835 to 2016, *Wine Economics Research Centre*, University of Adelaide, Available at www.adelaide.edu.au/wineecon/databases, Accessed on 12/12/2017; 1888-1950, Mitchell, B. R. (1980) *International historical statistics*; 1950-2000, Ramstedt, M. (2004) Alcohol consumption and alcohol-related mortality in Canada, 1950-2000. *Canadian Journal of Public Health/Revue Canadienne de*
Santé Publique, pp. 121-126; 1960-2012, Recorded Alcohol per Capita Consumption, Global Health Observatory Data Repository, *WHO*, Available at: http://apps.who.int/gho/data/node.main.A1022?lang=en, Accessed on 10/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Denmark.** 1850-1980, Eriksen, S. (1993) Skabelsen af den danske liberale drikkestil. *Nordisk Alkohol Tidsskrift, 10*(1), pp. 3-13; 1981-2012, Recorded Alcohol per Capita Consumption, Global Health
Observatory Data Repository, *WHO*, Available at: http://apps.who.int/gho/data/node.main.A1022?lang=en, Accessed on 10/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Finland.** 1840-2012, Vuorela, M. (2017) The historical criminal statistics of Finland 1842–2015–a systematic comparison to Sweden. *International Journal of Comparative and Applied Criminal Justice*, pp. 1-23; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. Prohibition period (1919-1932) Data is interpolated between 1919 and 1926 because alcohol data is partially unavailable during the prohibition period. **Germany.**1850-1959, Hoffmann, W. G. (2013) Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts.
Springer-Verlag; 1960-2012, Recorded Alcohol per Capita Consumption, Global Health Observatory Data Repository, *WHO*, Available at: http://apps.who.int/gho/data/node.main.A1022?lang=en, Accessed on 10/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Ireland**.1800-1898, Wilson. G.B. (1940) *Alcohol and the Nation:* A *Contribution to the Study of the Liquor Problem in the United Kingdom from 1800 to 1935* London: Nicholson and Watson; 18992012, British Beer and Pub Association, Available at: https://beerandpub.com/, Accessed on 14/12/2017; 1960-2012, Recorded Alcohol per Capita Consumption, Global Health
Observatory Data Repository, *WHO*, Available at: http://apps.who.int/gho/data/node.main.A1022?lang=en, Accessed on 10/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Italy**. 1860-2012, Anderson, K., V. Pinilla (2017), Annual Database of Global Wine Markets, 1835 to 2016, *Wine Economics Research Centre*, University of Adelaide, Available at www.adelaide.edu.au/wineecon/databases, Accessed on 12/12/2017; 2012-2016, OECD.Stat,

Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Netherlands.** 1800-1998, Tabel 12, Consumptie en Verbruik, *Centraal Bureau voor de Statistiek;* 1999-2012, Recorded Alcohol per Capita Consumption, Global Health Observatory Data Repository, *WHO*, Available at: http://apps.who.int/gho/data/node.main.A1022?lang=en, Accessed on 10/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Norway.** 1815-1849, Alkohol Statistik i. forbruk av brjendevin, vin og øl i Norge 1814- 1909, *Norges Officielle Statistikk*; 1850-1966, Tabell 3133 Forbruk av brennevin, vin og øl, *Historisk Statistikk 1968*; 1967-2012, *Statistical yearbooks of Norway* (1975-2013); 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. Prohibition period (1917-1927) Data is interpolated between 1917 and 1920 because alcohol data is partially unavailable during the prohibition period.
Sweden. 1853-1869, Hofer, H. (1985). Brott och straff i Sverige: *Historisk Kriminalstatistik* 1750-1984; 1853-1869, Centralbyrån, S. (1960). *Historisk statistik för Sverige*: *Statistiska Översiktstabeller*; 1870-2012, Tabell 1. *Drogutvecklingen I Sverige 2011*; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **Switzerland.** 18821891, T.9a Estimations de la consommation de boissons alcooliques, de 1880 à 1884 et de 1893 à 1984, *Historiche statistic der schweiz*; 1891-2012, Anderson, K., V. Pinilla (2017) Annual Database of Global Wine Markets, 1835 to 2016, *Wine Economics Research Centre*, University of Adelaide, Available at www.adelaide.edu.au/wine-econ/databases, Accessed on 12/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **United Kingdom.** 1800-1898, Wilson. G.B (1940) *Alcohol and the Nation:* A *Contribution to the Study of the Liquor Problem in the United Kingdom from 1800 to 1935* London: Nicholson and Watson; 1899-2012, British Beer and Pub Association, Available at: https://beerandpub.com/, Accessed on 14/12/2017; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. **United States.** 1850-2012, Table 1. Apparent per capita ethanol consumption, United States, 1850–2013, *National Institute on Alcohol Abuse and Alcoholism*; 2012-2016, OECD.Stat, Available at: https://stats.oecd.org/, Accessed on 31/01/18. Prohibition period (1920-1933) Data is interpolated between 1920 and 1933 because alcohol was prohibited during this time.

Drug Offenses

General note. The data are retropolated to 1950 using the average of the countries for which data are available.

Australia. 1970-2007, Reported Drug Offenses, *Statistical Yearbook of Australia* (19712010); 2008-2016, Illicit Drug Offenses, *Australian Bureau of Statistics*, Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/detailsPage/4519.02016-17?OpenDocument, Accessed on 15/05/2018. **Belgium.** 1998-2016, European Monitoring Center for Drugs and Drug Addiction, Available at: http://www.emcdda.europa.eu/data/stats2017/dlo, Accessed on 14/05/2018. **Canada.** 1973-2016, Section Z: Justice, Drug Offences, Police Reported Rates, Canada, Statistics Canada, Available at https://www150.statcan.gc.ca/n1/pub/11-516x/sectionz/4147446-eng.htm, Accessed on 15/05/2018. **Denmark**, **Finland**, **Norway** and **Sweden.** 1950-2010, Von Hofer, H., Lappi-Seppälä, T., and Westfelt, L. (2012) Nordic Criminal Statistics 1950-2010: Summary of a report. *Stockholm University*; 2011-2016, Available at: http://www.emcdda.europa.eu/data/stats2017/dlo, Accessed on 15/05/2018. **Germany.**1953-2010, *Dokumentation zum Zeitreihendatensatz für Deutschland* (1834-2012); 2011-2016, Drug offences, Available at: http://www.emcdda.europa.eu/data/stats2017/dlo, Accessed on 15/05/2018. **Ireland.** 1995-2016, Available at: http://www.emcdda.europa.eu/data/stats2017/dlo, Accessed on 15/05/2018. **Italy.** 1972-2009,

Delitti denunciati dalle forze di polozoa all'autorita giudiziaria per tipo di delitti-Anni 19552009, *Sommario di statiche storiche* (1861-2010). **Netherland.** 1975-2006, Available at: http://www.unodc.org/unodc/en/data-and-analysis/statistics/historic-data.html, Accessed on 14/05/2018; 2007-2016, Available at: http://www.emcdda.europa.eu/data/stats2017/dlo, Accessed on 15/05/2018. **Switzerland** 1971-2008, Available at: http://www.unodc.org/unodc/en/data-and-analysis/statistics/historic-data.html, Accessed on 15/05/2018. **United Kingdom.** 1898-2002, Total Drug Offences, A summary of recorded crime data from 1898 to 2001/02, Available at: https://www.gov.uk/government/statistics/historical-crime-data, Accessed on 13/05/2018; 2003-2015, A summary of recorded crime data from 2003-2015, Available at: A summary of recorded crime data from year ending Mar 2003 to year ending Mar 2015, Accessed on 13/05/2018. **United States.** 1950-1964, Uniform crime Reports, Available at: https://archive.org/search.php?query=uniform%20crime%20reports, Accessed on 14/05/2018; 1965-2003, Gettman, J., Pierre, A.S (2005). crimes of Indiscretion: Marijuana Arrests in the
United States; 1995-2016, Total Number of Arrests in the US by Year and Type of Offense, Available at: http://www.drugwarfacts.org/chapter/crime_arrests#overlay=table/total_arrests, Accessed on 14/05/18.

Population

General Note: The principal data source is The Conference Board Total Economy Database (Output, Labor, and Labor Productivity Country details, 1950-2011) Midyear Population (in thousands of persons), January 2012 (http://www.conference-board.org/data/economydatabase/), Accessed on 10/09/2012. The population data are backdated by splicing figures from different sources as mentioned below:

Australia, 1-1819 (Geometric interpolation of the series: 1, 1000, 1500, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978. *Atlas of World Population History*, London: Penguin Books Ltd. and Allen Lane; 1820-1949 Maddison, A., 2010. Historical Statistics, Statistics on World
Population, GDP and Per Capita GDP, 1-2008 AD, Accessed on 10/09/2012 (http://www.ggdc.net/MADDISON/oriindex.htm); 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **Belgium**, 1-1819 (Geometric interpolation of the series: 1, 200, 400, 600, 800, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1650, 1700, 1750, 1800, 1850)
McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*;
1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **Canada**, 1-1819 (Geometric interpolation of the series: 1, 1000, 1500, 1600, 1700, 1750, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **Denmark**, 1-1819 (Geometric interpolation of the series: 1, 1000, 1300, 1500, 1600, 1700, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **Finland**, 1-1399 (Geometric interpolation of the series: 1, 1000, 1500) Maddison, A., 2010, *op.cit.*; 1400-1819 (Geometric interpolation of the series: 1400, 1500, 1600, 1700, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.* **Germany**, 1-1819 (Geometric interpolation of the series: 1, 200, 400, 600, 800, 1000, 1100, 1200, 1300, 1400, 1500, 1600,

1650, 1700, 1750, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit*; **Ireland**, 11819 (Geometric interpolation of the series: 1, 400, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1650, 1700, 1750, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op. cit.*; **Italy**, 1-1299 (Geometric interpolation of the series: 1, 200, 400, 600, 800, 1000, 1100, 1200, 1300) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1300-1819 (Geometric interpolation of the series: 10-year interval from 1300-1820) Malanima, Paolo, 2003, Measuring the Italian Economy. 1300-1861, Rivista Di Storia Economica, XIX (3), pp. 265295; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op. cit.;* **Netherlands**, 1-1799 (Geometric interpolation of the series: 1, 800, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1650, 1700, 1750, 1800) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1800-1819 Centraal Bureau voor de Statistiek, 2001. *Tweehonderd jaar statistiek in tijdreeksen, 1800-1999*, Voorburg; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **Norway**, 1-1819 (Geometric interpolation of the series: 1, 1000, 1300, 1500, 1600, 1700, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **Sweden**, 11664 (Geometric interpolation of the series: 1, 1000, 1300, 1500, 1600, 1700,) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1665-1819 Edvinsson, Rodney, 2011. *New Estimates of Swedish GDP by Activity, 1665-2010*, Stockholm Papers in Economic History No. 12, Stockholm University, pp. 55-61;1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **Switzerland**, 1-1819 (Geometric interpolation of the series: 1, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1650, 1700, 1750, 1800, 1850) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **United Kingdom,** 1-1540 (Geometric interpolation of the series: 1, 200, 400, 600, 800, 1000, 1100, 1200, 1300, 1400, 1500, 1600) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1541-1819 (Geometric interpolation of the series: 5-year interval from 1541-1821) Wrigley, E. A., Davies, R. S., Oeppen, J. E., Schofield, R. S. 1997. *English Population History from Family Reconstruction 1580-1837*, Cambridge University Press; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*; **United States of America**, 1-1789 (Geometric interpolation of the series: 1, 1000, 1500, 1600, 1700, 1750, 1800) McEvedy, Colin and Jones, Richard, 1978, *op.cit.*; 1790-1819 (Geometric interpolation of the series: 10-year interval from 1790-1820) Carter, S. B. *et al.*, (Eds.), 2006. *Historical Statistics of the United States: Earliest Times to the Present*, Millennial Edition, Vol. One, Part A, Population, Cambridge University Press; 1820-1949 Maddison, A., 2010, *op.cit.*; 1950-2011 The Conference Board Total Economy Database, 2012, *op.cit.*

Per capita real GDP

General Note: The principal data source is the OECD.Stat's Real Gross Domestic Product (GDP) (http://stats.oecd.org/index.aspx?), accessed on 10/07/2012. The data are backdated by splicing figures from different sources as mentioned below:

Australia, 1800-1819 Snooks, Graeme D., 1994. *Portrait of the Family within the Total Economy-A Study in Long-run Dynamics, Australia 1788-1990*, Cambridge University Press;

1820-1958 Maddison, A. 2010, Historical Statistics on World Population, GDP and Per Capita
GDP, Accessed on 10/07/2012 (http://www.ggdc.net/MADDISON/oriindex.htm); 1959-2010 OECD.Stat, **Belgium**, 1820-1969 Maddison, A. 2010, *op.cit.*; 1970-2011 OECD.Stat, **Canada**, 1820-1969 Maddison, A. 2010, *op.cit.*; 1970-2010 OECD.Stat, **Denmark**, 1818-1819 Hansen, S. A., 1972. *Økonomisk vækst i Danmark Bind II : 1914-1970*, 2nd Ed., Universitetsforlaget**,** Copenhagen; 1820-1965 Maddison, A. 2010, *op.cit.*; 1966-2011 OECD.Stat, **Finland**, 18201969 Maddison, A. 2010, *op.cit.*; 1970-2011 OECD.Stat, **Germany**, 1820-1969 Maddison, A.
2010, *op.cit.*; 1970-2011 OECD.Stat, **Greece**, 1820-1959 Maddison, A. 2010, *op.cit.*; 19602011 OECD.Stat, **Ireland**, 1270-1819 Broadberry, S. Campbell, Klein, Overton and van Leeuwen, 2011. *British Economic Growth, 1270-1870: An Output-Based Approach*, School of Economics Discussion Papers, KDPE1203, University of Kent; 1820-1999 Maddison, A. 2010, *op.cit.*; 2000-2010 OECD.Stat, **Italy**, 1310-1819 Malanima, P., 2011. The Long Decline of a Leading Economy: GDP in Central and Northern Italy, 1300-1913, *European Review of Economic History*, 15, pp. 169-219; 1820-1969 Maddison, A. 2010, *op.cit.*; 1970-2011 OECD.Stat, **Netherlands**, 1510-1806 Zanden, J. L.V. and Leeuwen, B. V., 2012. Persistent but not Consistent: The Growth of National Income in Holland 1347-1807, *Explorations in Economic History*, 49(2), pp.119-130; 1807-1819 Centraal Bureau voor de Statistiek, 2001. *Tweehonderd jaar statistiek in tijdreeksen, 1800-1999*, Voorburg; 1820-1968 Maddison, A. 2010, *op.cit.*; 1969-2011 OECD.Stat, **Norway**, 1820-1969 Maddison, A. 2010, *op.cit.*; 19702011 OECD.Stat, **Sweden**, 1665-1819 Edvinsson, R., 2011. *New Estimates of Swedish GDP by Activity, 1665-2010*, Stockholm Papers in Economic History No. 12, Stockholm University, pp. 55-61; 1820-1949 Maddison, A. 2010, *op.cit.*; 1950-2011 OECD.Stat, **Switzerland**, 18201979 Maddison, A. 2010, *op.cit.*; 1980-2010 OECD.Stat, **United Kingdom,** 1270-1819 Broadberry et al., 2011, *op.cit.*; 1871-1947 Mitchell, 1988, *op.cit.*; 1820-1969 Maddison, A.
2010, *op.cit.*; 1970-2011 OECD.Stat, **United States of America**, 1790-1819 Johnston, L. and Williamson, S. H., 2011. *What Was the U.S. GDP Then? MeasuringWorth*, accessed on 18/07/2012, (http://www.measuringworth.com/); 1820-1969 Maddison, A. 2010, *op.cit.*; 19702010 OECD.Stat.

Divorce

Divorces per 1000 existing marriages are used. *Australia:* 1820-1870 backdated using UK, 1871-1874 ratio computed using stock of married and divorce numbers from Australian Statistical Yearbook 1908, 1875-2004 ABS cat no. 3105.0.65.001 Australia Historical Population Statistics Table 12.1, 2005-2010 ratio computed using data from Australian Statistical Yearbook 2010 and abs.gov.au. *Austria:* 1831-1881 backdated using the average of Netherlands and Belgium, 1882-1975 Flora *et al* (1983), 1976-2010 ratio computed using divorce numbers from Eurostat Database and stock of married (Census data) http://www.statistik.at/web_en/statistics/population/population_censuses/population_at_census_day/index.html, Note: linearly interpolated 1914-1918 and 1926-27, 1938-1945. *Belgium:* 1831-1851 backdated using divorce numbers only from Flora *et al* (1983), 1852-1975 Flora *et al* (1983), 1976-2010 ratio computed by using the stock of married (1976-1990 from Statistical Yearbook of Belgium various years, 1990-2010 from Eurostat Database) and divorce numbers (Eurostat Database). Note 1853, 1914-18 and 1939-45 linearly interpolated. *Canada:* 18201867 backdated using the UK, 1868-2005 ratio computed using stock of married (Census data) and divorce numbers, 1868-1920 from Canada Statistical Yearbook various years, 1921-1974 Leacy (1983), 1955-2005 from CANSIM Database Statistics

Canada – Table 053-0002, 20062008 ratio computed using data from CANSIM Database, 2009-2010 updated using average divorce rate of Australia, NZ and the US. *Denmark:* 1831-1895 backdated using Sweden, 18961975 Flora *et al* (1983), 1976-2010 ratio computed by using stock of married (1975-1990 Denmark Statistical Yearbook, Eurostat Database 1991-2010) and divorce numbers (Eurostat Database). *Finland:* 1831-1878 backdated using Sweden, 1879-1880 backdated using divorce numbers only (data in email received from Statistical Office), 1881-1975 Flora *et al* (1983), 1976-2010 ratio computed by using stock of married and divorce numbers (data in email received from Statistical Office). *Germany:* 1831-1887 backdated using the average of Netherlands and Belgium, 1888-1975 Flora *et al* (1983), 1976-2010 ratio computed using divorce numbers from Eurostat Database and stock of married from German Microcensus records https://www-genesis.destatis.de, data before 1971 spliced with 1971 post data,1915-18 and 1940-45 linearly interpolated. *Italy:* 1879-1970 backdated using separation data Timeseries Historical Statistics Italy http://timeseries.istat.it/index.php?id=60&user_100ind_ pi1[id_pagina]=182&cHash =3fd0627ea395cecd6513367a19c6c014, 1971-2009 ratio computed using stock of married and divorce numbers Timeseries Historical Statistics Italy http://timeseries.istat.it /index.php?id=60&user_100ind_pi1[id_pagina]=189&cHash=a32f635eedace55869a47149c7 12d21f and the previous link, 2010 updated using average of the other European countries. *Ireland:* Divorce not allowed due to constitution, separation allowed. *Japan:* 1950-2010 ratio computed using divorce numbers and stock of marriages from the Historical Statistics of Japan and Statistical Yearbooks of Japan via Japan Statistical Bureau. *Netherlands:* 1831-1839 backdated using Belgium, 1840-1975 Flora *et al* (1983), 1976-2009 ratio computed by using the stock of married from CBS Netherlands and divorce numbers CBS (2010), data before 1976 spliced with post 1976 data, 2010 updated using crude divorce rate data. *Norway:* 1831-1899 backdated using Sweden, 1900-1975 Flora *et al* (1983), 1976-2009 ratio computed using stock of married and divorce numbers from Eurostat Database, 1940-45 linearly interpolated, 2010 updated using crude divorce rate data. *Sweden:* 1831-1975 Flora *et al* (1983), 1976-2010 ratio computed using stock of married and divorce numbers from SCB Database. *Switzerland:* 1831-1865 backdated using the average of Belgium and Netherlands, 1866-1876 backdated using divorce numbers only as census data for stock of married is not available (divorce numbers are from Historical Statistics of Switzerland, Chronos), 1877-1975 ratio from Flora *et al* (1983), 1976-2010 ratio computed by using stock of married (Chronos 1975-1990; Eurostat database 1990-2010) and divorce numbers (Eurostat Database). *United Kingdom:* 1820-1858 backdated using Phillips (1991, p. 65 divorce acts of parliament 1670-1857), 1859-1975 Flora *et al* (1983), 1976-2010 ratio computed using stock of married and divorce numbers 1976-1980 Mitchell (1988, p.75), 1981-2010 England and Wales is from Office of National Statistics UK, 1981-2010 Scotland is from General Register Office for Scotland, data 1976 and post spliced with older data as stock of marriages is not available for Scotland and Northern Ireland, 193945 linearly interpolated. *United States:* 1820-1866 from Phillips (1991) gives total number of divorces in time intervals which are spread out over the relevant time period this is used to backdate for this period, 1867-1879 number of divorces used to backdate, 1880-2010 ratio computed using stock of married Census data from Carter *et al* (2006) and number of divorces

- 1880-1939 NCHS (1973), 1940-1990 from Monthly Vital Statistics Report Vol. 43 (5) NCHS, 1990-1999 from Monthly Vital Statistics Reports, 2000-2010 from CDCP www.cdc.gov/nchs/nvss/marriage_divorce_tables.htm.

Table 3. 4- Other Data Sources

Data	Source

Age distribution of population	Madsen, J. B. (forthcoming, 2018), "Health-Led Growth in the OECD since 1800," *Macroeconomic Dynamics*.
Urbanization	Banks, A.S. (2009). *Cross-Polity Time-Series Data*, Cambridge, MA: MIT Press. Updated using World Development Indicators, see, https://www.gapminder.org/data/, Viewed on 11.4.2018

Chapter 4

Income Inequality and Crime

Abstract

Using data over the period 1800-2016 for 17 OECD countries this study examines impact of income inequality and deterrence on violent (homicide, rape, robbery and assault) and property crime (larceny, burglary and motor vehicle theft). The results show that inequality is more influential for property crime and deterrence for violent crime. Further, it is shown by including top income shares that fraction of poor is relatively more involved in committing crime.

4.1. Introduction

The incidence of criminal and violent behaviour has been a major concern across the world in recent years as it has prevailed across different cultures and has affected almost everyone in society. The concern with crime is well-justified given its damaging effects on economic activities and quality of life. Comparative statistical studies of crime are rare despite the interest of many social scientists in identifying the differences among nations in the trends of crime and understanding the causes and consequences of deviant behaviour.

Since early twentieth century, scholars from psychology and sociology disciplines studied crime as a social problem to investigate the main drivers of criminal activities. Until late 1960s criminal behaviour was a characteristic of vicious, depraved and psychologically disturbed individuals (see, e.g., Cook and Laub, 2001).

In 1968, Becker presented a new economic approach to criminology. He revolutionised the theory by applying the model of rational choice to economic theory of crime. He pointed out that criminal activity is a choice accessible by everyone, can even be a rational choice for some, according to their preferences and expected utility of crime. Economic literature on crime has since then followed Becker (1968) analytical framework in which criminals behave rationally and make their decisions based on cost-benefit analysis. Any violation of law and order in society can be considered as a likely increase in delinquent's wealth, well-being or even both. In breaking the law, criminal risks a drop in his wealth and well-being as conviction demands a fine, a criminal record, imprisonment and other drawbacks. crime rate thus depends on the risks and penalties related with being caught and also on the difference between potential gains from crime and linked opportunity cost. If the expected return of illegal activities is greater than return on legal activities a person will most likely commit crime. By implementing policies that increase probability or severity of punishment participation in crime tends to reduce (Cook *et.al*., 2013). Moreover; an increase of opportunity costs such as rise in income through legal channels can also reduce crime (Trumbull, 1989).

Economic theory of crime has important implications for relationship between crime rates and income inequality. High inequality and high crime rate is an increasing trend witnessed by almost all industrialized economies of the world since 1980s. Several studies have used measures of income inequality as proxy of distance between gains from crime and its opportunity costs (see, e.g., Kelly, 2000; Fleisher, 1966 & Ehrlich, 1973).

In unequal societies the differential between legal and illegal activities is large for individuals at lower end of the distribution (Demombynes and Ozler, 2002). Hence opportunity cost for people at lower end of distribution to commit crime for is lower than others making criminal activities rewarding and attractive for marginalised in the society. They feel they have little to lose by engaging in irresponsible behaviour. Later violent strategies and tactics become attractive. This increases chance of more criminals being associated with lower class in the society (Machin and Meghir, 2004).

Theories from other disciplines such as biology, sociology and criminology have interesting implications for inequality and criminal behaviour. Merton's (1938) strain theory argues that individuals at bottom of social structure feel frustrated by not being able to achieve material attributes of success. This frustration becomes more infuriating when people around them are more successful. The higher the inequality; the higher is the strain and the probability to become alienated from society. Individual alienation tends to induce criminal behaviour. Social disorganisation theory (1942) suggests that crime occurs when ties of social control are weakened. The factors that account for such weakening are poverty, racial heterogeneity, residential mobility and family instability. In this case inequality causes crime by being indirectly associated with poverty. According to Kelly (2000) different theories of crime are seen better as complements than substitutes each focusing on a different feature of the relationship between crime and inequality.

The purpose of this study is not to differentiate between economic and sociological theories for determining crime rather it is to support the idea that above theories all have a crucial role in determining crime. This work follows Becker's model and applies its recent extensions by highlighting sociological and demographic features. Unlike earlier work that has looked at determinants of crime within countries for short time periods this paper studies crime across countries from a historical perspective. Most of economic literature on crime that shows a strong positive relationship between crime and income inequality is based on cross sectional studies. These studies have been widely criticized and are not considered to be very reliable because they are unable to control for unobserved heterogeneity across countries (see, e.g., Kelly, 2000; Ehrlich, 1973; Brush, 2007). A few studies have responded to this weakness by looking at panel data for a large sample of countries but are mostly looking at post 1960s period (Fajnzylber, 2002a; 2002b). To understand big picture of crime over last two centuries this study constructs data for homicide, violent crime, deterrence (*det*) and property crime for 17 OECD countries for period of 1800-2016. This long run perspective enables us to see whether this relationship between crime and inequality is robust to different time

specifications after controlling for unobserved heterogeneity across countries. Moreover, this study provides an alternative insight to existing literature because it addresses aggregate measures of crime rates and does not solely look at specific components of crime as done earlier by most of the literature. The core regression model considers effect of income inequality on crime. This basic model is firstly extended by including economic growth and *det*. The second extension includes demographic variables. In particular degree of urbanization and age composition of population is studied to evaluate its impact on crime. The third extension is addition of human capital variable measured by literacy rates. Finally, top income shares are introduced in analysis to understand which part of income distribution is more relevant in determining crime.

The results of this study show that income inequality has a positive effect on both violent and property crimes with the latter being much stronger. Incorporating different components of income distribution in the analysis indicates that poor people mostly engage themselves in criminal activities. This shows that people at bottom of income distribution are more prone to commit crime as deprivation induces anger, frustration, and economic need which triggers antisocial and criminal behaviour.

The outline of the paper is as follows. Literature review is discussed in section 4.2. Sections 4.3 and 4.4 discuss data and empirical model used in this study. Section 4.5 analyses the results obtained and last section concludes this study.

4.2. Literature Review

The studies on crime are inclusive of both cross sectional and panel approach. The strong positive relationship between crime and inequality has long been established in cross sectional literature. However; more recent literature looks at crime and inequality by controlling for unobserved factors that can affect crime rates using panel data approach**.**

4.2.1. Cross-Sectional Studies

Enormous literature suggests that biased or inequitable resource allocation provokes criminal activity. Most of the studies that have looked at this relationship are cross sectional and within country as it is hard to find countries with high data quality for both inequality and crime. At city or state level several studies have shown that income inequality is a strong predictor of violent crimes such as homicides or assault (see, e.g., Blau and Blau, 1982; Morenoff *et al.,* 2001). Kelly (2000) uses ratio of mean to median household income as a measure of inequality and covers urban counties of United States. The results show that income inequality is a strong and significant predictor of violent crime but not property

crime. Similarly, Ehrlich (1973) analyse crime rates across U.S states and shows for the years 1940, 1950 and 1960 that inequality has a positive relation with both violent (murder and rape) and property crime (robbery, burglary, larceny and auto theft) with the latter being much stronger. Nadanovsky and Cunha-Cruz (2009) investigate association of income inequality and imprisonment with homicide rates using negative binomial models. Impunity index is constructed to indicate imprisonment. This study finds that low income inequality and high imprisonment of criminals are related to low homicide rates.

On aggregate level, LaFree (1999) and lately Nivette (2011) have many cross-national studies on determinants of crime and have verified that relationship between inequality and crime rates is quite consistent. Although generally studies find a significant association there is literature that does not show any support for a causal relationship between inequality and crime (Messner & Rosenfeld, 1997).

Nilson (2004) and Dahlberg and Gustavsson (2008) time series studies look at property crime and inequality in context of Sweden. Both studies suggest a positive association between two variables. The difference between their estimates occur because a more comprehensive measure of inequality is used by latter study which accounts for both permanent and transitory income. Brush (2007) finds that crime rates is positively related with income inequality in cross sectional approach in which unit of observation is county for year 2000. Conversely, he shows that there is negative association between crime rates and income inequality in time series fixed effect model. However, his time series study only includes two years (1990 and 2000).

4.2.2. Panel Studies

The above studies, although, showing strong positive relationship between inequality and crime have their imperfections. The inability to control for unobserved heterogeneity across countries can be a severe cause of bias. To overcome these problems few studies have examined the relationship between crime and inequality using panel data and advanced econometric techniques. Poveda (2011) in his study uses several econometric data panel models and also addresses the endogeneity problem among explanatory variables. The results show that education, poverty, inequality and labour market are strong predictors of homicide rates in seven Colombian cities thereby causing adverse effects on Colombia's economy.

The most sophisticated panel study in econometric terms is by Fajnzylber, Lederman and Loayza (FLL) (2002) who look at intentional homicide and robbery rates for a period of 1970-1994. They use three measures of inequality which include Gini coefficient, ratio of income of the richest to the poorest quintile of the population and an index of income

polarization. They conclude that Gini coefficient and income polarization have strong positive effect on crime rates which is robust to when controlling for other crime covariates. In contrast Neumayer (2003 and 2005) criticizes the study by FLL (2002) and argues that strong relationship between inequality and crime is spurious. It dissolves once the sample includes a larger number of countries and controls for country specific effects[15]. The study also uses an alternative measure of inequality that measures income of people in top quintile to those in bottom. According to Neumayer, the spurious relationship between inequality and crime might be caused by the fact that inequality is "strongly correlated with country-specific fixed effects such as cultural differences" (2005, p. 2). The contrary remarks of Neumayer (2005) to FLL (2002a, 2002b) motivates the concern to further investigate this relationship. Enamorado, López-Calva, Rodríguez-Castelán & Winkler (2016) study focus on reverse causality between crime rates and income inequality. The author suggests that with high crime rates rich people tend to move out of wealthier locations thereby reducing inequality. They construct an instrument based on initial income distribution of local area and national patterns of income growth. Their results highlight importance of treating reverse causality.

4.3. Data and Variables

4.3.1 Violent and Property crime

This study incorporates a long dataset for violent and property crime which are collected from statistical yearbooks of respective countries. The data is sought in different categories of criminal justice which include offenses known to police and number of convictions for each offense. Offenses known to police and convictions data provide a very close measurement of crime control policies and latter replaces the former wherever it is not documented or are limited.

Data is compiled for seventeen OECD countries that are economically developed democracies for the years 1800-2016. The seventeen countries for which substantial data are found are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherland, Norway, Sweden, Switzerland, U.K and U.S. For violent crime, data is inclusive of murder, rape robbery and assault[16]. Both known offenses and

[15] Neumayer uses 59 countries in his sample while there are 45 countries in Fajnzylber et al (2002b) study.

[16] I understand that robbery in Ehrlich (1973) paper is included in property crime. Initially this confused me but the reason underlying this is the definition of robberies. Robberies are committed with an intent to threaten or harm the other person. However; there are studies that only include robberies with no intent of threatening or harming the person and these are included under the category of property crime. The robberies data that I have used in this thesis

convictions data are available. Eleven countries are represented by data series on convictions and six represent data on offenses known to police. For property crime, data is inclusive of theft, larceny, burglary and motor vehicle theft. Nine countries represent data series on convictions and eight represent data on offenses known to police (see appendix-A). Table 4.8 and table 4.9 (appendix-A) also report number of years covered by each category of crime in this study. Sometimes data reported is inconsistent. It may be restricted to few years, or to only some jurisdictions and may be subject to significant changes over time. Therefore; statistical data series that are unsuitable for panel data over long period are excluded[17]. For some countries the number of crimes escalated (due to war related crime) or was unavailable during war period. In such instances missing values within data series are estimated by interpolation using linear trend and adjustments during the war period is done wherever required. For some countries recording aggregate indicators provide greater coverage and consistency. Violent and Property crimes are reported with varied consistency in statistical yearbooks so alternative levels of aggregation are included in final data set as shown in both tables.

4.3.2 Deterrence

Data on *det* is collected from statistical yearbooks and archives of respective countries and is measured by prison population. For Germany prison population data is unavailable for historical period because prison administration was not located at federal state level and in addition was split among different ministries. Therefore, number of sentences to imprisonment are used as proxy for prison population. Table 4.10 reports data coverage for prison population for each country.

Det is measured as number of prisoners divided by number of violent crimes between period *t*-1 and *t*-15 weighted by 15% geometrically declining weights; reflecting distribution of prisoner's sentence length.[18] Thus, the *det* rate computed here reflects expected time of imprisonment of violent crime; that is expected years in prison if caught times the likelihood of being caught. The number of violent crimes is superior to population size as the denominator in *det*, where population is usually used as denominator in *det* in macro studies,

includes threat to life (to the best of my knowledge) and is therefore counted under violent crime. This is noted on p.122 in the footnote.

[17] The data for Portugal, Greece, Spain and New Zealand are not included in the analysis for both violent and property crime due to inconsistency.

[18] See the third chapter of the thesis for detailed explanation. Homicide in the West, 1800-2016. THE IMPACT OF ALCOHOL, DRUGS AND DETERRENCE.

probably reflecting that violent crime data are often not readily available. It is problematic to use population as denominator in *det* because it is only reflecting number of criminals to the extent that an increase in population, *ceteris paribus*, increases number of criminals proportionally.

4.4. The Model

4.4.1 Theory

The central hypotheses of economic model formulated by Becker (1968) suggests that criminals like other individuals are rational utility maximizers. They make a decision whether or not to commit crime based on cost/benefit analysis. All potential criminals perceive gains from crime which can be both monetary and psychic. Monetary benefits can include the gains from robbery or theft etc. The psychic benefits vary for each person, for instance, young people tend to enjoy adventure of risk more than elderly. The costs associated with criminal behaviour are monetary, psychic, punishment related and opportunity costs. Monetary costs can be associated with purchase of guns, equipment or vehicles etc. to undertake a criminal activity while psychic costs can include fear or guilt associated with crime and penalty. Opportunity costs varies with person's income. The higher a person's income the higher is his opportunity cost to engage in crime while punishment includes fines, imprisonment, costs associated with litigation etc. People allocate time to illegal activities if marginal benefit of doing so exceeds its costs. The marginal benefit for some people can be lower than marginal cost associated with crime and vice versa depending on people's preferences.

In a given period both legal and illegal activities are mutually exclusive, and a person can choose between these two by comparing the expected utility of each.

$$E\,[U] = PU(Y - f) + (1 - P)\,U(Y), \qquad (1)$$

where U is the individual's utility function, P is the probability of being caught and sentenced, Y is income from committing crime, and f refers to punishment. The individual will only commit crime if expected utility is positive.

Ehrlich (1973) extends Becker's model by attributing monetary equivalents to different psychic costs and benefits of legal and illegal activities. He suggests that actual participation in illegitimate activity is determined by income inequality, crime-deterrent variables and cultural or sociological variables. As Ehrlich noted "people with legitimate returns well below median have greater differential returns from property crimes and thereby a greater

incentive to participate in such crimes relative to those with income well above the median". The theory thus predicts positive relationship between inequality and property crimes. Glaeser (2005) writes in his study that as "inequality rises the proceeds from crime increase for the poor and the opportunity costs of crime rate lower".

It is important to see precisely the kind of criminality that is the basis of this model. As per the preceding arguments the economic model of crime better explains crimes against property involving material gains than crimes against persons[19]. With high income inequality low expectations of lifetime improvement in legal earnings can lead to discrediting of established institutions and lessening of moral loss associated with infringement of law and order. This tends to lower opportunity cost of participation in illegal activities and encourages people to engage in them for self-enrichment. Conversely, it cannot be denied that violent crime for e.g. homicides are committed mostly in areas where there are many poor people with low education standards and weak *det* measures. In such situations homicides are determined by same variables as property crime. However, if homicides are not directly related to property crime determinants the relationship among these variables is likely to be weaker.

4.4.2 Empirical model

The following empirical model focuses on determinants of violent and property crime suggested by theory for seventeen OECD countries between 1800 and 2016. All variables are expressed in logs.

$$Crime_{it} = \propto + \beta_1 IQ_{it} + \beta_2 Z_{it} + \gamma_i + \mu_t + \varepsilon_{it}, \qquad (2)$$

where time is indicated by t, countries by i; $crime_{it}$ is the crime rate per 100,000 inhabitants denoted by Q/N; $\propto$ is a constant; *IQ* refers to income inequality; *Z* includes the controls variables: deterrence (*det)*, economic growth, age composition ($Pop\_{15\text{-}29}$), urbanisation (*Urb*) and literacy (*lit*) while β_1 and β_2 are the coefficients to be estimated; γ_i represent country specific effects which eliminate time invariant unobserved effects; μ_t refers to time fixed effect and ϵ_{it} is an error term.

The most common measure for income inequality used in literature is Gini coefficient. In this study both Gini and top income shares are used. In computing Gini coefficients extreme top incomes can be missed especially in small samples. Therefore, their inclusion helps to

[19] Crimes against person are motivated by hate or passion which involves interdependencies in utilities as people who are close acquaintances to each other with frequent social contact mostly commit such crimes unlike property crimes.

understand the effect of different types of income inequality as top income shares capture inequality using only the top income levels. Although several time series studies suggest that there might be two-way relationship between inequality and crime it is difficult to see how crime can cause inequality at macro level. Even if there exists two-way relationship the magnitude of it must be quite little and can be ignored as it will not affect the results. *Det* is measured as number of prisoners divided by number of violent crimes between period *t*-1 and *t*-15 weighted by 15% geometrically declining weights; reflecting distribution of prisoner's sentence length.[20] Thus, the *det* rate computed here reflects the expected time of imprisonment of violent crime; that is expected years in prison if caught times the likelihood of being caught. The number of violent crimes is superior to population size as denominator in *det*, where population is usually used as denominator in *det* in macro studies, probably reflecting that violent crime data are often not readily available. It is problematic to use population as denominator in *det* because it is only reflecting number of criminals to the extent that an increase in population, *ceteris paribus*, increases number of criminals proportionally.

On the foundation of previous cross sectional and panel studies the following variables are considered to be the important correlates of crime in addition to inequality measures:

GDP growth rate is used as measure for employment and economic opportunities. It is seen that economic development hampers crime and deters criminal behaviour (FLL, 2002a).

Economic literature proposes that large share of crimes is committed by young men. If proportion of young males in population increases; high crime rates are expected to occur as young people are responsible for a disproportionate share of crimes (Lochner, 2004) explains that young men acquire little human capital and have fewer opportunities to earn; thus, indulging more in illegal activities for subsistence. For this study, due to unavailability of segregated data, proportion of total population between 15 and 29 (*Pop_15-29)* is used as a proxy.

The association between crime and cities is not new. Economists have suggested urban tendency toward crime for decades. The degree of urbanization (*Urb)* of each country is measured as percentage of population in a country that lives in urban settlements. Bruinsma (2007) proposed that rural areas are less confronted to crime because of greater social cohesion and informal social control while criminals live more often in urban cities and

[20] The prison population median prison sentence in the US over the period 1923-1981 was, on average, 59.5 months (Cahalan, 1986). This is approximately the median number created by an annual depreciation rate of 15%

crimes occur in city centres and their surroundings. Another perspective by Glaeser and Sacerdote (1999) is that structure of cities is such that it offers more opportunity to potential offenders and provides suitable targets.

Literacy *(Lit)* increases the opportunity cost of crime in terms of forgone work and costs related with being caught and punished. With investment in human capital people can earn higher wage which in turn acts as an incentive to lower crime (Lochner, 2004). In this study it measures number of people who can read and write.

An important motivation for considering unobserved heterogeneity across countries, as captured by country dummies, is the possibility that countries vary in the amount to which their citizens report crime. With use of different definitions and criteria for recording crime statistics systematic errors can be involved in the measurement of crime rates. Some countries can report very high crime rates while others report low rates due to societal and cultural norms. As the factors that determine underreporting of crime are quite stable or change gradually their effect can be modelled by time-invariant country-specific effects. By controlling for these specific effects this study tries to minimise estimation bias due to under reporting of crime. The estimates are based on annual, five and ten years average data and sample of countries in this study are selected based on availability of data and consecutive observations.

4.5. Results & Analysis

4.5.1 Summary Statistics

Table 4.1 reports descriptive statistics for variables used in this study. The overall standard deviation is calculated using total number of observations which is 3,689 while between variations uses number of panels (17) in this case. The between standard deviation captures variance of the variable between countries whereas within standard deviation covers variance within a country over the years. Table 4.1 shows that the overall variation among variables is shared between both time and across countries; implying that within and between variation is quite similar for most of the variables.

Table 4. 1- Summary Statistics

Variable		*Violent crime*	*Property crime*	*Gini Coefficient*	*Growth*
Mean		3.62	5.47	3.937	0.015
Std. Dev	Overall	1.78	1.060	0.218	0.049
	Between	1.50	0.795	0.135	0.003
	Within	1.02	0.728	0.174	0.049
	Observations	*N=3689*	*N=3519*	*N=3689*	*N=3672*

Variable		*Pop_15-29*	*Urb*	*Lit*	*Det*
Mean		3.194	3.291	4.35	-0.652
Std. Dev	Overall	0.121	1.175	0.38	1.667
	Between	0.039	0.485	0.22	1.39
	Within	0.115	1.077	0.31	0.9797
	Observations	*N=3689*	*N=3689*	*N=3689*	*N=3674*

Note: The time period is 1800-2016 for 17 OECD countries. All variables are expressed in logs.

4.5.2 Results

Table 4.2 and 4.3 present the main results of violent and property crime which are measured per 100,000 inhabitants.

Table 4. 2- Violent crime

VARIABLES	(1) Ln *(violent crime)*	(2) Ln *(violent crime)*	(3) Ln *(violent crime)*	(4) Ln *(violent crime)*	(5) Ln *(violent crime)*
Ln (*Gini)*	0.92***	0.36***	0.33***	0.28***	0.20**
	(0.17)	(0.08)	(0.08)	(0.08)	(0.08)
Growth		0.687***	0.64***	0.68***	0.61***
		(0.19)	(0.19)	(0.19)	(0.21)
Ln (*det)*		-1.00***	-1.00***	-1.01***	-0.96***
		(0.02)	(0.02)	(0.01)	(0.01)
Ln (*Pop_15-29)*			0.50***	0.63***	0.72***
			(0.15)	(0.14)	(0.14)
Ln (*Urb)*			0.04*	0.09***	-0.11***
			(0.02)	(0.02)	(0.04)
Ln (*Lit)*				-0.38***	-0.35***
				(0.04)	(0.05)
Observations	3,417	3,417	3,417	3,417	2,482
Est Per	1815-2016	1815-2016	1815-2016	1815-2016	1870-2016

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. Both dependent and independent variables are in logs. Column 5 denote post-1870 period.

Table 4. 3- Property crime

VARIABLES	(1) Ln *(Property crime)*	(2) Ln *(Property crime)*	(3) Ln *(Property crime)*	(4) Ln *(Property crime)*	(5) Ln *(Property crime)*
Ln (*Gini)*	0.67***	0.55***	0.48***	0.50***	0.27***
	(0.11)	(0.09)	(0.09)	(0.09)	(0.09)
Growth		0.31	0.28	0.26	0.30
		(0.21)	(0.22)	(0.22)	(0.26)
Ln (*det)*		-0.20***	-0.21***	-0.20***	-0.36***
		(0.01)	(0.01)	(0.01)	(0.02)
Ln (*Pop_15-29)*			0.44***	0.37**	0.31**
			(0.16)	(0.16)	(0.14)
Ln (*Urb)*			0.16***	0.13***	0.3***
			(0.02)	(0.02)	(0.04)
Ln (*Literacy)*				0.20***	0.01
				(0.04)	(0.07)
Observations	3,417	3,417	3,417	3,417	2,482
Est Per	1815-2016	1815-2016	1815-2016	1815-2016	1870-2016

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. Both dependent and independent variables are in logs. Column 5 denote post-1870 period.

The results of regression of Eq.2 are shown in Tables 4.2 and 4.3. For full estimation period Gini coefficient and *det* keep a significant, positive and negative relationship respectively with both crime rates. However, relationship of Gini with the two types of crime is stronger for property crime. Referring to column 4 in table 4.2 and 4.3, a 1% increase in Gini leads to approximately (0.5 and 0.3) % rise in property and violent crime respectively. According to Ehrlich (1973) crimes against property are better explained by economic model of crime than violent crimes. As violent crimes can be a result of hate and passion economic theory may not be able to explain it as well as crimes committed for material gains. Moreover, borrowing from strain theory individuals tend to compare themselves with people around them who are rich. Being relatively poor leads to frustration and anger which causes them to become alienated form the society. This then eventually results in committing property crimes for self-enrichment.

The larger robust effect of Gini on property crime is supported by economic theory of crime discussed earlier and is similar to former studies (Ehrlich, 1973; Portnov & Rattner, 2003; Doyle *et.al*., 1999). Ehrlich (1973) notes that Gini having a higher effect on crimes against property "supports our choice of them as indicators of the relative opportunities associated with these crimes".

Absolute values of sensitivity of crime rate to *det* for violent crime is higher compared to crimes against property. A 1% increase in penalty can have 1% and 0.2% crime reducing effect on violent and property crime respectively. This indicates that law application and enactment can combat both types of crimes but is more effective with crimes involving hate and passion. However; there is direct correspondence between denominator of *det* (violent crime) and dependent variable (violent crime). This correspondence can drive coefficient of *det* for violent crime to be biased towards minus one because of a direct relationship between the two.

In post-1870 period the quality of data is much more reliable, so separate regressions are run to see robustness of results and to rule out if results are driven or affected by pre-1870 period. For post-1870 period (Column 5 in both tables 4.2 and 4.3) Gini and *det* both are significant and of the right sign for both property and violent crimes. The elasticity of Gini for property crime in this period remains higher compared to violent crime supporting the results of the whole period.

Urb and population *Pop_15-29* have a positive relation with both violent and property crime in full estimation period. However; elasticity of *urb* is higher for property crime (0.13) than violent crime (0.09)[21]. The coefficient of *urb* for property crime increases by almost 8% between pre and post-1870 period as property crimes seem to be mostly an urban phenomenon Glaeser (1999) and *urb* is mostly associated with latter period. *Pop_15-29* are ones who commit most of violent crimes as can be seen from both tables. Jencks (1991) in his study shows that men between 15 and 24 age group are three times more likely to commit violent offences than older males. The elasticity for *Pop_15-29* is almost twice for violent crime (0.63) compared to property crime (0.37) for whole period in column 4. Comparing post-1870 period between two crimes coefficient of Pop_15-29 highlights its role for violent crime.

For full estimation period *lit* is negatively associated with violent crime with an elasticity of 0.4 in column 4 but positively related with property crimes. After breakdown of the period coefficients still do not make intuitive sense for property crime.

Turning to main variable of interest it is seen that Gini keeps its significance and expected sign even after controlling for other covariates. However; absolute value of coefficients reduces once controls are included. With the results shown above this study supports the idea that ecological theories of crime are important in determining crime and they work together rather than asserting that only economic theory is valid.

4.5.3 Robustness Tests

4.5.3.1 Inclusion of top income shares

The inclusion of top income shares (top 0.1 and top 0.5) in tables 4.4 and 4.5 along with Gini helps to evaluate the part of income distribution that contributes more to crime.

[21] The correlation between growth and urbanisation is very weak (0.07) and will have minor effect on the results.

Table 4. 4- Violent crime-With top income shares

VARIABLES	(1) Ln *(violent crime)*	(2) Ln *(violent crime)*	(3) Ln *(violent crime)*	(4) Ln *(violent crime)*	(5) Ln *(violent crime)*	(6) Ln *(violent crime)*
Ln (*Top0.1)*	-0.29***	-0.50***	-0.19***			
	(0.04)	(0.04)	(0.03)			
Ln (*Top1)*				-0.05	-0.17***	0.04
				(0.05)	(0.06)	(0.04)
Ln (*Gini)*		1.91***	0.47***		1.36***	0.18**
		(0.188)	(0.1)		(0.18)	(0.09)
Growth			0.64***			0.6***
			(0.22)			(0.21)
Ln (*det)*			-0.95***			-0.96***
			(0.02)			(0.01)
Ln (*Pop_15-29)*			0.70***			0.72***
			(0.14)			(0.14)
Ln (*Urb)*			-0.15***			-0.11***
			(0.04)			(0.04)
Ln (*Lit)*			-0.26***			-0.4***
			(0.05)			(0.05)
Observations	2,482	2,482	2,482	2,482	2,482	2,482
Est Per	1870-2016	1870-2016	1870-2016	1870-2016	1870-2016	1870-2016

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. Both dependent and independent variables are in logs.

Table 4. 5-Property crime-With top income shares

VARIABLES	(1) Ln *(Property crime)*	(2) Ln *(Property crime)*	(3) Ln *(Property crime)*	(4) Ln *(Property crime)*	(5) Ln *(Property crime)*	(6) Ln *(Property crime)*
Ln (*Top0.1)*	-0.26***	-0.4***	-0.27***			
	(0.03)	(0.04)	(0.03)			
Ln (*Top1)*				0.01	-0.05	-0.01
				(0.05)	(0.05)	(0.05)
Ln (*Gini)*		1.19***	0.65***		0.71***	0.27***
		(0.13)	(0.10)		(0.13)	(0.1)
Growth			0.35			0.304
			(0.27)			(0.26)
Ln (*det)*			-0.34***			-0.36***
			(0.02)			(0.02)
Ln (*Pop_15-29)*			0.27*			0.31**
			(0.14)			(0.143)
Ln (*Urb)*			0.25***			0.3***
			(0.04)			(0.05)
Ln (*Lit)*			0.15*			0.01
			(0.08)			(0.08)
Observations	2,482	2,482	2,482	2,482	2,482	2,482
Est Per	1870-2016	1870-2016	1870-2016	1870-2016	1870-2016	1870-2016

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. Both dependent and independent variables are in logs.

Looking at both tables above if Gini coefficient increases because of an increase in top income shares but not bottom there is either a negative or no effect on violent and property crime. However, if Gini increases but top income shares remain unaltered crime tends to increase as income is redistributed away from poor. If we control for top income shares we neutralize the effect of redistribution within high-income class so we get a more genuine effect on crime of poor. Column 3 and 6 in both tables show that if top income shares remain unchanged the effect of Gini coefficient is between (0.5 and 0.2) % and (0.6 and 0.3) % on violent and property crime respectively for a 1% rise.

If redistribution takes place at top of distribution so that inequality in a country diminishes crime rate may not come down because people with high income are not motivated to be involved in criminal activities. Public welfare acts directed towards redistributing from rich to the poor aim to prevent crime as it increases opportunity cost of committing crimes. These are directed towards bribing people out of activities that are harmful to society. These

policies tend to reduce incentive to commit crime as they increase income that can be received out of jail. According to some studies transfers behave in same manner as penalties but transfers can be more effective in terms of reducing crime (Sala-i- Martin, 1992). Given that severe penalties do not provide incentives to move out of crime as convicted people already lose almost everything and it is extremely hard for them to return to labour force. In such situations transfers work as an incentive device to deter crime. They are not a direct cost rather an opportunity cost to commit crimes.

Therefore, when transfers are high, crime does not pay (Danziger and Wheeler, 1975).

4.5.3.2. Inequality and Homicide

Most of the studies that have looked at the relationship between crime and inequality have used homicides as proxy for violent crime. For this purpose, this section separately analyses the effect of income inequality on homicide rates. The results in table 4.6 show that there is strong negative association between the two variables which is robust to addition of other covariates. Box (1987:96) notes that: 'Income inequality is strongly related to criminal activity-with the exception of homicide'. There are some studies (see, e.g., Kelly, 2000; Ehrlich, 1973) that find violent crime to be positively related to income inequality but when disaggregated they may not give similar results. This study also shows that Gini is negatively associated with homicides unlike aggregate violent crime.

There are several explanations that can explain this negative relation between inequality and homicide. Firstly, homicides when compared to robberies and assault show a weaker relationship with income inequality most likely due to relative rarity of this crime to others. United Nations Office on Drugs and crime (UNODC) also recognizes that "There are countries in which there is an abundance of violent crime that does not result in homicide and others where homicide appears high in comparison to general levels of non-lethal violence" (2011, p.15). Recent data suggests that correlation between homicides and violent offenses varies but still it is a practise among researchers to proxy homicides for violent offenses even if the empirical correlation does not exist.

Secondly, it is seen that areas with high inequality are accompanied with large number of police. According to conflict theorists this observation is rooted in the idea that disparities in incomes/economic resources gives rise to dangerous class that can threaten the elite. Pronounced inequality provide elites with strong desire and need to maintain their power and supremacy. This can be translated as an increase in penalties or number of police to maintain

order where differences in economic resources are greatest thereby reducing instability, threat and violence in a society (Jacobs, 1979; Jacobs and Helms, 1997; Collins, 2009).
Thirdly; most of the studies that have found positive relationship between inequality and crime are either cross country or within country studies using a very recent time period. This paper uses two centuries panel data controlling for unobserved heterogeneity across countries and shows that relationship between inequality and homicides is not as flawless as the literature suggests.
det and *lit* have a strong negative relationship with homicide suggesting that penalties and education are a way to reduce crime. A 1% increase in imprisonment and literacy is associated with a 0.6% and 1% fall in homicides. *Pop_15-29* are strongly associated with homicides with an elasticity of 0.5 indicating that young people commit murder. This has been well supported in the literature. With the disintegration of family ties, communities and neighbourhoods there is a higher tendency for young people to become delinquent Case and Katz, (1991). *Urb* is strongly related with homicides as there is a higher probability for the perpetrators to escape punishment in areas with high population density.

Table 4. 6- Homicide

VARIABLES	(1) Ln *(homicide)*	(2) Ln *(homicide)*	(3) Ln *(homicide)*	(4) Ln *(homicide)*
Ln (*Gini)*	-0.79***	-1.12***	-1.14***	-1.27***
	(0.1)	(0.10)	(0.11)	(0.10)
Growth		0.19	0.18	0.28
		(0.2)	(0.20)	(0.2)
Ln (*det)*		-0.59***	-0.59***	-0.61***
		(0.03)	(0.03)	(0.03)
Ln (*Pop_15-29)*			0.16	0.52***
			(0.21)	(0.18)
Ln (*Urb)*			0.02	0.19***
			(0.03)	(0.03)
Ln (*Lit)*				-1.12***
				(0.05)
Observations	3,417	3,417	3,417	3,417
R-squared	0.389	0.627	0.628	0.670

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *. Both dependent and independent variables are in logs.

4.5.3.3. Variations in time aggregation

Time aggregation helps to remove observations that deviate markedly from other observations in a data set. This can arise randomly and can even occur due to measurement errors. To see robustness of results obtained above five and ten-year averages are shown below in table 4.7 which exhibit consistent results with annual data. Similar to annual data Gini coefficient has a stronger effect on property crime than violent crime for both five and ten-year periods. *det* has a strong deterrent effect on both crimes with violent crime being much stronger. Urbanisation is seen as an important predictor of property crime with almost similar magnitudes of elasticity for both five and ten-year averages. Similar to annual data literacy strongly deters violent crime but not property crime. Conversely, $Pop\_{15\text{-}29}$, effect on both types of crime almost disappears.

Table 4. 7- Time Aggregation

VARIABLES	(1) *Violent crime 5 years*	(2) *Property crime 5 years*	(3) *Violent crime 10 years*	(4) *Property crime 10 years*
Ln (*Gini)*	0.29*	0.56***	0.31	0.56*
	(0.17)	(0.21)	(0.23)	(0.31)
Growth	2.12**	0.35	4.24**	1.29
	(0.85)	(1.25)	(1.87)	(2.26)
Ln (*det)*	-1.02***	-0.22***	-1.03***	-0.23***
	(0.03)	(0.03)	(0.04)	(0.04)
Ln ($Pop\_{15\text{-}29}$)	0.60*	0.34	0.43	0.3
	(0.31)	(0.36)	(0.46)	(0.55)
Ln (*Urb)*	0.088*	0.14***	0.09	0.148*
	(0.05)	(0.05)	(0.06)	(0.08)
Ln (*Lit)*	-0.40***	0.2**	-0.42***	0.19
	(0.07)	(0.09)	(0.10)	(0.13)
Observations	680	680	340	340
R-squared	0.95	0.81	0.95	0.82

Note: The numbers in parentheses are robust standard errors. Significance at the 1 %, 5 % & 10 % levels are denoted respectively by ***, ** and *.

4.6. Conclusion

The results of this study provide sufficient evidence in favour of income inequality being a very strong determinant of both violent and property crimes. However, inequality is seen to have a higher elasticity for property crime (0.27) relative to violent crime (0.20). This finding

is in line with literature on crime which suggests that income inequality is more relevant in determining crimes against property than violence. With high income inequality the opportunity cost of participation in illegal activities lowers and encourages people to engage in them for self-enrichment. However, motivation behind crimes against persons is not based on self-enrichment rather they are driven by hate or passion and mostly involve people who are close acquaintances to each other. While this is true income inequality can still determine crimes against violence because factors that determine violent crimes can be common to property crimes as discussed in subsection 4.4.1. Furthermore, after controlling for demographic and educational variables Gini remains a robust determinant of both property and violent crime.

The crime rates are negatively associated with costs of criminal activity. The relative magnitude of estimates of crimes with respect to *det* indicate that offenders tend to avoid risk. It is interesting to see that estimated elasticity of violent crime with respect to *det* is higher than crimes against property. This implies that law enforcement is quite strong in combating crimes of hate and passion.

After controlling for top income shares it is found that people at lower part of income distribution are relatively more involved in committing crime. A 1% increase in Gini can have almost 0.65% (0.27%) rise in property and violent crimes respectively. This suggests that it is quite important to alleviate inequality and increase redistribution from rich to poor as it can have multiple effects on society. Programs that involve redistributing from rich to poor may reduce crime at a direct cost to rich. The ones who commit crimes are those with lowest market incomes according to Becker's model. Therefore; increasing their return by redistribution can be an effective crime control policy.

It is quite difficult to relate results in this study to existing literature because studies that have looked at aggregate violent and property crime are within country studies and do not use panel data. Few panel data studies examine components of violent and property crime such as homicides and robberies (see e.g., Fajnzylber, 2002; Messner, 2002; Neumayer, 2005). In this regard this study has moved the literature further and has shown that inequality is a significant and robust determinant of crime across countries.

Since rate of both types of crime are positively related to income inequality this suggests that equalization of training and earning opportunities can be an effective method of combatting crime. Therefore, a society spending more resources on enforcement of law and order may not deter crime effectively if it is unaccompanied by alternative methods of combatting crime.

For the future it will be worthwhile to look at specific components of violent and property crime in context to income inequality and see if results are similar to aggregate measures for both crimes.

References

Blau, J. R., & Blau, P. M. (1982). The cost of inequality: Metropolitan structure and violent crime. *American Sociological Review*, 114-129.

Becker, G. S. (1968). Crime and punishment: An economic approach. In *The Economic Dimensions of crime* (pp. 13-68). Palgrave Macmillan UK.

Bruinsma, G. J. (2007). Urbanization and urban crime: Dutch geographical and environmental research. *Crime and Justice*, *35*(1), 453-502.

Brush, J. (2007). Does income inequality lead to more crime? A comparison of crosssectional and time-series analyses of United States counties. *Economic Letters*, *96*(2), 264268.

Collins, R., & Sanderson, S. K. (2015). *Conflict sociology: A sociological classic updated*. Routledge.

Cook, P. J., & Laub, J. H. (2001). *After the epidemic: recent trends in youth violence in the United States* (No. w8571). National Bureau of Economic Research.

Cook, P. J., Machin, S. J., Marie, O., & Mastrobuoni, G. (2012). Lessons from the Economics of crime.

Danziger, S., & Wheeler, D. (1975). The economics of crime: Punishment or income redistribution. *Review of Social Economy*, *33*(2), 113-131.

Dahlberg, M., & Gustavsson, M. (2008). Inequality and crime: separating the effects of permanent and transitory income. *Oxford Bulletin of Economics and Statistics*, *70*(2), 129153.

Demombynes, G., & Özler, B. (2002). *Crime and local inequality in South Africa*. The World Bank.

Doyle, J. M., Ahmed, E., & Horn, R. N. (1999). The effects of labor markets and income inequality on crime: evidence from panel data. *Southern Economic Journal*, 717-738.

Ehrlich, I. (1973). Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy*, *81*(3), 521-565.

Enamorado, T., López-Calva, L. F., Rodríguez-Castelán, C., & Winkler, H. (2016). Income inequality and violent crime: Evidence from Mexico's drug war. *Journal of Development Economics*, *120*, 128-143.

Fajnzylber, P., Lederman, D., & Loayza, N. (2002). Inequality and violent crime. *The Journal of Law and Economics*, *45*(1), 1-39.

Fajnzylber, P., Lederman, D., & Loayza, N. (2002). What causes violent crime?. *European Economic Review*, *46*(7), 1323-1357.

Glaeser, E. L., & Sacerdote, B. (1999). Why is there more crime in cities?. *Journal of Political Economy*, *107*(S6), S225-S258.

Jacobs, D. (1979). Inequality and police strength: Conflict theory and coercive control in metropolitan areas. *American Sociological Review*, 913-925.

Jacobs, D., & Helms, R. E. (1997). Testing coercive explanations for order: The determinants of law enforcement strength over time. *Social Forces*, *75*(4), 1361-1392.

Kelly, M. (2000). Inequality and crime. *Review of Economics and Statistics*, *82*(4), 530-539.

LaFree, G. (1999). A summary and review of cross-national comparative studies of homicide. *Homicide: A Sourcebook of Social Research*, 125-145.

Lochner, L. (2004). Education, work, and crime: A human capital approach. *International Economic Review*, *45*(3), 811-843.
Machin, S., & Meghir, C. (2004). Crime and economic incentives. *Journal of Human resources*, *39*(4), 958-979.
Messner, S. F., & Rosenfeld, R. (1997). Political restraint of the market and levels of criminal homicide: A cross-national application of institutional-anomie theory. *Social Forces*, *75*(4), 1393-1416.
Messner, S. F., Raffalovich, L. E., & Shrock, P. (2002). Reassessing the cross-national relationship between income inequality and homicide rates: Implications of data quality control in the measurement of income distribution. *Journal of Quantitative Criminology*, *18*(4), 377-395.
Morenoff, J. D., Sampson, R. J., & Raudenbush, S. W. (2001). Neighborhood inequality, collective efficacy, and the spatial dynamics of urban violence. *Criminology*, *39*(3), 517-558.
Nadanovsky, P., & Cunha-Cruz, J. (2009). The relative contribution of income inequality and imprisonment to the variation in homicide rates among Developed (OECD), South and Central American countries. *Social Science & Medicine*, *69*(9), 1343-1350.
Neumayer, Eric , 2003. 'Good Policy Can Lower Violent crime: Evidence from a CrossNational Panel of Homicide Rates, 1980–97', *Journal of Peace Research*, 40(6): 619–640.
Neumayer, E. (2005). Inequality and violent crime: Evidence from data on robbery and violent theft. *Journal of Peace Research*, *42*(1), 101-112.
Nivette, A. E. (2011). Cross-national predictors of crime: A meta-analysis. *Homicide Studies*, *15*(2), 103-131.
Nilsson, A. (2004). *Income inequality and crime: The case of Sweden* (No. 2004: 6). Working Paper, IFAU-Institute for Labour Market Policy Evaluation.
Poveda, A. C. (2011). Economic development, inequality and poverty: An analysis of urban violence in Colombia. *Oxford Development Studies*, *39*(4), 453-468.
Sala-i-Martin, X. X. (1992). *Public welfare and growth* No. 666. Center Discussion Paper.
Trumbull, W. N. (1989). Estimations of the economic model of crime using aggregate and individual level data. *Southern Economic Journal*, 423-439.

Appendices

Appendix-A

Table 4. 8- Countries and Type of Violent crime Data Available

Countries	**Type of Violent crime**	**Category of violent crime**	**Years coveredviolent crime**
Australia	Convicted	Offences against person Categorical violent crime	1824-1969 1970-2016
Austria	Convicted	Total violent crime	1874-2016
Belgium	Reported	Homicide	1825-2016
Canada	Convicted	crime against person Total violent crime	1886-1972 1973-2016
Denmark	Convicted	Categorical violent crime	1833-2016
Finland	Convicted	Convicted for assaults Categorical violent crime	1844-1876 1877-2016
France	Convicted	Categorical violent crime	1825-2016
Germany	Convicted	Categorical violent crime excluding rape	1854-2016
Ireland	Reported/known to police	crime against persons Categorical violent crime	1864-2003 2003-2016
Italy	Reported/known to police	Categorical violent crime except rape	1880-2016
Japan	Reported/known to police	Categorical violent crime	1900-2016
Netherland	Convicted	Categorical violent crime except rape Total violent crime between 1973&2016	1852-1972 1973-2016
Norway	Convicted	Categorical violent crime Between 1923&1956 crimes against person is used	1846-2016
Sweden	Convicted	Categorical violent crime	1843-2016
SWZ	Convicted	Offences against person/body and life	1929-2016

UK	Reported/known to police	crime against person Categorical violent crime excluding assault	1857-1897 1898-2016
		as definition of assault continues to change.	
U.S	Reported/known to police	Categorical violent crime	1932-2016

Table 4. 9- Countries and Type of Property crime Data Available

Countries	**Type of Property crime**	**Category of property crime**	**Years covered-property crime**
Australia	Convicted	Property crime	1825-2016
Austria	Convicted	Property crime	1874-2016
Belgium	Reported/known to police	Property crime	1843-2016
Canada	Reported/known to police	Property crime	1886-2016
Denmark	Convicted	Property crime	1859-2016
Finland	Convicted	Property crime	1877-2016
France	Convicted	Property crime	1825-2016
Germany	Reported/known to police	Property crime	1836-2016
Ireland	Reported/known to police	Property crime	1864-2016
Italy	Reported/known to police	Theft	1880-2016
Japan	Convicted	Larceny, fraud, counterfeiting & embezzlement	1924-2016
Netherland	Reported/known to police	Property crime	1900-2016
Norway	Convicted	Theft, blackmail, motor theft and larceny	1846-2016
Sweden	Convicted	Larceny, aggravated larceny, infringement and embezzlement	1841-2016
SWZ	Convicted	Property crime	1929-2016
UK	Reported/known to police	Property crime	1857-2016

U.S	Reported/known to police	Theft, burglary, motor theft & robbery	1932-2016

Note: crime rate is calculated from the adjusted statistical series per100, 000 inhabitants.

Table 4. 10- Countries and Type of Imprisonment Data Available

Country	**Type of data**	**Country**	**Type of data**
Australia	Prison population	Italy	Prison population
Austria	Prison population (SWZ)	Japan	Prison population
Belgium	Prison population	Netherland	Prison population
Canada	Prison population	Norway	Prison population
Denmark	Prison population	Sweden	Prison population
Finland	Prison population	Switzerland	Prison population
France	Prison population	U.K.	Prison population
Germany	Sentenced to imprisonment	U.S.A	Prison population
Ireland	Prison population		

Appendix- B: Data Sources

Violent crime

Australia. 1824-1838 Tasmania, *Statistical Returns*, van Diemen's Land from 1824-1839, Compiled from official Records in the colonial secretary's office Hobart, 1839; 1860-1975, Vamplew, W. (1987), *Australian Historical Statistics*, CJ 52-67 Homicide offences, charges, Offenses heard and determined at Magistrate courts Australia; 1971-2012, *Year book*, Australia (1975-2012), Selected crimes reported to Police. ***Austria.*** 1800-1865; 1865-1873 Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014;1874-1974 Zentralamt, Ö. S. (1979), Tabelle A7.2 Zahl der Verurteilten Die Entwicklung der Verbrechenskriminalität in Osterreich 1874-1974, *Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829–1979*. Wien: Österreichisches Statistisches Zentralamt; 1947-2015 *Statistics Austria*, conviction statistics. Table C1 Verurteilungen nach ausgewählten Abschnitten des Strafgesetzbuchs und

Sanktionen seit 1947. ***Belgium.***1825-1869, Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014; 1870-1992, *Annuaire statistique de la belgique* (1881-1995); 1993-2012, *NRILP Comparative Homicide Time Series* (version 25-10-2013), National Research Institute of Legal Policy, Helsinki. ***Canada***. 1879-1885, Murder: Charges, dispositions, commutations and executions, Canada, Series Y61-66, M.C.Urquhart, *Historical Statistics of Canada*, 1886-1972, *Statistics Canada* Section Z: Justice, series Z79-84, Convictions for indictable offences by nature of the offence, Canada; 1973-2012, Violent crimes, *Statistics Canada*, Canadian Centre for Justice Statistics, Uniform crime Reporting Survey. ***Denmark.*** 1833-1835,*Statistisk Tabelvcerk Ny Rcekke Tyvende Bind detaillerede Criminaltabeller jar Kongeriget Danmark jar Aarene* 1841-1885; 1859-1885, Oversigt over den Kriminelle Retspleje I Aarene 1859 til 1868, *Sammendrag af statistiske Oplysninger* (1880-1896); 1886-2012, Condamnations pour crimes, *Statistisk Aarbog* (1896-2014). ***Finland.*** 1800-1844, spliced using Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014; 1845-1876, Assault convictions, Vuorela, M. (2017). *The historical criminal statistics of Finland 1842–2015–a systematic comparison to Sweden. International Journal of Comparative and Applied Criminal Justice*, 1-23 ; 1877-2012, Nombre des personnes condamnees pour les infractions, *Tilastollinen Vuosikirja* (1879-2014). ***France.*** 1828-1964, pour crimes contre l'order public et les personnes, Tableau III, IV & V *Annuaire statistique de la France*, 1966b (pp.161-163); 1965-1987, Tableau 5A (pp. 634) *Annuaire statistique de la France*, 1988; 1988-2010, Condamnations pour crimes, *Annuaire statistique de la France* (2004-2012). ***Germany.*** 1803-1855, Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014; 1856-2012, Datentabelle 9.2 x0433 Verurteilte - Mord und Totschlag,x0434 Verurteilte - gefährl. Körperverletzung (1836-2011) and x0435 Verurteilte - Raub, *Dokumentation zum Zeitreihendatensatz für Deutschland* (1834-2012). ***Ireland.*** 1825-1863, Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014; 1864-1980, Offences against the person, Indictable offences known to the Police, *British Historical Statistics* (1988); 2003-2012, Recorded crime Offences (Number) by Type of Offence and Year, *Statistical Yearbook of Ireland* (2002-2012). ***Italy.*** 1825-1875, Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014; 1880-2014, Delitti denunciati di autorenoto per I quali l'autorita giudizaria ha iniziato l'azione penale e delitti di autore ignoto per tipo di delitto, *Sommario di statiche storiche* (1861-2010). ***Japan.*** 1888-1899, Homicide rate, Johnson, D. T. (2005). *The vanishing killer:*

Japan's postwar homicide decline. Social Science Japan Journal, *9*(1), 73-90, 1900-1923, crimes reported to police, Archer, D., & Gartner, R. (1987). *Violence and crime in crossnational perspective*. Yale University Press, 1924-2012, Penal Code crime Cases Known to the Police and Cases Cleared up by Type of crime, *Statistics Japan*, (1924-2004), Available at: http://www.stat.go.jp/english/data/chouki/28.htm . ***Netherland*.** 1852-1899, Number of convictions for murder and manslaughter, assault and robbery, Franke, H. (1994). *Violent crime in the Netherlands. A historical-sociological analysis. crime, law and social change*, 21(1), 73-100, 1900-1972, Number of convictions, Archer, D., & Gartner, R. (1987). *Violence and crime in cross-national perspective*. Yale University Press, 1973-2012,
Table 11a, Gewelds-misdrijven, *Tweehomderd jaar statistiek in tijdreeksen*, 1800-1999; ***Norway.*** 1846-1867, Opgave over Antallet af de for Justitsforbrydelser hvert af Aaerne 1846 til 1885, *Criminalstatistiske Tabeller for Kongeriget Norge for Aaret 1860*; 1868-2012,Antal straffaeldte stiller sig gjennemsnitlig pr.aar saaledes, *Annuaire Statistique de la Norvège* (1919-2013). ***Sweden.*** 1800-1842, Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014; 1843-2012, Persons convicted in the courts of first instance, by nature of offence, *Historisk Statistik for Sverige* (1950-2014). ***Switzerland.*** 1825-1928, Homicide rate per 100,000, Baten, J, Bierman, W., Foldvari, P. and van Zanden, J. L.: Chapter 8 *Personal security since 1820 In How Was Life? Global Well-being since 1820* (Jan Luiten van Zanden, Joerg Baten, Marco Mira d'Ercole, Auke Rijpma, Marcel Timmer eds,), OECD, Paris, 2014; 1929-1983, W.10. Personnes condamnees, par canton at par groups principaux de delits, *Statistisches Jahrbuch der Schweiz* (1930-1986); 1984-2012 convictions for crimes or offenses according to articles of the Criminal Code, Switzerland and cantons Available at: https://www.bfs.admin.ch/bfs/de/home/statistiken/kriminalitaetstrafrecht.assetdetail.333911.html. ***United Kingdom***. 1800-1856, Homicide rate for London and Liverpool, Available at: https://cjrc.osu.edu/research/interdisciplinary/hvd/europe/london, 1857-1897, crime against persons, *British Historical Statistics 1988*; 1898-2002, A summary of recorded crime data from 1898 to 2001/02, Available at: https://www.gov.uk/government/statistics/historicalcrime-data; 2003-2012, A summary of recorded crime data from 2003-2015 Available at: A summary of recorded crime data from year ending Mar 2003 to year ending Mar 2015. ***United States*** 1839-1931, Series Ec237-241, Homicides in New York city and Philadelphianumber, indictments and rates, Contributed by Douglas Eckberg, *Sourcebook of Criminal justice Statistics, 2012*; 1932-59, Offences known to the police, Uniform crime reports (1931-59); 1960-2012, Table Ec1-10, Estimated number and rate (per 100,000 inhabitants) of offenses known to police, *Sourcebook of Criminal.*

Property crime

Australia. 1825-1838 Tasmania, *Statistical Returns*, van Diemen's Land from 1824-1839, Compiled from official Records in the colonial secretary's office Hobart, 1839;1860-1900, CJ 36-51 Offences against property, convictions, *Australian Historical Statistics*; 1900-1971,

Table C3 Offences against Property, convictions, Mukherjee, S. K., Scandia, A., Dagger, D., & Matthews, W. (1989). *Source Book of Australian Criminal and Social Statistics*. *Canberra: Australian Institute of Criminology*; 1973-2016, crimes known to Police, *Year book, Australia (1975-2012).* **Austria.** 1874-1974, Tabelle A7.2 Die Entwicklung der Verbrechenskriminalitat in Osterreich 1874-1974, Zentralamt, Ö. S. (1979) *Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829–1979. Wien: Österreichisches Statistisches Zentralamt*, 1947-2016, *Statistik Austria*, C1 Verurteilungen nach ausgewählten Abschnitten des Strafgesetzbuchs und Sanktionen seit 1947; **Belgium.** *Annuaire statistique de la belgique* (1843-1995) **Canada.** 1886-1972, Statistics
Canada Section Z: Justice, series Z79-84; 1973-2016, *Statistics Canada*, Canadian Centre for Justice Statistics, Uniform crime Reporting Survey. **Denmark.** 1859-1885, Antal af domfaeldte for egentlige Forbrydelser og for offentlig politiforseelser, *Sammendrag af statistiske Oplysninger (1880-1896)*; 1886-2016, Convictions for criminal offences involving sentences more serious than fines, *Statistisk Aarbog* (1896-2016) **Finland.** 1877-1926, Nombre des personnes condamnees pour les infractions, 1927-2016, offences known to the police, *Tilastollinen Vuosikirja (1879-2016).* **France.** 1825-1964, Tableau III, IV & V (pp.161-163) pour crimes contre l'order public et les personnes, *Annuaire statistique de la France, 1966b*, 1965-1987, Tableau 5A (pp. 634), *Annuaire statistique de la France, 1988*; *1988-200*5, *Annuaire statistique de la France (1991-2007)* **Germany** 1836-2012, Datentabelle 9.2 x0424, *Dokumentation zum Zeitreihendatensatz für Deutschland (18342012)*; **Ireland.** 1864-1980, Indictable offences known to the police, *British Historical Statistics (1988)*; 1981-2012, Recorded crime Offences (Number) by Type of Offence and Year, Available at: http://www.cso.ie; **Italy** 1880-2016, *Sommario di statiche storiche (18612010)* **Japan.** 1924-2016, Penal Code crime Cases Known to the Police and Cases Cleared up by Type of crime, *Statistics Japan, (1924-2004)* **Norway.** 1846-1954, nombre des condamnes, repartis selon la nature des crimes et delits et des contravetions, 1955-2016, offenses reported to police, *Annuaire Statistique de la Norvège (1919-2013)* & https://www.ssb.no; **Sweden.** 1841-1975, Person convicted in the courts of first instance, Historisk Statistik for Sverige (1950-2014), 1975-2016, Tabel. 4.2. All conviction decisions, by principal offence and year, 1975–2016, https://www.bra.se/bra-in-english/home/crimeand-statistics/crime-statistics.html; **Switzerland** 1929-1983,Persnnes condamnees, par canton et par groups principaux de delits, *Statistisches Jahrbuch der Schweiz* (1930-1986); 19842016, Erwachsene: Verurteilungen für ein Vergehen oder Verbrechen 1) nach Artikeln des Strafgesetzbuches (StGB), Schweiz available at: https://www.bfs.admin.ch/bfs/de/home/statistiken/kriminalitaetstrafrecht.assetdetail.333911.html; **United Kingdom** 1857-1980, crimes known to the police- England and Wales, *British Historical Statistics 1988*; 1981-2012 Police Recorded crime, Home Office available at: https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/datasets/focusonpropertycrimebulletintables; **United States** 1932-2016, Estimated number and rate of offences known to police, Uniform crime reports (1931-59) & *Sourcebook of Criminal justice Statistics, 2012.*

Prison Population

Australia. 1860-1899, CJ116-129, Daily Average of Prisoners by Jurisdiction, *Australians Historical Statistics*; 1900-1999, C8.11, Prisoners, Daily Average Number and Rates per 100,000
Population 1900-1999, Mukherjee, S. K., Scandia, A., Dagger, D., and Matthews, W (1998), *Source Book of Australian Criminal and Social Statistics*, Canberra: Australian Institute of Criminology.; 2006-2016, Table 2 Prisoners, selected characteristics, *Australian Bureau of Statistics*, Available at: http://www.abs.gov.au/AUSSTATS/abs@.nsf/detailsPage/4517.02017?OpenDocument, Accessed on 4/02/18. **Belgium.** 1835-1992, Inculpes condamnes a l'emprisonnement, *Annuaire Statistique de la Belgique* (1870-1995). **Canada.** 1886-1951, Series Z85-93, Sentences for indictable offenses, Canada, 1886-1951; 1952-1972, Series Z94-102 Sentences of persons convicted for indictable offenses, Canada, 1952-1972; 1950-2016, Prison population, Available at: http://www.prisonstudies.org/country/canada, Accessed on 5/02/18. **Denmark**. 1810-1965, Number of persons imprisoned per 100,000 of the population in Denmark, Christie, N. (1968) Changes in penal values. *Scandinavian Studies in Criminology*, 2, pp. 161-172; 1966-2016, Offences against the penal code by type of penalty, *Statistisk Årbog* (1960-2016). **Finland**. 1886-1965, Number of persons imprisoned per 100,000 of the population in Finland, Christie, N. (1968). Changes in penal values. *Scandinavian Studies in Criminology*, 2, pp. 161-172; 1966-2016, Number of people sentenced to imprisonment in courts of first instance, *Tilastollinen Vuosikirja* (1960-2016). **Germany.** 1882-2016, Table X0443 and X0444, Rahlf, T. , *Dokumentation zum Zeitreihendatensatz für Deutschland, 1834-2012*. **Ireland.** 1851-1980, Total criminal prisoners convicted, Available at *Microfiche Thom's directory of Ireland* (1885-1980); 2001-2016, Sentenced prisoners in custody by length of sentence and sex, *Statistics Ireland* (2002-2012); 2012-2016, Available at: http://www.prisonstudies.org/country/ireland, Accessed on 4/02/18. **Italy.** 1890-2016, Tavola 6.21 Condannati per delitto con sentenza irrevocabile secondo la pena, il sesso,l'eta e il paese di nascita-Anni 1890-2009, *Sommario di statistiche storiche 1861-2010*. **Netherlands.** 18372005, Figure 3, Tonry, M., and Bijleveld, C. (2007). crime, criminal justice, and criminology in the Netherlands. *crime and justice*, 35(1), p.1-30; 2006-2016, Prison population trend, Available at: http://www.prisonstudies.org/country/netherlands, Accessed on 10/01/2018. **Norway.** 1810-1966, Number of persons imprisoned per 100,000 of the population in Norway,
Christie, N. (1968). Changes in penal values. *Scandinavian Studies in Criminology, 2*, pp. 161172; 1967-2016, Prison population trend, Available at: http://www.prisonstudies.org/country/norway. Accessed on 10/01/2018. **Sweden.** 1810-1966, Number of persons imprisoned per 100,000 of the population in Sweden, Christie, N. (1968) Changes in penal values. *Scandinavian Studies in Criminology*, 2, pp. 161-172; 1967-1993, Number of people sentenced to imprisonment in the courts of first instance *Statistical Yearbook of Sweden* (1967-1993); 1994-2016, Tabell 5.3, Persons sentenced to imprisonment and admitted to prison, by principal offence, 1994–2016, Available at https://www.bra.se/bra-inenglish/home/crime-and-statistics/crime-statistics/the-prison-and-probation-service.html; Accessed on 10/02/2018. **Switzerland**. 1890-1986, Verurteilte Gefangene, *Statistisches Jahrbuch_der Schweiz* (1932-1988); 1987-2012, Federal office of statistics, Switzerland. Available at: https://www.bfs.admin.ch/bfs/de/home/statistiken/kriminalitaetstrafrecht/strafjustiz/sanktionen-untersuchungshaft.assetdetail.334019.html, Accessed on 12/01/2018. **United Kingdom.** 1900-2016, Table 1a: Prison population annual average by gender, England and Wales, 1900-

2016, Allen, G. and Watson, C. (2017) Prisons and Courts Statistics, England and Wales, *House of Commons Library*, WP Number CBP7892. **United States** 1925-2016, Table 6.28.2012, Number and rate (per 100,000 resident population in each group) of sentenced prisoners under jurisdiction of State and Federal correctional authorities on December 31, by sex, United States, *Sourcebook of Criminal Justice Statistics*, Available at: https://www.albany.edu/sourcebook/tost_6.html, Accessed on 10/02/2018.

Table 4. 11- Other Data Sources

Data	**Source**
Gini	Madsen, J. B., Islam, M. R., & Doucouliagos, H. (2018). Inequality, financial development and economic growth in the OECD, 1870–2011. *European Economic Review*, *101*, 605-624.
Pop_15-29	The source is the same as chapter 3
Urbanisation	The source is the same as chapter 3
Literacy	Madsen, J. B. What have been the Fundamental Drivers of Growth in the Advanced Countries over the Past Two Centuries?
Real GDP per capita	The source is the same as chapter 2 and 3
Population	The source is the same as chapter 3

Chapter 5

Conclusion

5.1 Summary

This thesis looks at development of crime and income inequality within different contexts. Chapter 2 examines relationship between income inequality and social transfers while chapter 3 and 4 study development of crime. The effect of alcohol, drugs and deterrence on homicide are investigated in the former while the latter looks at the role of income inequality in determining violent and property crime. All three chapters use long historical data for OECD countries. Below I discuss the main results obtained in each chapter, the key findings and later the areas which can be further explored.

Second chapter of this thesis revisits the median voter hypothesis using data on 20 OECD countries to evaluate the impact of income inequality and democracy on social transfers between 1860 and 2013. Top income shares are used as measure of income inequality and PCA between voter participation and polity score is used as measure for democracy. The OLS estimates show that as inequality increases in a democratic country social transfers will reduce. However; there is a two-way relationship between inequality and transfers as well as democracy and transfers. Therefore, it is crucial to instrument both endogenous variables. Unionisation has long been associated with reducing inequality because of their bargaining power (Islam, Madsen and Doucouliagos, 2016). In this study union influence is used as an instrument for inequality and threat of Revolution is used as an instrument for democratisation (Aidt and Jensen, 2013). Due to limited number of revolutions occurring after mid twentieth century this study also uses franchise extensions which can trigger preemptive democratisation. Treating for endogeneity is essential as it is clearly seen that strength of the coefficients increase quite significantly. This study's results are in sharp contrast to median voter theory put forward by (Meltzer & Richard, 1981) and suggests that democracies may not always be in favour of higher redistribution. Some studies show that the way democracies behave depends on the way democracies are born (Acemoglu and Robinson, 2008; Acemoglu *et.al.*, 2011). If elite are very powerful and have strong influence on Government, they may use lobbying and power to direct resources towards their own vested interests.

The third and fourth chapters of this thesis look at development of crime in different settings. Economic literature has followed Becker (1968) and Ehrlich (1973) paradigm and have published several comprehensive studies studying criminal behaviour. However, these

economic studies have completely neglected the role of alcohol and drugs on crime. Most of the studies that have looked at the effect of alcohol and drugs on crime belong to other disciplines including psychology, medicine, sociology, criminology etc. These studies suggest that alcohol reduces self-control of a person which increases probability of him engaging in crime (Bartholow *et.al*, 2012). The third chapter of the thesis develops a simple model in which criminality is jointly determined by deterrence and addiction. The model shows that probability to commit crime decreases in the probability of severity of punishment and increases in alcohol consumption. This hypothesis is tested using data on 14 OECD countries for period between 1800 and 2016 and results show that alcohol, drugs and deterrence are significant determinants of homicide. Among control variables *Div* and $Pop\_{15\text{-}29}$ are generally positive determinants of homicide but their significance is sensitive to inclusion of other covariates as well as time period. This paper has been relatively successful in explaining movements in homicide during past century but less effective in explaining waves up to WWI.

Most of economic literature on crime has stressed on income inequality being a very important determinant of crime. Majority of cross sectional studies have found a strong positive relationship between income inequality and crime. However, most of this literature has been criticised because these studies do not control for unobserved heterogeneity across countries. To overcome this problem few studies have looked at the relationship between inequality and crime across countries. These studies generally only look at specific components of violent and property crime due to unavailability of data for post 1960 period (Fajnzylber *et.al*, 2002a; 2002b). In light of these limitations fourth chapter of this thesis studies the impact of income inequality using two centuries data for 17 OECD countries on both aggregate violent and property crime. After controlling for unobserved heterogeneity across countries this chapter finds that income inequality measured by Gini is robust and significant determinant of both violent and property crime. As per economic literature, the elasticity is higher for property crime compared to violent crime. This statement is based on the idea that property crimes are mostly committed for self-enrichment by people at bottom of income distribution. In contrast; violent crimes are mostly associated with hate and passion and are crimes that occur among acquaintances. Despite this distinction both violent and property crimes can share same determinants because violent crimes may occur in areas where there are illiterate and underprivileged people. Among control variables *det* and *Pop_15-29* are seen to be significant determinants of both violent and property crime. *Urb* is strongly associated with property crime and *lit* with violent crime but both variables are

sensitive to type of crime that they are determining. This chapter extends its investigation by adding top income shares in the analysis. It is then found that poor are more involved in committing crime relative to other parts of income distribution. Overall this thesis has tried to address gaps in existing literature by constructing extensive datasets for eight variables (threat of revolution, homicide, violent crime, property crime, imprisonment, capital punishment, alcohol consumption and drugs). By means of instrumental variables approach and using different measures of crime, punishment and addiction for long time period this thesis has uncovered some unnoticed areas of crime and inequality.

5.2. Key Findings

This thesis has seen several interesting findings which has developed the literature further. In the first essay the results are in contrast with median voter theory. The finding of this chapter suggests that higher social transfers in unequal democracies is really a myth. The OLS estimates as well as IV results in second chapter both show that unequal democracies redistribute less. The idea this chapter's results reflect is that it is really the elite that are driving the political agendas in a country and not the marginalised.

The second essay sheds light on addiction as being a very important predictor of crime. Enormous economic literature has looked at crime but with different approach. Alcohol has not been explored in economics literature in context to crime. This essay emphasizes that it is a variable that is crucial to development of crime and contributes to it quite strongly. In the third essay although income inequality is a significant predictor of violent and property crime the same relationship is not observed for homicides. Most of cross-sectional literature has proposed strong positive relationship between homicides and income inequality. This study by collecting new dataset for homicides for two centuries for 17 OECD countries shows that this relationship does not hold. This difference in results may ensue from the idea that this paper controls for the unobserved heterogeneity across countries and uses a long historical period.

5.3. Directions for Future Research

For second chapter it will be worth looking at the role of inequality in developing democracies. Although results in second chapter suggest that unequal democracies with high income inequality are negatively related with social transfers; this result may also hold true for developing economies where the elite are quite influential in policy making.

The third and fourth chapter of this thesis can be further enhanced by using an instrument for deterrence as both deterrence and crime have a two-way relationship. It is widely discussed in

literature that punishment reduces crime. Conversely, substantial literature suggests that higher crime causes an increase in penalties (Levitt, 1996; Johnson & Raphael, 2012). Although, this paper has tried to reduce bias by using different measures of deterrence; it will be useful if an instrument for deterrence can be applied to substantiate the results further. The analysis of chapter 4 shows that income inequality is a strong determinant of aggregate measures of crime. Further work can be done which is focused on segregated measures of crime to evaluate whether results stay consistent and if there are any deviations from results obtained.

References

Acemoglu, D., & Robinson, J. A. (2008). Persistence of power, elites, and institutions. *The American Economic Review*, *98*(1), 267-293.

Acemoglu, D., Ticchi, D., & Vindigni, A. (2011). Emergence and persistence of inefficient states. *Journal of the European Economic Association*, *9*(2), 177-208.

Aidt, T. S., & Jensen, P. S. (2013). Democratization and the size of government: evidence from the long 19th century. *Public Choice*, *157*(3-4), 511-542.

Bartholow, B. D., Henry, E. A., Lust, S. A., Saults, J. S. and Wood, P. K. (2012). Alcohol effects on performance monitoring and adjustment: Affect modulation and impairment of evaluative cognitive control. *Journal of Abnormal Psychology*, 121(1), 173-86. Becker, G. S. (1968). Crime and punishment: An economic approach. In *The Economic Dimensions of crime* (pp. 13-68). Palgrave Macmillan UK.

Ehrlich, I. (1973). Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy*, *81*(3), 521-565.

Fajnzylber, P., Lederman, D., and Loayza, N. (2002a). What causes violent crime? *European Economic Review*, 46(7), 1323-1357.

Fajnzylber, P., Lederman, D. and Loayza, N. (2002b). Inequality and violent crime. *The Journal of Law and Economics*, 45(1), 1-39.

Islam, M. R., Madsen, J. B., & Doucouliagos, H. (2018). Does inequality constrain the power to tax? Evidence from the OECD. *European Journal of Political Economy*, *52*, 1-17.

Johnson, R., & Raphael, S. (2012). How much crime reduction does the marginal prisoner buy? *The Journal of Law and Economics*, *55*(2), 275-310.

Levitt, S. D. (1996). The effect of prison population size on crime rates: Evidence from prison overcrowding litigation. *The Quarterly Journal of Economics*, *111*(2), 319-351.

Meltzer, A. H., & Richard, S. F. (1981). A rational theory of the size of government. *The Journal of Political Economy*, 914-92