Distribution effects of central bank independence

A panel data analysis of 134 countries between 1980 and 2012

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Abstract

Increasing inequality within countries has been put on the agenda in recent years, much due to the impact of Thomas Piketty's *Capital in the Twenty-First Century*. The distributive effects of central bank independence have however been largely ignored by economists and political scientists alike, focusing solely on fiscal policy, i.e. taxation and spending, as a means of redistribution.

Using a regression model of 134 countries during the period between 1980 and 2012, I find that central bank independence has a positive, significant effect on market inequality, i.e. inequality before taxes and transfers, producing more inequality. The effect diminishes with higher levels of inflation. The results are robust to trends, different magnitudes of lag, exclusion of a control variable reducing the amount of observations substantially, and to varying inflation measures.

The effect is not present when the dependent variable is exchanged with a net inequality measure, i.e. inequality after taxes and transfers. As both redistribution, market inequality and central bank independence have increased in the period, this indicates that redistributive taxation and transfers pulls in the opposite direction, reducing inequality. I suggest that due to efficiency and justice issues relating to redistributive taxation and transfers, it may be favorable to adjust inequalities *ex ante*, i.e. through monetary policy, rather than *ex post*, i.e. through fiscal policy. The alternative may be a vicious cycle of increasing central bank independence, inequality and redistributive taxation.

The findings also have strong implications for the debate regarding central banks' mandates and the balance between central bank independence and democratic accountability.

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Thank you to my parents for invaluable support throughout eight years of studies.

Any remaining errors are my own.

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1. Introduction

1.1 Research question

This thesis is about the distributive effects of central bank independence. The indirect effects of central bank independence have been researched previously; the hypothesis being that independent central banks implement conservative monetary policies, leading to lower inflation and thus less inequality. The research has to some degree confirmed the first part of the hypothesis, i.e. that independent central banks are more restrictive and correlate to lower inflation rates (Brumm 2011, 220). Research on the second part, regarding inflation's effect on inequality, has not led to a consensus in the same degree.

Here, however, the focus will be on the direct effect of central bank independence on inequality. Central banks are "key governmental institutions that, compared with other main organs of government, tend to be neglected in political science" (Lijphart 1999, 232). This will be apparent in the literature review, where the question of central banks and their distributive effects have to a little degree been accounted for. The indirect effect, inflation being the link between central bank independence and inequality, has been studied by economists, but has been mainly ignored by political scientists.

The main hypothesis in the thesis is that central bank independence advantages the rich and disadvantages the poor, hence having a positive effect on inequality. I make the argument that multiple qualities of an independent central bank contribute to this: First, its main priority is reducing inflation, disregarding distributive effects. Second, central banks must be considered agents with goals of their own, which may conflict with redistributive goals. Third, independent central banks have substantial influence over interest rates, monetary policy and control of banks, making room for distributive effects not being picked up in models studying only inflation. And fourth, there cannot be a conflict between monetary and fiscal policy in the long run, implying that central banks' contractive monetary policies may cause governments to introduce contractive fiscal policies.

The secondary hypothesis, based on an extensive literature review, is that the distributive effects of central bank independence is dependent upon inflation. In other words, there is an interaction

effect of central bank independence and inflation on inequality, inflation being the moderating variable. This hypothesis is based on the notion that the arguments for the main effect are stronger at low levels of inflation. Most importantly, at high levels of inflation, central banks must focus on fighting inflation, reducing the impact of competing goals and interests.

The hypotheses will be tested by use of quantitative methods, using two panel data regression models featuring 134 countries in the period 1980–2012. One model will include the interaction term, while the other will not. To test the robustness of the results, the models will be exposed to trends as well as changes in dependent and independent variables.

In the following chapter, I will describe the motivation behind researching the distributive effects of central bank independence. I will then shortly discuss the contributions of the thesis, before I give a short preview of my findings. Lastly, I will outline the structure of the chapters to come.

1.2 Motivation of research question

Thomas Piketty received widespread attention among scholars and laymen alike when he released his book *Capital in the Twenty-First Century* in 2013 (English version in 2014). The central thesis in the book is that the return on capital over time exceeds the return of economic growth, resulting in increasing inequality (Piketty 2014, 571). He suggests a global tax on capital to remedy this (Piketty 2014, 515–539).

At the same time, monetary policies such as Quantitative Easing, which aim to "increase the level of central bank money in the economy", were being used in order to kick-start the economy again following the recession (Green and Lavery 2015, 898). Prominent economists and politicians, among them the former chairman of the American central bank (Federal Reserve), Ben Bernanke, and the leader of the British Labour Party, Jeremy Corbyn, suggested such remedies as "helicopter money" and "People's Quantitative Easing", respectively (Bernanke 2016; Green & Lavery 2015; Spence 2015).

Murray Rothbard's book *The Case Against the Fed* (1994) elegantly puts these two seemingly unrelated issues in connection. Here, Rothbard argues that the Federal Reserve is in practice "accountable to nobody", and that the concept of central bank independence is undemocratic

(Rothbard 1994, 3–5). Further, he suggests, contrary to Milton Friedman's theory of "helicopter money" – implying that an increase in the money supply will be proportionally shared among citizens – that money printing has a redistributive effect (Rothbard 1994, 23). Comparing it to a process of counterfeiting, Rothbard concludes that "the early receivers of the new money (…) gain at the expense of those who receive the money toward the end of the chain" (Rothbard 1994, 24). Inflation thus works as form of "hidden 'tax'" (ibid).

The development of central bank independence and inequality in recent decades may be seen in the two following graphs, generated from the dataset used in this thesis.

Figure 1.1. Development in central bank independence 1980–2012.

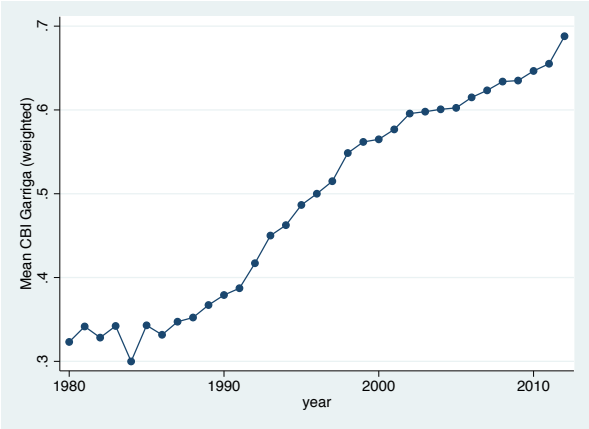
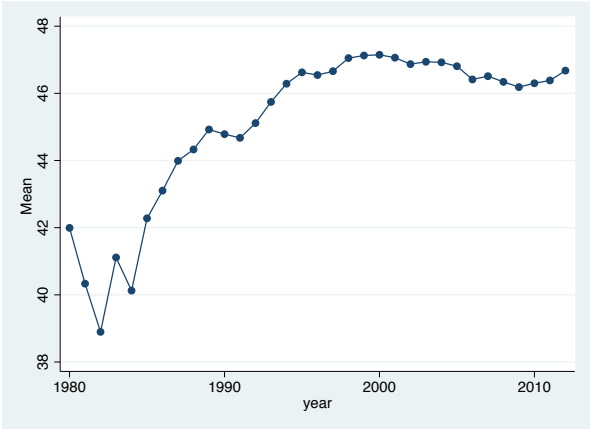


Figure 1.2. Development in inequality (market Gini) 1980–2012.



Source: Garriga (2016). Generated by use of the Stata package `lgraph`.

In other words, in the same period as inequality has been soaring, the increase in the independence of central banks has been pronounced as well. This begs the question of whether the development of the two variables may be related in some way.

Should Rothbard's theory be correct, it could represent a plausible explanation for the growth in capital exceeding the growth in income. At the same time, it would have major implications for Piketty's conclusion, that capitalism is to blame for increasing inequality, as well as his remedy, the global tax on capital (Piketty 2013, 515–539; 571). Piketty's theory can be interpreted as such that inequality is caused by the market, with government regulation, i.e. higher taxes, as the solution. However, taking Rothbard's theory into account, it may be true that the government may decrease inequality by increasing taxes, but at the same time, it would be pulling in the opposite direction through its monetary policies. In Piketty's terminology, the

factors pushing towards convergence, i.e. less inequality, may "nevertheless be thwarted and overwhelmed by powerful forces pushing in the opposite direction, toward greater inequality" (Piketty 2014, 22). Tax increases may in this perspective still be an efficient countermeasure, but it could potentially be even more effective to remove the cause of increasing inequality in the first place.

What makes the question even more important, is the fact that, should there be a distributive effect of the central bank system, this effect will be very difficult to observe. Rothbard (2014, 25) argues that the process of inflation is "particularly insidious and destructive because everyone enjoys the feeling of having more money". In addition, a finding would further broaden the discrepancy between the regard to democratic control and the regard to independence in monetary policy.

Looking further into the question of a potential distributive effect of the central bank, I found that some research has been conducted on the subject. Even so, a consistent quantitative analysis seemed to be lacking (Bodea and Hicks 2015).

1.3 Contribution of thesis

As outlined above, the effect of central bank independence on inequality has not received much attention among scholars. The research that is available, has been mostly focused on the economic issues relating to central banks, such as monetary policies and inflation. This is in line with Lijphart's claim that central banks "tend to be neglected in political science".

This thesis makes a contribution to the research on causes of inequality by focusing on central bank independence as an independent variable. Frey and Schneider (1981, 291) complain that there is "little known about the *actual* behavior of central banks", central banks being "an important actor that has a strong influence on the course of the economy". More recently, Fontan, Claveau and Dietsch (2016, 320) argue that given the importance of monetary policy, we still do not know "nowhere near enough about how it affects inequalities, how sensitive central banks should be to any such effect if it exists, and what relevant policy alternatives might look like".

Central bank independence has in later years "become the norm rather than the exception" (Bernhard 2009, 177), to the point where it has "achieved an almost taken for granted quality in contemporary political life, with little questioning of its logic or effectiveness" (McNamara 2002, 47). More and more countries have adopted central bank independence as a fundamental principle of monetary policy (Arnone et al. 2009; Bodea and Hicks 2015; Elgie 1998). In a quantitative analysis of 163 central banks globally, Arnone et al. (2009) conclude that central bank independence has "about doubled" in recent decades. If central bank independence indeed has an effect on inequality, this finding could have major implications for the discourse on the trade-off between central bank independence and democracy.

Perhaps most importantly, the thesis shows that the traditional view on measures against inequality may be too narrow, focusing on redistribution through fiscal policy, i.e. after the fact, rather than redistribution through monetary policy, i.e. before the fact. I show that while redistribution through taxes and transfers may be efficient, it does not change the underlying, fundamental factors, as indicated by the fact that both market inequality and redistribution through taxes and transfers have increased during recent decades. Redistribution through taxation and transfers is a controversial measure, but the arguments against it, especially the arguments relating to efficiency and justice, do not carry the same strength with regards to redistribution through monetary policy.

1.4 Central findings

Using a regression model of 134 countries in the period between 1980 and 2012, I find that central bank independence does indeed have a distributional effect, causing greater inequality. The interaction effect of inflation and central bank independence is negative, implying that the effect of central bank independence on inequality diminishes with increasing levels of inflation. The results are robust when exposed to trends, different magnitudes of lag, exclusion of the education variable, and to varying inflation variables.

The results suggest that central banks and monetary policy have been underestimated as factors of distribution, and that policy makers should expand their focus in redistribution issues from solely decreasing net inequality to also decreasing market inequality. In other words, it may be possible to reduce inequality at an earlier stage, reducing the need for redistribution through fiscal policy.

The results indicate that some countries may find themselves in a vicious cycle of increasing central bank independence, inequality and redistribution. As more and more countries increase the independency of their central banks, thereby causing higher levels of market inequality, the demand for redistribution increases. Although redistribution through taxation and transfers is an effective counter-measure against inequality, market inequality remains high.

1.5 Structure

In chapter two, I will go through relevant literature and theory, as well as summarizing previous research. I will discuss the theoretical and empirical grounds for the expansion in central bank independence in many countries in recent years, as well as some of the challenges, such as accountability, democracy and transparency. In chapter three, I will discuss the consequences of inequality and why it is an important measure for society. Further, I will go through literature on the causes of inequality.

Chapter four will outline and discuss the methods used, the assumptions made as well as the challenges related to quantitative analyses. In chapter five, I will describe the data and measurements used in the regression models. Chapter six will present and analyze the results. In chapter seven, I will discuss the implications of the findings, primarily for the debates regarding policy and democracy.

2. Understanding central bank independence

In order to understand the implications of the findings for the debate regarding policies remedying inequality as well as the debate regarding democratic accountability, we must first understand the arguments being used to justify independence of central banks. This chapter will discuss the main theoretical and empirical arguments for central bank independence, as well as the arguments regarding independent central banks' lack of democratic accountability. In chapter 7, I will discuss how these arguments are affected by the findings of this thesis.

2.1 Why central bank independence?

The main argument for central bank independence has traditionally been the regard for long-term monetary policy, made possible by the fact that an independent central bank may not be controlled by shifting constellations of government (Bodea and Hicks 2015, 37; Elgie 1998, 53–54; Garriga 2016, 850). According to Lijphart (1999, 20), "independent [central] banks are widely considered to be better at controlling inflation and maintaining price stability".

The idea of central bank independence builds on agency theory. In this perspective, governments have a strong incentive to increase inflation, thereby being able to finance goods and services to the electorate. Central bank independence is seen as a way to avert this "inflationary bias", the central bank being a more "credible" actor in the absence of "electoral motives" (Fontan, Claveau and Dietsch 2016, 322; Polillo and Guillén 2005, 1769–1770).

Polillo and Guillén (2005, 1768) sum up the arguments for central bank independence as follows:

> *A central bank free from political contingencies is supposed to be in a position to pursue the goals of fiscal discipline and monetary stability by preventing the rest of the state from engaging in discretionary deficit spending. By controlling the inflation rate and preventing the government from causing inflationary shocks that could monetarily boost output, the central bank is heralded as a necessary check to self-interest politicians. Whereas dependent central banks could lend to the government and public institutions,*

an independent central bank is barred from either activity, thus imposing austerity and stability on the economy.

In other words, central bank independence may have many macroeconomic advantages, such as lower inflation rates and increased stability and discipline (Arnone et al. 2009, 264). A quantitative study of 78 countries in the period 1973–2008, shows that central bank independence has both a "discipline effect" and a "credibility effect", indicating that independent central banks are more disciplined, i.e. they print less money, and are more credible to the public.

Other scholars find similar results. Huffman (1997, 943) demonstrates, using a dynamic equilibrium model, that if agents were able to vote on the level of inflation rates, rates would tend to be higher than were they set at fixed levels. Based on this model, the argument could be made that independent central banks will adopt monetary policies that lead to lower inflation rates than would a politically controlled central bank.

However, the moderating effect on inflation of central bank independence could be dependent on other political institutions, such as government partisanship, organization of labor markets, checks and balances and the quality of political institutions. An important consequence of this, is that democracies, in particular democracies with strong partisan competition, i.e. a strong opposition, will show a stronger relationship between central bank independence and stable monetary outcomes (Bodea and Hicks 2015, 40–41).

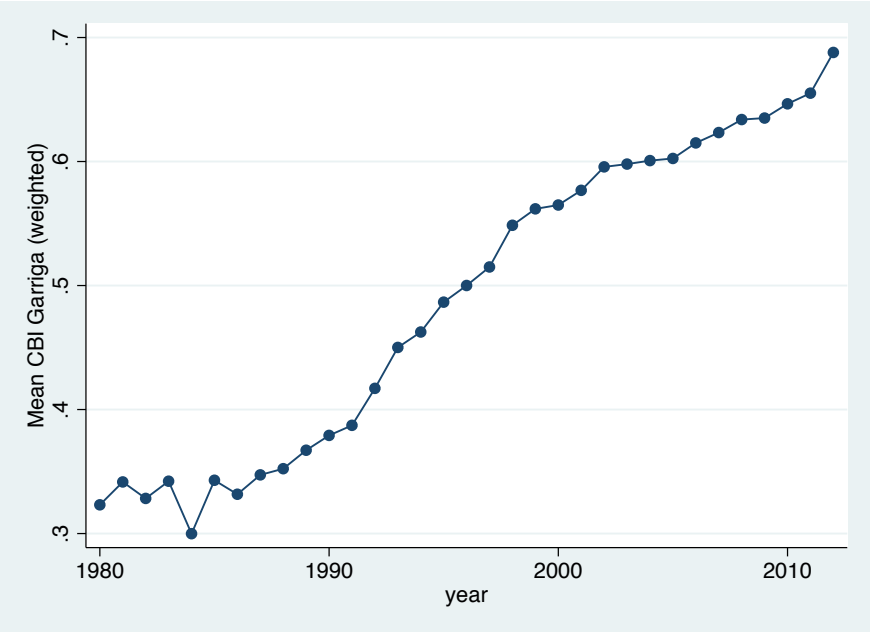
2.2 Development in central bank independence

There is consensus among scholars that there has been an increase in central bank independence in recent decades (Arnone et al. 2009, 275; Bodea and Hicks 2015, 38; Elgie 1998, 64). In the 1990s, 54 countries had their central banks move in the direction of more independence. This is compared to a mere 24 countries not implementing changes, and Malta being the sole exception, moving in the opposite direction (Polillo and Guillén 2005, 1770). As to the magnitude of the increase, a quantitative analysis of 163 countries demonstrates that overall central bank independence has about doubled between the late 1980s and early 2000s (Arnone et al. 2009, 275).

Polillo and Guillén (2005, 1788) explain this development with governments being subject to "international coercive, normative, and mimetic pressures" due to globalization. Furthermore, they suggest that behind this development lies a new ideological paradigm, where Keynesian economics, focusing on fiscal policy, i.e. government spending, as a remedy for counteracting business cycles, unemployment and recessions, have been replaced by neoliberal principles, such as austerity and monetary stability (Polillo and Guillén 2005, 1768; 1788; 1793–1794).

An illustration of the development in central bank independence, retrieved from the dataset used in this thesis, may be found in figure 2.1 below. The graph shows average central bank independence in the complete dataset for the period from 1980 to 2012, measured on a scale from 0 to 1 (Garriga 2016).

Figure 2.1. Development in central bank independence 1980–2012.



Source: Garriga (2016). Generated by use of the Stata package `lgraph`.

As the graph shows, there has been a pronounced increase in central bank independence at least since the late 1980s. From levels of under 0.35 in the early 1980s, the average level of central bank independence in 2012 has doubled to almost at 0.7. This is consistent with the contention by Arnone et al. (2009, 275) that there has been a doubling of central bank independence between the late 1980s and the early 2000s.

2.3 Democratic deficit

The concern is that central bank independence may be undemocratic, as it moves the control of monetary policy from democratically elected governments, removing monetary policy from the realm of the government (Polillo and Guillén 2005, 1768). Rothbard (1994, 3) describes the American central bank – the Federal Reserve – as "[b]y far the most secret and least accountable operation of the federal government". It "is accountable to no one; it has no budget; it subject to no audit; and no Congressional committee knows of, or can truly supervise, its operations" (ibid).

Levy (1996, 190) argues that the existence of an independent central bank may be democratic only if two requirements are met: First, the central bank must not influence social trade-offs such as the trade-off between unemployment and inflation. Such trade-offs should be democratic decisions, and should thus not be left to central banks. Second, the central bank's ends should be clearly regulated by democratically elected actors, as opposed to being up to the central bank's arbitrary choices (ibid).

"The reality is that neither of the above conditions holds", claims Levy (1996, 191): The central bank's decisions have many social effects, and its decision-making is neither scientific nor objective. As central banks "make monumental policy choices for the nation, choices that should be democratically determined", he suggests that central banks are made more accountable, by demanding that they demonstrate that their actions are in society's interests, all implications taken into account (Levy 1996, 191–192).

However, it may be useful to distinguish *political* independence from *economic* independence (Arnone et al. 2015; Elgie 1998). *Political autonomy* points to the degree to which the central bank can control its ends, i.e. the "final objectives of monetary policy", while *economic autonomy* is about to which degree the central bank may choose the measures to achieve these objectives (Arnone et al. 2009, 265; 275).

Based on reforms in Germany, Britain and France, Elgie (1998, 64) concludes that even "the most independent of national central banks" do not "suffer from a 'democratic deficit'". The argument that central bank independence is inversely proportional with democratic accountability is flawed, he claims, for even a central bank scoring high on economic

independence may still be subject to government control. On the other hand, a central bank with a low level of economic independence may have a high level of political independence. Thus, the essential question is not the degree to which a central bank is independent, but to which degree it is *politically* independent, i.e. to which degree it controls its ends (Elgie 1998, 60–61).

In this perspective, the trend towards increased central bank independence is not necessarily a trend towards decreased democratic accountability. In fact, reforms of the Bank of England and the Banque de France have increased economic independence, but decreased political independence. In other words, although central banks become more independent overall, their political independence is still lower than it was in the 19th century and the first part of the 20th century (Elgie 1998, 61–62).

A number of scholars have touched upon similar topics. Hetzel (1997, 59) argues that central bank independence increases transparency for the public by treating fiscal and monetary policies on equal terms. If central banks are not independent, it is more feasible for governments to print money and thereby impose a "tax" on the citizens. He concedes, though, that there may be a conflict between independence and accountability, suggesting that independence should be combined with "a rule mandating price stability" in order to balance independence and accountability properly (ibid).

A similar argument is that independence with regards to goals should be separated from independence with regards to instruments. Fischer (1995, 202) concludes that a central bank should have the latter, but not the former. In other words, a central bank should choose the instruments, but the government should set the goals. In this sense, accountability is paramount, both to set incentives for the central bank to achieve the goals set, and for transparency (ibid).

Historically, central banks' level of independence has been balanced against the extent of their mandate (Fontan, Claveau and Dietsch 2016, 321–322; 339). In other words, the more power a central bank has, the less autonomy it has (ibid). This would indicate that even if there has been an increase in the independence of central banks in many countries, their mandates have narrowed.

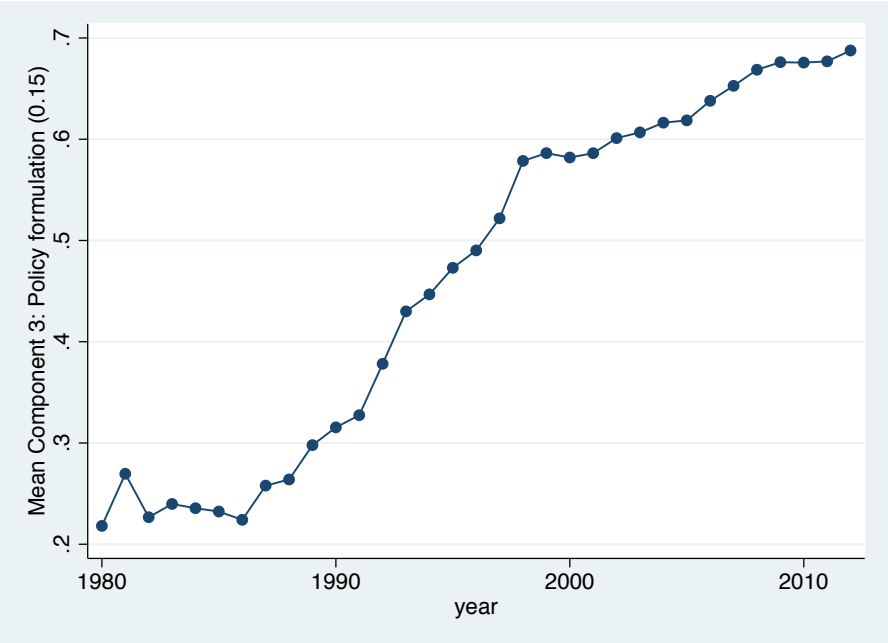
Also, as central banks face strong constraints from the government, it is likely in the long run that the government has "the final say" (Frey and Schneider 1981, 294–295). The central bank

also faces the threat of government taking away its mandate. Hence, "its survival requires a state of no-conflict with the government" (Frey and Schneider 1981, 295). Studying the case of the German Bundesbank, Frey and Schneider (1981, 308) conclude that there have been seven conflicts between the government and the central bank in the period between 1957 and 1977, all of them relating to a conflict between the central bank's restrictive policies and the government's expansionary policies. In all seven cases, the result was that the central bank changed course and implemented expansionary monetary policies (ibid).

Although it may be true that central banks are generally more economically independent than they are politically independent, the trend is that political independence is on the rise. Especially in developed countries, where economic independence was high already in the 1980s, the better part of the increased independence has been due to increased political independence (Arnone et al. 2009, 275).

Our dataset (Garriga 2016) indicates that Arnone et al. (2009) are on the point. The variable of policy formulation is an index of three weighted variables, measuring the central bank's role when it comes to formulation of monetary policy, resolution of conflicts with the government as well as the formulation of government budgets. How conflict with governments are resolved is the most important variable, representing half the index (Garriga 2016b, 9–10).

Figure 2.2. Development in independence of policy formulation 1980–2012.



Source: Garriga (2016). Generated by use of the Stata package `lgraph`.

Using the policy formulation variable as a proxy for political independence, the pattern is clear: There has been a massive increase in the political independence of central banks at least since the end of the 1980s. Based on Elgie's argument, this would indicate there could be a problem with democratic accountability relating to this increase.

The European Central Bank is an interesting case in this regard, as it is regarded as the most independent central bank in the world (Kaltenthaler, Anderson and Miller 2010, 1262). Elgie (1998, 63–64) argues that the European Central Bank, as opposed to the German, British and French central banks, has a higher level of political independence than economic independence. More importantly, it has a substantially higher level of political independence than its British and French counterparts. This indicates that, to a larger degree than the German, British and French central banks, the European Central Bank may have a challenge with regards to democratic accountability (ibid).

A different perspective is that independent central banks generate feelings of distrust in the public. This is the argument made by Kaltenthaler, Anderson and Miller (2010). Also focusing on the case of the European Central Bank, they conclude that the European Central Bank's "extremely low levels of accountability" has led to distrust in the institution. The authors argue that for citizens to trust the central bank, they must believe that it is able to "fulfil the duties that the citizenry has assigned" it, concluding that the European Central Bank must balance its autonomy in policy-making with popular support (Kaltenthaler, Anderson and Miller 2010, 1262; 1278–1279).

On the other hand, some reject that democracy and central bank independence are in conflict on grounds of the argument that central bank independence is "a well accepted part of a democratic system" (Drazen 2002, 11). Central bank independence may be described as one of ten characteristics of a consensus democracy, i.e. a system aiming at including as many as possible in democratic decision-making, as opposed to a majoritarian model of democracy, where the majority rules (Lijphart 1999, 46). Lijphart (1999, 2; 7; 46) argues that a consensus democracy "may be considered more democratic than majoritarian democracy in most respects". In this sense, independent central banks are a way of dividing power, contrary to a system where power is concentrated in the executive branch (Lijphart 1999, 233).

Also, even though the way politicians influence monetary policy has changed by more actors being involved in policy setting, politicians still play a big part in monetary policy in countries with independent central banks. Instead of being the sole decision of the cabinet, the central bank debates policies publicly with the cabinet and parliament, increasing accountability. Furthermore, politicians and parties will choose institutional arrangements reflecting their interests. Independent central banks may further the interests of parties in systems where intra-party competition makes it difficult to hold office for longer periods of time (Bernhard 2009, 180).

This division of power need of course not be seen as in a positive light. Polillo and Guillén (2005, 1793) suggest that more independent central banks are a manifestation of technocracy, benefitting "certain groups of policy makers and external constituencies", seeing the development in connection with the effect of globalization, where national states are exposed to international pressure to adopt similar policies. Monetary policy has as such "been socially and politically constructed as lying beyond the scope of democratic oversight and control" (Polillo and Guillén 2005, 1793–1794).

2.4 Chapter summary

Central bank independence has been defended primarily on grounds of its allegedly positive effect on monetary stability. While being met with some criticism in a democracy perspective, the claims that it is undemocratic have mainly been rejected due to arguments about division of power as well as the priority of stable monetary policies. The consensus among economists has been that independent central banks are better at keeping inflation low, leading to a trend towards greater independence of central banks during the last decades.

3. Understanding inequality

In this chapter, I will first discuss why inequality *matters*, that is what consequences inequality has for society. In other words, why should we care if central bank independence increases inequality? Further, I will go through the literature with regards to some of the most important explanations for inequality. The focus will of course lie on central bank independence and inflation, as they are at the center of this enquiry.

3.1 Why is inequality important?

First of all, the argument could be made that "inequality provides incentives for effort and risk-taking, and thereby raises efficiency" (Wade 2004, 582). In this sense, inequality is either desirable or neutral, and should not be remedied. A related argument is that as long as they are the results of voluntary exchanges, inequalities are just (Kymlicka 2002, 103).

I will not discuss arguments regarding just distribution in detail, as they do not apply to the same degree when it comes to the distributional effects of central banks and monetary policy. This is because these effects would occur *ex ante*, i.e. before or outside of the market place (Kymlicka 2002, 82). This is apparent in the fact that libertarians, who are the most vehemently opposed to redistributive taxation, have been vocal against the distributive effects of independent central banks (Kymlicka 2002; Paul 2009; Rothbard 1994).

I will thus focus on empirical arguments, making the argument that inequality matters because it negatively affects democracy, trust and values, among other things. In addition, inequality within countries seems to be increasing, making the distribution an important contemporary political issue.

Much research has been done when it comes to the effects of inequality. One argument is that inequality affects democracy negatively. For instance, Gilens (2005) argues, based on survey data from the United States, that inequality has a negative effect on democratic responsiveness. He finds a "vast discrepancy" between the responsiveness to citizens with high and low incomes, and concludes that "the difference between democracy and plutocracy is one of degree" (Gilens 2005, 794).

Similarly, results from a study of 35 developed countries indicate that income inequality is more important than economic development with regards to support for democracy. People in relatively equal societies tend to support democracy more strongly, and people with higher income within countries have the same tendency (Andersen 2012, 395). Another study shows a correlation between economic and political inequality, as high levels of inequality reduce all but the most affluent citizens' political interest, the frequency of political debate and electoral participation (Solt 2008, 48).

A similar argument is that inequality makes it possible for the powerful to take control over legal, regulatory and political institutions, especially if the latter institutions are weak (Glaeser et al. 2003). Furthermore, inequality "may prevent the sustainability of robust democracy" (Guillén 2008, 2). Bourguignon (2015, 6) claims that "excessive inequality" will "necessarily undermine the stability of societies" and may in the long run "trigger major social disruptions", due to a small elite receiving the lion's share of the economic growth.

A number of scholars suggest that inequality affects values and attitudes in society. Inequality may undermine social trust and thus create social intolerance. Survey data for attitudes toward homosexuality in 35 countries between 1990 and 2002 demonstrate "a clear link" between high inequality and low tolerance for minority groups. The effect is stronger with regards to the attitudes of people in lower social classes, implying that the difference between the attitudes of the middle and the working class is greater in relatively unequal societies. The effect of inequality on tolerance is not dependent on the level of economic development (Anderson and Fetner 2008, 945; 955–956).

A different study also concludes that inequality significantly affects values and attitudes in general. People in unequal societies tend to be more religious, more critical to the political and democratic system, and to have more traditional family values. Generally, they have less trust in fellow citizens. Concurring with Anderson and Fetner (2008), they also tend to be more critical of homosexuality (Pryor 2012, 618–621).

Related to the effect on values and attitudes, there is also more violence in societies with less equality. A number of studies have focused on the correlation between homicide rates and inequality, both in the United States and internationally, producing robust results with different

control variables. This may be part of a pattern where inequality reduces "the quality of social relationships", manifesting itself in lower trust, less active communities and more discrimination, in addition to more violence (Wilkinson 2004, 2–3). In sum, Wilkinson (2004, 4) concludes that there is "little room to doubt that larger income differences are accompanied by a poorer quality of social relations in society".

Inequality may also increase problems relating to a wide array of health and social issues, such as teenage pregnancies, drug abuse, trust and violence (Wilkinson and Pickett 2009). However, this is "a controversial conclusion" (Pryor 2012, 615). In a meta-study of 98 previous studies of the relationship between inequality and health issues, Lynch et al. (2004, 82) find little support for the suggestion that income inequality, either within or between countries, "is a major, generalizable determinant of population health".

Furthermore, there seems to be a concern among scholars that inequality in general is on the rise, indicating that the problems mentioned above will be increasing in magnitude. According to Piketty (2014, 15), "income inequality has increased significantly in the rich countries". The top one percent's share of income in the United States increased from 9 to 20 percent in the period 1976–2011 (Alvaredo et al. 2013, 4).

The nature of the change in inequality has also changed in recent years, especially in the United States, inasmuch as the growth in inequality has been "concentrated at the top end of the distribution since" the 1980s. In the 1990s, however, a "wide consensus" was established, saying that inequality was "growing sharply" and that the development was mainly caused by an "increase in the relative demand for skill" (Lemieux 2007, 22). Lemieux (2007, 46) concludes that although there are a number of possible explanations for this development, such as differing wage-setting institutions for workers and CEOs, "most of the growth in top-end inequality over the last 15 years remains unaccounted for" (Lemieux 2007, 46).

However, a quantitative study of 138 countries shows that global inequality has been reduced in the 1980s and 1990s (Sala-i-Martin 2006). Bourguignon (2015, 2) argues that while there has been an increase in *national* inequality, there has been a decrease in *international* inequality. In other words, inequality *within* countries has increased, but inequality *between* countries has decreased.

In a meta-study of previous research on the development in inequality, Wade (2004, 575) concludes that "world inequality measured in plausible ways is probably rising". However, Anand and Segal (2008, 57) conclude that findings regarding the direction of development in inequality "are not robust across different estimation methods and datasets". Reviewing previous studies, they find that there is a substantial variation in results both when it comes to the level and the direction of inequality. Thus, their conclusion is that it is not possible to say for certain whether inequality has increased or decreased during the period between 1970 and 2000.

Galbraith (2016, 60) concurs, arguing that "there appears to be no single permanent trend to inequality". After increasing in the 1980s and 1990s, inequality has remained at the same level, even decreasing in many countries (ibid). However, despite the divergence in results, all the studies under review agree that inequality is "very high", and most of them find that inequality within countries has increased since the 70s or 80s (Anand and Segal 2008, 90–91).

3.2 What causes inequality?

Piketty (2014, 21) separates between "mechanisms pushing alternately toward convergence and divergence". The main factors pushing toward convergence, i.e. less inequality, he argues, are "the diffusion of knowledge and investment in training and skills". Furthermore, he mentions supply and demand, and its corollary, mobility of capital and labor (Piketty 2014, 21). As causes of inequality, Piketty mentions population growth and scarcity of resources, increasing land and property prices, capitalism, economic freedom as well as industrialization and growth. Furthermore, he argues that taxes on capital would cause inequality to recede (Piketty 2013, 4–5; 8; 11; 25; 471). Piketty's main finding is what he calls "the central contradiction of capitalism", namely that over time, the growth in capital will tend to be higher than the growth in income (Piketty 2013, 571).

Alvaredo et al. (2013) argue that there are four main factors behind increasing inequality: tax rates, the labor market, capital income, and the correlation between earned income and capital income. Roine et al. (2009), using a 16-country panel covering the 1900s, find that high economic growth and financial development increase the income share of the richest, while tax

progressivity reduces it. Government spending seems to have a positive effect for the poorest, a negative effect for the upper middle class, and no effect on the rich.

In the following, I will discuss a number of the mentioned causes of inequality. The discussion will include twelve possible causes of inequality, including the main variable in this thesis, i.e. central bank independence.

3.2.1 Globalization

The main argument for the negative effect of globalization on inequality, is that income inequality between developed and developing countries has decreased "substantially" in the period between 1980 and 2005, a period characterized by "rapid globalization". Developing countries open for globalization present better results than its counterparts, suggesting that "if more developing countries globalize, the income gap may close a little faster" (Salvatore and Campano 2012, 12–13). Economic openness may increase or decrease inequality, depending on how it is defined, according to Reuveny and Li (2003, 578–579). They conclude that trade openness decreases inequality, while foreign direct investments (FDI) increase it (Reuveny and Li 2003, 593).

In response to similar studies, Wade (2004) discusses what he calls the "neoliberal argument", i.e. the claim that globalization has led to decreasing income inequality and poverty across the world. He concludes that this claim is not supported by available data (Wade 2004, 581). The conclusions drawn are dependent on how inequality and globalization are measured and which countries are chosen (Wade 2004, 575; 580). Also, assuming that trade growth is the most important explanation for economic growth, the argument fails to account for other variables affecting economic performance, such as quality of government (Wade 2004, 580). In sum, the argument that globalization has reduced inequality does not hold because inequality is not falling "even by the most favorable measure" (Wade 2004, 581).

Others conclude that globalization has increased inequality, especially income inequality, and especially in OECD countries (Dreher and Gaston 2008, 531). This is however not the case for developing countries (ibid). Potrafke (2014, 21) comes to the same conclusion with regards to inequality within countries, especially in developing countries.

Bourguignon (2015, 2–3) argues that as to the effect of globalization on inequality, one must separate between inequality *within* countries and *between* countries. Although globalization may have contributed to the trend of increasing inequality within countries, it may at the same have caused a reduction in inequality between countries (ibid).

3.2.2 Democracy

The argument for democracy reducing inequality is that democratically elected governments to some degree must introduce policies that are in the interest of the people, thereby being conducive to reduce inequality. In practice, democracy "redistributes political power in favor of the majority and therefore lead to policies that reduce inequality" (Reuveny and Li 2003, 577–578). Another explanation is that elites are forced to maintain redistributive policies due to threats of revolution (Acemoglu and Robinson 2000).

In a study of 69 countries between 1960 and 1996, Reuveny and Li (2003) find that both trade and democracy reduces inequality. The results are similar to other studies, finding a "significantly negative impact" of democracy on income inequality (Acemoglu and Robinson 2000; Tavares and Wacziarg 2000).

On the other hand, Dreher and Gaston (2008, 531) find that democracy has in fact not had a positive effect on income equality, and that it is more likely to have increased inequality, contrary to the results of Acemoglu and Robinson (2000), Reuveny and Li (2003) and Tavares and Wacziarg (2000). They suggest, as opposed to the mentioned hypothesis of democracy encouraging redistribution, that democracy rather encourages market reforms, thereby producing further inequalities (Dreher and Gaston 2008, 520).

3.2.3 Aging population

Goldstein and Lee (2014) argue that aging populations have a "substantial effect on economic inequality". They discuss three primary reasons behind this connection: First, decreasing population growth rates have an effect on capital intensification. Given the same rate of saving, this increases the difference between the growth in capital and income (Goldstein and Lee 2014, 195–196).

Second, changing age structures are increasing inequality as the growth in the share of people in working age cannot keep track with the growth in the share of dependents (Goldstein and Lee 2014, 198–199).

Third, increased life expectancy increases the possibility for "incomes and assets to fluctuate randomly", in effect increasing inequality (Goldstein and Lee 2014, 203). In sum, Goldstein and Lee (2014, 206) conclude that these three variables "could account for around seven percent of the increase in the share of income held by the top decile".

Similar results are found in a quantitative analysis of household income inequality in Taiwan between 1998 and 2006 (Lin, Lahiri and Hsu 2014). Population aging creates inequality on two fronts: First, older people have lower income, and second, a higher and higher share of older people are living alone (Lin, Lahiri and Hsu 2014, 772). A study of the distributive effect of an aging population in China in the same period yields similar conclusions (Zhong 2011).

3.2.4 Population density

Campante and Do (2007, 1; 4) find that population size and density affect income equality positively, although this relationship "should not be present in more advanced democracies". They suggest that density and concentration of populations increases the threat of revolution, thus giving non-democratic regimes an incentive to implement redistributive reforms. This may be one of the reasons why the United States have traditionally had less redistribution than Western European countries, as the geographical spread of the population has made it difficult to gather support for claims of redistribution.

Inspired by Alesina and Glaeser (2004), they argue further that, inasmuch as a country's capital is the "'focal point' for a revolution", the distance between populated cities such as New York and the capital in Washington D.C. has also contributed to less demand for redistribution (Campante and Do 2007, 18).

3.2.5 Urban – rural gap

The urban – rural gap may be seen in connection with Stein Rokkan's model of center and periphery. The important decisions are taken in the power centers, which are normally placed in urban areas. This is the case for both administrative centers, such as parliaments and courts; economic centers, such as unions, major banks and stock markets; and cultural centers, such as universities and theatres. The periphery is defined by its dependence on and subordination to the center: The periphery is distant from where decisions are taken; it is different in values and identity; and it is dependent due to decisions being taken somewhere else. A higher share of its population is employed in the primary and secondary industries. This suggests that the decisions taken may primarily benefit people living in the areas where the decisions are taken, that is in urban areas (Flora 1999, 110–111; 115).

Young (2013, 1727) claims that the gap between urban and rural populations as to living standards "accounts for 40% of mean country inequality and much of its cross-country variation". The magnitude of the urban–rural gap correlates strongly with the level of inequality, and countries with unusually high inequality are the same countries that have unusually large gaps between urban and rural populations (Young 2013, 1728). The urban–rural gap is caused by "the relative skill intensity of production in urban and rural areas" (Young 2013, 1729). This means that it is more likely for a skilled worker to reside in urban areas, and for an unskilled worker to reside in rural areas (Young 2013, 1768).

An argument supporting this, is "the agricultural productivity gap", implying that rural jobs, i.e. jobs in agriculture, produce less value per worker than non-agricultural jobs. The value produced by the latter is typically two times as big as the value produced by agricultural jobs. In developing countries, the gap is even bigger (Gollin, Lagakos and Waugh 2013). Gollin, Lagakos and Waugh (2013, 990) suggest that there could be "large income gains from workers moving out of agriculture and into other economic activities", a theory that gets support from a recent study of rural Bangladesh.

This argument could in part also be related to the globalization argument, as rural workers may not be in position to take part in the advantages of the global market. Salvatore and Campano (2012, 12–13) suggest that developing countries should take part in globalization in order to

reduce inequalities between countries, but it is not a given that all members of society are equally benefitted from this. Rural jobs are also related to low levels of education (Gollin, Lagakos and Waugh 2013, 965), indicating that rural workers may have more difficulty competing with new labor from abroad.

3.2.6 Capitalism / economic freedom

Capitalism "may promote inequality", as it focuses on reward rather than redistribution (Reuveny and Li 2003, 576–577). Muller (2013, quoted in Sturm and De Haan 2015, 593) describes inequality as "an inevitable product of capitalist activity (…) because some individuals and communities are simply better able than others to exploit the opportunities for development and advancement that capitalism affords". Piketty (2013, 571) as well fundamentally blames capitalism for increasing inequality, calling the capital growth / income growth ratio "the central contradiction of capitalism".

The redistributive effects of economic freedom "are threefold", according to Apergis, Dincer and Payne (2013, 67–68): First, it gives poor people opportunities through equality in property rights. Second, it creates economic growth, which in turn affects economic inequality. And third, economic freedom is related to less redistribution (ibid). Based on these three effects, the net effect on inequality could be both positive and negative.

This may be part of the explanation for why the results of studies on this relationship have been mixed (Aspergis, Dincer and Payne 2013, 68; Pérez-Moreno and Angulo-Guerrero 2016, 342). A quantitative analysis of data from 108 countries between 1971 and 2010 finds that economic freedom does not have a significant effect on income inequality within countries (Sturm and De Haan 2015, 594–595). Krieger and Meierrieks (2016) come to the same conclusion, suggesting that the causal link may be the opposite, i.e. that inequality has a negative effect on economic freedom.

Apergis, Dincer and Payne (2013) concur to some degree, suggesting that the effect goes in both directions, both in the long run and the short run. In the long run, economic freedom has a positive effect on equality. The authors thus suggest that it is possible to "get caught in a vicious circle of high income inequality and heavy redistribution", as high levels of inequality will encourage governments to introduce redistributive reforms, in effect reducing economic

freedom, and as a consequence further increasing inequality (Apergis, Dincer and Payne 2013, 74).

However, in a study of EU countries, Pérez-Moreno and Angulo-Guerrero (2016, 342–343) reach the opposite conclusion of Apergis, Dincer and Payne (2013), finding that economic freedom produces higher levels of inequality. Sturm and De Haan (2015, 593), on the other hand, find that there is no robust effect of economic freedom on inequality.

3.2.7 Higher education

According to Thomas Piketty (2014, 313), investment in education and skills is "the best way to increase wages and reduce wage inequalities". However, this negative effect of education on inequality may be stronger at lower levels of education. The difference between wages of college graduates and high school graduates has increased in the United States, and there has been an explosion in wages for the top 1 and top 0.1 percent in recent decades. This development has happened within the group of college graduates, implying that education may not explain the increase (Piketty 2014, 313–315)

Education may in fact increase inequality, as the effect of education on wages is stronger for people with high wages, or in other words, "returns to schooling increase over the wage distribution" (Martins and Pereira 2004, 367). Lemieux (2006, 15–16) makes a similar argument, suggesting that "most of the increase in wage inequality between 1973 and 2003 is due to a dramatic increase in the return to post-secondary education". In effect, one may expect the effect of education on inequality to be negative at low levels of education, but positive at high levels of education.

3.2.8 Economic growth

In a seminal article on the relationship between economic growth and income inequality, Kuznets (1955) argues that the correlation follows a U-shaped pattern, first increasing income inequality, before peaking and then decreasing. Conceding that the article is "perhaps (…) 95 per cent speculation" (Kuznets 1955, 26), the hypothesis has been researched by a number of scholars with mixed results (Acemoglu and Robinson 2002, 183).

Acemoglu and Robinson (2002, 184) argue that reduced inequality was not a necessary consequence of economic growth, but rather an effect of redistribution. As the Kuznets curve does not necessarily apply, alternative paths are possible. Two of these possible paths are the "autocratic disaster" and the "East Asian miracle". While the former is defined by high inequality, the latter is characterized by low inequality and considerable growth. In both cases, the demand for redistributive reforms is delayed. In the first case, this is due to shortcomings of civil society, and the second case due to small social tensions (Acemoglu and Robinson 2002, 184; 199–200).

However, it may also be the case that economic growth benefits the poor. A quantitative analysis of 92 countries over forty years show that the poorest quintile's average incomes increase (or decrease) proportionally with average incomes. This may be explained with "private property rights, stability, and openness" giving the poor the opportunity to increase their incomes (Dollar and Kraay 2002, 218–219).

Research on the relationship between economic growth and inequality may be divided into two categories: One, based on Kuznets and Lewis, suggests that there exists a "mechanistic relationship" between the two variables. The other treats each variable separately, suggesting both have exogenous explanations (Lundberg and Squire 2003). Lundberg and Squire (2003, 326) thus suggest that that the two variables are treated as "simultaneously determined" and as such "subject to the same set of determining factors". This gives a new dimension to policy choices, as it must be taken into account in many cases the effect on both growth and distribution (Lundberg and Squire 2003, 341).

3.2.9 Diversity/fractionalization

A number of scholars have claimed that in democratic societies, high levels of inequality will lead to more redistribution. This hypothesis may be seen in connection with the democracy theory mentioned above, where voters will demand redistributive policies as a response to high levels of inequality (Houle 2017, 1–2). Houle (2017, 1) has tested this hypothesis, and concludes that although there is such an effect, it is dependent on the degree of ethnic diversity. This could imply that diversity has a positive effect on inequality (negative effect on equality). This is consistent with previous research, showing that people tend not to support redistribution to people of other ethnic groups (Houle 2017, 7)

Houle (2017, 6–7) suggests three reasons for the positive effect of ethnic diversity on inequality. First, when the working class is divided by ethnic cleavages, the poor are not able to form a cohesive coalition in support of redistributive policies. This reduces their ability to mobilize and organize, which has been found to be an important factor when it comes to making parties prioritize redistribution. Second, ethnic diversity increases the number of issues seen as relevant for voters. In other words, although poor people may share a preference for redistribution, cultural conflicts may make them prioritize other issues, such as abortion or defense. Third, ethnic diversity may reduce the likelihood that other groups support the poor's demands for redistribution. This argument is based on the idea of "parochial altruism", implying that people are more likely to support redistribution to poor people when they are part of the same social networks (ibid).

Sturm and De Haan (2015) argue that the effect of ethno-linguistic fractionalization on inequality and redistribution is conditional on the level of economic freedom, implying that countries with a high degree of economic freedom redistribute more at low levels of fractionalization. In other words, high levels of economic freedom or ethnic diversity are not in themselves enough for a country to have high levels of inequality, but if both characteristics are present, redistribution is less likely, and thus high levels of inequality are more likely.

3.2.10 Taxes/redistribution

Thomas Piketty (2014, 471) argues that a "progressive global tax on capital" would be "the ideal policy for avoiding an endless inegalitarian spiral", suggesting that government redistribution is the major factor behind reducing inequality.

The effect of taxes and redistribution on inequality has unfortunately been researched to a little degree, in large part due to the lack of data, but also due to the difficulty in finding measures of different aspects of tax systems making possible cross-country comparisons (Martinez-Vazquez et al. 2012, 3; 21).

Martinez-Vazquez et al. (2012) have researched the effect of taxes and public spending on inequality, using a number of variables, such as measures of personal income taxes and the progressivity of which. Their results suggest that personal income taxes have a positive effect on equality, and that the effect is stronger when the tax system is more progressive (Martinez-Vazquez et al. 2012, 22–24; 28–29).

The effect of corporate income taxes is also shown to have a positive effect on equality, although the effect decreases at higher levels of globalization and open markets. This contradicts the consensus among scholars that such taxes are ultimately at the cost of employees, in effect causing higher levels of income inequality. The results of sales taxes indicate that such taxes are regressive in nature, in effect causing higher levels of inequality. Martinez-Vazquez et al. suggest that the same might be the case for "all other types of indirect taxes, excises and customs duties" (Martinez-Vazquez et al. 2012, 29; 38).

While some taxes pull in the direction of greater inequality and some pull in the opposite direction, the net effect turns out to be negative. In the years between 1990 and 2005, tax policies increased inequality (Martinez-Vazquez et al. 2012, 41). However, this research does also suffer from the aforementioned lack of relevant data, with the number of observations in the different models being at 936 at the highest (Martinez-Vazquez et al. 2012, 32; 35; 38).

3.2.11 Inflation

Although little or no research has been conducted regarding the direct causal relationship between inequality and central bank independence, the indirect effect has to some degree been researched through central bank independence's effect on inflation, and inflation's effect on inequality. There has been a consensus among researchers that independent central banks cause lower inflation (Brumm 2011, 220). There has, however, been disagreement regarding the distributional effects of inflation.

Piketty (2014, 132) describes a describes a development in public perception of debt in the twentieth century, where debt and inflation would redistribute in advantage of the poor. The argument is intuitively plausible, on the assumption that poor people are loaners and rich people are lenders. Although Piketty describes the "mechanism of redistribution via inflation" as "extremely powerful", there are two fundamental challenges with this perspective: First, the owners of government bonds, who are disadvantaged by high levels of inflation, are not necessarily the richest. Second, as high inflation rates become the norm, the market adapts by increasing interest rates (Piketty 2014, 133–134).

A number of researchers have discussed this in detail. Luigi Spaventa (2013, originally published 1963) looks at the distributary effect of inflation in Italy in the period 1953–1962, and concludes that inflation affects different sectors of the economy differently. Romer and Romer (1998, 38) conclude that the long-run and short-run distributive effect of inflation are diametrically opposed. Although monetary policies may reduce inequality in the short run, this effect is only temporary. Cross-country data show that inflation increases inequality in the long run. Also, to the degree that higher inflation leads to demands for contractionary monetary and fiscal policies, this may lead to higher unemployment, in effect increasing inequality (ibid). Similar results are found by Easterly and Fischer (2001, 177–178), who conclude that inflation tends to increase poverty and reduce the real minimum wage as well as the bottom quintile's share.

Albanesi (2007, 1105) suggests that the results of Romer and Romer (1998) and Easterly and Fischer (2001) are due to a "distributional conflict underlying the determination of fiscal policy". Viewing determination of fiscal and monetary policies as a "bargaining game", people

with lower income are left with a weaker bargaining position, resulting in an equilibrium where inflation is high and thus inequality increasing (Albanesi 2007, 1105).

Using a quantitative model of OECD countries, Paola Boel (2017, 21) finds that inflation in practice works as a "regressive tax" in most of the countries in their model, although this is dependent on both wealth distribution and returns and liquidity of bonds. Similar conclusions are reached by Erosa and Ventura (2002), claiming that inflation is in effect "a *regressive* consumption tax".

Green and Lavery (2015) argue that the monetary policies following the regression has led to increased inequality. The policies implemented include Quantitative Easing, which in an attempt to improve the banking system's liquidity involves creating new reserves through the central bank purchasing assets from market actors. Although they describe this as "an extremely unusual form of monetary policy", its "*ends* are extremely orthodox", suggesting a focus on reducing inflation, as opposed to reducing unemployment (Green and Lavery 2015, 898).

Assets bought in the first phase of Quantitative Easing, from March 2009 to January 2010, were in the magnitude of 14 percent of GDP, manifesting itself in increasing asset prices. Due to this increase, demand increases as well, in effect increasing consumer prices. In other words, the consequences of Quantitative Easing are very much in favor of actors not relying on wages, at the expense of wage-earners. As assets are concentrated among the wealthy, the effect is increased inequality (Green and Lavery 2015, 898–900).

Weymark (2003, 308; 311) rejects the notion of a causal relationship between central bank independence inflation, claiming that "a causal relationship has not been convincingly established". Instead, she suggests that both low inflation and central bank independence have a common cause in "economic structures and government objectives" (Weymark 2003, 308–309). This supports previous findings of central bank independence and inflation having opposite relationships in high-income countries compared to middle and low-income countries. While there is negative correlation in the former, the correlation is positive in the latter (Weymark 2003, 310).

3.3 Central bank independence as a cause of inequality

An argument can be made that the central bank creates inequality simply because it prioritizes other ends, such as reducing inflation or creating growth. For example, Fortin (2003, 223) claims that the Bank of Canada's goal of less than two percent inflation creates unemployment, and thus poverty and inequality. This is based on the theory of the Phillips curve, which suggests that there is a trade-off between low inflation and high employment. In other words, the central bank cannot pursue both ends (Fortin 2003, 223–224). In practice, this has led to inflation being the main focus of independent central banks, or as Weymark (2007, 311) puts it: "a fully independent central bank is concerned only with inflation and output performance".

The argument for prioritizing inflation has been that the positive effects of low inflation are "large and permanent", while the effects of unemployment are "small and temporary", or transitionary (Fortin 2003, 224–225). However, Fortin (2003, 225; 229) concludes that this has not been the case in Canada in the 1990s, as the low inflation levels has had a permanent effect on unemployment. He suggests that instead of a target of minimum inflation, the central bank should pursue "the unemployment-minimizing inflation rate", in effect making high employment a target on par with low inflation as regards to the central bank's mandate (Fortin 2003, 229).

A qualitative analysis of central banks in the US, the EU and the UK show that the mandates and goals of central banks imply that inequality is seen merely as an instrumental goal, hence not being prioritized in competition with "standard objectives of monetary policy", such as low inflation (Fontan, Claveau and Dietsch 2016, 320). This may especially be the case for independent central banks, as an important means to keeping independent central banks accountable has been to give them clear and limited goals. In fact, of the three central banks in question, the European Central Bank is least committed to the cause of reducing inequality, the Bank of England is most committed to it, and the Federal Reserve ends up in the middle (Fontan, Claveau and Dietsch 2016, 346). The European Central Bank is considered the most independent of these, due to its appointments not being political and its relatively unprecise goal of price stability (Fontan, Claveau and Dietsch 2016, 323).

A different argument is that the central bank has interests of its own, besides the goals the government has set for it, and that pursuing these interests may create more inequality. Frey and Schneider (1981, 292) argue that the central bank "must be considered as an institution with goals of its own, the same as all other decisionmakers". Central bank officials "may be considered as deriving utility from keeping the price level as stable as possible", as this will give them "prestige (…) and potentially job offers from private business" (Frey and Schneider 1981, 293–294).

Thus, the central bank's mandate must be defined in such a way that its policies are formed by incentives to act in society'' interests (Frey and Schneider 1981, 292). In the same vein, Rothbard (1994, 24; 49–50) suggests that the central bank may benefit from its own monetary policies, being "early receivers" of new money. It could be argued that the more independent a central bank is, the freer it is to pursue its own goals, hence distributing resources from the "late receivers", i.e. people living of wages rather than financial income. This hypothesis is partly confirmed by results presented by Ledoit (2009) and Williamson (2008). The former finds that "the agent closest to the location where money is injected is better off, and the one furthest is worse off" (Ledoit 2009, 1). The latter separates between "connected" and "unconnected" agents, claiming that connected agents benefit more from the central bank's policies (Williamson 2008, 1039).

The central bank also controls measures besides inflation that may have distributional effects, both in the direction of more and less inequality. The central bank's functions also include setting interest rates, controlling money supply, supervising banks and being the lender of last resort, i.e. offering loans in times of liquidity crisis (Ferguson 2014, 156; Fontan, Claveau and Dietsch 2016, 322). Low interest rates should theoretically decrease inequality, inasmuch as it would benefit borrowers more than lenders. In an analysis of the European Central Bank's role as lender of last resort during the European debt crisis starting in 2010, Drechsler et al. (2016, 1933) find that the lender of last resort lending led to a "reallocation of risky assets from strongly to weakly capitalized banks", potentially increasing inequalities further. However, even if it is the case that low interest rates benefit the poor while lender of last resort policies pull in the opposite direction, the effect of interest is the total net effect of central bank independence. Reforms of central banks and their independence have "fundamentally altered the relationship between the banks and their respective governments" (Elgie 1998, 60), and it would be surprising if this did not affect essential economic measures such as inequality.

Also, as implied by Frey and Schneider (1981), a conflict between monetary policy and fiscal policy is not possible in the long run. This could mean that if an expansive (contractionary) monetary policy is upheld over longer periods of time, expansive (contractionary) fiscal policies will follow. The most used argument for independent central banks is exactly that they may be expected to lead a more contractionary monetary policy. If this leads to contractionary fiscal policies as well, for instance reducing government transfers, this could have a positive effect on inequality, assuming that taxation and government spending decrease inequality.

Frey and Schneider (1981, 308) suggest, based on a study of seven conflicts between the German government and central bank between 1957 and 1977, that such conflicts end with the central bank changing course and implementing expansionary monetary policies. However, this does not mean that there cannot be an effect going in the opposite direction before the conflict is resolved by the central bank giving in. Also, the study is based on one case in a 20-year period, which means that the results do not necessarily carry high external validity. In any case, there must necessarily be an interaction between monetary policy and fiscal policy where the central bank and the government must engage in a form of game, both adjusting to each other's policies.

In addition to the direct effect of central bank independence on inequality, the secondary hypothesis of this thesis is that there is an interaction effect of central bank independence and inflation on inequality, inflation being the negative moderating variable. In effect, this means that the effect of central bank independence on inequality would be stronger at low levels of inflation than at high levels of inflation. This hypothesis makes sense when taking into account the arguments above regarding the interests and goals of independent central banks, cf. Fontan, Claveau and Dietsch (2016) and Frey and Schneider (1981). When inflation is low, the central bank's main target has been achieved, and it may focus on other goals. On the other hand, when inflation is high, the main priority is reducing inflation, leaving little room for adjusting monetary policy to the interests of the central bank.

3.4 Chapter summary

Inequality is important for many reasons. Research shows that high levels of inequality may have many negative consequences for society, such as lower quality of democracy and less tolerant values. Many scholars also believe inequality is on the rise, making the question even more relevant for contemporary policy-making.

The literature mentions many causes of inequality. Here, twelve possible relations are discussed: globalization, democracy, aging populations, population density, rural population, education, economic freedom, economic growth, diversity, redistribution, inflation and central bank independence.

Central bank independence is expected to have a positive effect on inequality, i.e. increasing inequality, due to four reasons: First, its main priority is reducing inflation, disregarding distributive effects. Second, central banks must be considered agents with goals of their own, such as prestige. Third, independent central banks have substantial influence over interest rates, monetary policy and control of banks, creating room for distributive effects not being picked up in models studying only inflation. And fourth, there cannot be a conflict between monetary and fiscal policy in the long run, implying that central banks' contractive monetary policies may cause governments to introduce contractive fiscal policies. These arguments are expected to be weaker at high levels of inflation, as central banks then must focus on fighting inflation, reducing the impact of competing goals and interests.

4. Method

This thesis relies exclusively on the use of quantitative method. A fixed-effects model with panel data will be used, featuring 134 countries in the period 1980–2012. In this chapter, I will describe the methods used. First I will outline some important concepts, such as panel data, fixed effects and interactions effects. Thereafter, I will go through the regression model assumptions and describe how the data have been adjusted in order to fulfill these criteria. Lastly, I will describe the choice of regression models and how different models will be used to test the robustness of the results.

4.1 Panel data

The data used in this thesis are *panel data*, also known as *longitudinal data*. This means that each unit, in this case each country, is listed with more than one observation for each variable, differing in time (Dougherty 2011, 514). In other words, the dataset has two dimensions: time and space.

In the dataset used in this thesis, the two dimensions are years and countries, covering 134 countries over a 33-year period (from 1980 to 2012). Although some of the variables have values before 1980, the number of observations in this period is so low that I have decided to remove these observations. In the model including the education variable, 12 observations are lost due to this. In the model excluding the education variable, 11 observations are lost. The list of countries and years in the dataset may be found in the appendix.

Although panel data give cause to some difficulties with regards to regression analysis, a number of advantages has increased its popularity in applied work (Wooldridge 2012, 474). First, panel data may reduce the common problem of omitted variable bias due to unobserved heterogeneity. Second, they make it possible to ascertain dynamics difficult to find using cross-sectional data.[1] Third, panel data allows a substantially higher number of observations. If we

[1] In Dougherty's (2011, 515) example, the case of married men earning more than single men may be caused by either increased productivity due to financial responsibilities or due to unobserved qualities and skills which both potential spouses and employers value. Panel data allows the researcher to ascertain whether the effect (higher wages) is observed after marriage, implying the former explanation, or before marriage, implying the latter explanation.

have observations for ten countries over ten years, that means 100 observations in total (Dougherty 2011, 514–515).

The models including and excluding the education variable features a total of observations at 1,785 and 2,445, respectively. Had the dataset had observations for every year for every country, the number of observations would be 4,422, indicating that a large number of observations are missing. This means that we have an *unbalanced* panel (Dougherty 2011, 515).[2]

Random or fixed effects

With regards to unobserved effects in panel data models, these are commonly remedied by use of either random or fixed effects estimation (Dougherty 2011, 518). Random effects estimation is generally preferable, as it, in contrast to fixed effects estimation, allow us to keep "observed

[2] With an unbalanced panel, we must consider the possibility that missing observations relate to the variables in the model, i.e. that observations are not missing at random. For instance, it is not unlikely that developing countries have a higher frequency of missing data. If we were to remove the countries for which many observations are missing, we may not be certain that the data are representative (Dougherty 2011, 515).

Ideally, missing values should be "missing completely at random" (MCAR). However, this is seldom the case, as units with missing values most likely differ from units without missing values. Thus, we assume instead that we have a situation where data are "missing at random" (MAR). This means that although we expect missing values not be completely random, we assume that the "missingness" is explained by one or more of the variables in the model. If, as in the example above, developing countries have higher frequencies of missing values, this may be picked up by including the GDP variable as a proxy for development. Unfortunately, there is no way to test whether a model lives up to this assumption (Acock 2014, 395–396).

However, as a test of the robustness of the data in question, I have compared the results of a regression with the full unbalanced panel with the results of a regression with a panel without countries with 10 observations or less. The similar results of the two models indicate that removing countries with few observations is not necessary.

characteristics that remain constant for each individual". In addition, fixed effects estimation reduced the number of degrees of freedom, i.e. "the number of independent pieces of information that go into the estimation of a parameter" (Aneshensel 2013, 420; Dougherty 2011, 525).

However, the use of random effects estimation is possible only if two criteria are fulfilled: First, the observations must be randomly drawn; and second, the unobserved effect must be distributed independently of the variables (Dougherty 2011, 525). In this case, it is uncertain whether the first criterion is fulfilled. Reviewing the country-years covered in the dataset (see appendix), it is apparent that missing values are more prevalent among non-Western countries. Also, countries that achieved independence during the data set period (1980–2012), such as Slovenia or Albania, obviously do not have data for all years. Had the observations been completely random, all countries should have about the same number of missing values.

With regards to the second criterion, the distribution of the unobserved effect, this may be tested in Stata with the Durbin–Wu–Hausman test (Dougherty 2011, 525). By running the fixed effects estimation model and the random effects estimation model, respectively, and storing the estimates of each model, we are able to test the hypothesis of independent distribution. If the null hypothesis is not rejected, random effects may be used; if it is rejected, we must instead use fixed effects (ibid).

In this case, the Hausman test shows clearly that the null hypothesis must be rejected, indicating that a model with fixed effects estimation should be used.[3] This is consistent with the quite dissimilar results of the models with fixed and random effects estimation. Had the distribution been independent, the results of both models should be relatively similar (Doughery 2011, 525). Here, the results are substantially different. Although the directions stay the same, both coefficients and significance levels change drastically.[4]

[3] Chi2 = 3,064.78
p = 0.0000
[4] For instance, in the models including the interaction term, the fixed effects model has a coefficient of 0.547 for central bank independence, while the random effects model has a coefficient of 0.065. The p values are 0.000 and 0.479, respectively.

Unfortunately, the choice of a fixed effects estimation model means that the cultural diversity variable must be omitted. This is because the values for this variable do not change from year to year for each country. In other words, any country has one value for all years on this variable. This makes the variable unsuitable for comparison within countries.

Interaction effect

An interaction effect is present when "the effect of an independent variable (X) on a dependent variable (Y) varies across levels of a moderating variable (Z)" (Andersson, Cuervo-Cazurra and Nielsen 2014, 1064). In other words, the effect of the independent variable on the dependent variable is dependent on a third variable. Including an interaction term in a model may thus shed light on the question of under what conditions the independent variable has the strongest effect on the dependent variable (ibid). In this case, we would like to know at which levels of inflation the effect of central bank independence on inequality is strongest, i.e. whether the effect of central bank independence on inequality diminishes as inflation increases.

Interpreting interaction effects may be difficult for multiple reasons. First, the interaction term is "symmetrical with respect to the two variables" (Allison 1999, 168). In other words, it does not distinguish between the independent variable and the moderating variable. This means that it cannot be ruled out that there is reverse interaction, i.e. that the independent variable is actually the moderating variable (Andersson, Cuervo-Cazurra and Nielsen 2014, 1066). In this case, there is a possibility that instead of central bank independence having an effect on inequality which is dependent on inflation, the effect of inflation on inequality is dependent on central bank independence. Besides relying on a literature review, there is no way to rule out the reverse interaction (Andersson, Cuervo-Cazurra and Nielsen 2014, 1067).

Second, a significant interaction effect makes interpretation of both the main effect (central bank independence on inequality) and the interaction effect difficult (Acock 2014, 305). Acock (2014, 305) warns against looking blindly at coefficients for the main term, as they may "suggest ridiculous relationships". This is because the coefficients in a model with interactions indicates the effect when the moderating variable has a value of 0, which does not make sense for all variables (Allison 1999, 168). Accordingly, the coefficient for central bank independence may be interpreted as the effect of central bank independence on inequality when the inflation

variable has a value of zero. Allison (1999, 168) suggests one should not concern oneself with the statistical significance of the main term, but rather concentrate on the interaction effect.

There are two ways to implement an interaction effect in a regression model. One is to generate a new variable representing the product of the two variables in question. However, Acock (2014, 304) recommends using "factor-variable notation". This has two advantages: First, it is not necessary to generate a new variable in advance, and second, it makes it possible to use some post-estimation commands that would not be possible to use with the product variable. Factor variables need to be preceded by either `i.` or `c.`, depending on whether the variable is categorical or continuous (ibid). Hence, the interaction term in this model will be as follows, `lvaw_garriga` being the central bank independence variable and `lninfl` the logarithm of the inflation variable: `c.lvaw_garriga#c.lninfl`

Allison (1999, 168) warns that when interaction effects are included in a model, one "should not be concerned about the statistical significance (or lack thereof) of the main effects of the two variables in the product", implying that the main focus of the model including the interaction effect should be to measure the effect of the interaction effect. In that sense, we should be careful to draw strong conclusions regarding the direct effect of central bank independence. Another reason for caution is the relatively weaker results of the model without the interaction term (model 1). Had this model provided stronger and more robust results, this would give more strength to the first hypothesis. That is however not the case.

AIC/BIC

In order to test how well the respective models fit the data, i.e. the models' explanatory power, two measures will be used: the Bayes Information Criterion (BIC) and Akaike Information Criterion (AIC). Unlike R^2, low values are desirable. In other words, the model with the lowest value of AIC and BIC should be chosen.[5] Both measures have it in common that large models with low explanatory power are punished with high values, although BIC is even stricter than AIC. More than saying something about each model's explanatory power per se, the AIC and

[5] All the regression models used in this thesis have negative AIC and BIC values. This does not affect the interpretation of the values or the comparison of which. It should however be noted that absolute values are not used. The lower value indicates that the model fits the data better, meaning that a value of -20 is better than a value of -10.

BIC values may be used to compare models. A difference of more than 10 points between two models, gives strong grounds for choosing the model with the lowest AIC/BIC. In Stata, AIC and BIC values are found by use of the `estat ic` command following a regression (Acock 2014, 270; Dougherty 2011, 500; Midtbø 2012, 103–104; Treiman 2009, 133).

There are multiple advantages of using these measures instead of R^2: First, they may be used to compare any models describing the same phenomenon, even nonhierarchical models. Second, they correct for large samples, requiring a greater increase in R^2 for larger samples than for small samples. Third, whereas R^2 will increase when models get more complex, i.e. the number of independent variables is increased, AIC and BIC punishes large models (Treiman 2009, 133).

4.2 Regression model assumptions

The assumptions of a model may be seen as "specifying the conditions under which multiple regression works well" (Allison 1999, 119). When a regression works well, it is *unbiased.* This means that there must be no systematic error in the data, i.e. that the model's estimates are not systematically above or beneath the real values. In other words, the estimates should on average be in balance. In addition, the model needs to be *efficient*. This means that the variation should be as small as possible. If the real value of a variable is 100, the model would be unbiased if it estimated a value of 50 in half of the instances and 150 in the other half. It would however not be efficient (Allison 1999, 120).

The validity of a regression model is thus dependent on to which degree the assumptions of the model are fulfilled. If the assumptions are robust, the conclusions drawn from the results of the model will also be robust (Allison 1999, 119). Allison (1999, 122–123) lists five assumptions for a linear regression model: linearity, mean independence, homoscedasticity, uncorrelated disturbances and normal disturbance. These will be discussed in turn.

Linearity

It is assumed that the dependent variable is a linear function of the independent variables, plus a random disturbance. The latter may be "interpreted as the combined effects of all the causes of *y* that are not directly included in the equation" (Allison 1999, 122). Although linearity is

assumed, in reality this will only be an approximation. However, transformation of independent variables may contribute to the model coming closer to linearity (Allison 1999, 6; 123).

Outliers are extreme values which "can have an extreme effect on an analysis". Because they are extreme, the regression equation is not able to predict them properly (Acock 2014, 283). Such extreme values are a problem for the inflation variable, as the values of the IMF percent-change inflation variable ranges from -73 to 992. A solution to this problem is to transform the variable to a logarithmic form. This narrows the range of the variable, in this case from -73–992 to 0.24–6.97.[6]

Mean independence

This assumption implies that the independent variables are not related to the model's random disturbance. This means that the mean disturbance should be zero (Allison 1999, 124). According to Allison (1999, 124), mean independence is "the most critical assumption of all". This is because violations are very common, and they have serious consequences with regards to biased estimates (ibid).

Violations may be caused by three conditions: First, omitted independent variables will be part of the disturbance term. If there is correlation between one of the omitted variables and one of the included variables, this will mean that there is correlation between the independent variables and the disturbance term. Second, if the dependent variable has an effect on an independent variable, i.e. reverse causation, this effect will be part of the disturbance term, hence violating the condition of mean independence. Third, if there is measurement error in the independent variables, this error will be part of the disturbance term. The difficulty of this assumption is that it is difficult both to ascertain that it is violated and to remedy it. The methods remedying it, are often based on assumptions "as dubious as the assumption of mean independence" (Allison 1999, 124–125).

[6] Due to the variable having negative values, the logarithmic transformation was done by adding 74, i.e. `log(74 + y)`. (Wooldridge 2012, 193–194).

Homoscedasticity

An assumption of a multiple regression model is that the "disturbance term is homoscedastic" (Dougherty 2011, 160). This means that for any given value of a variable, the probability for a positive or negative deviation from the average value will be the same for all values. If this is not the case, we have a problem with *heteroscedasticity*. Multiple tests for heteroscedasticity exist, such as the Goldfeld–Quandt test and the White test (Dougherty 2011, 285–286).

Heteroscedasticity does not per se affect the estimates of coefficients, but it produces inefficiency and bias in standard errors. Of these challenges, the latter is the most important, as it involves a greater possibility of drawing wrong conclusions. If heteroscedasticity may not be resolved by modifying the variables, methods such as *weighted least squares method* or *robust standard errors* may be used (Allison 1999, 127). However, an often used method is *variance stabilizing transformation* of the dependent variable. An example of such a method would be to logarithmically transforming the dependent variable, making it less heteroscedastic (Allison 1999, 128). Although it may make interpretation of the coefficients more difficult by changing the relationship between the dependent and the independent variables, it also has the advantage of changing the interpretation of effects on the dependent variable from absolute to relative terms (Allison 1999, 128; 154).

As mentioned, there are different tests available for revealing heteroscedasticity. Here, the Breusch-Pagan / Cook-Weisberg test was used, demonstrating substantial heteroscedasticity in the models. To remedy this, Allison (1999, 128) suggests transforming the dependent variable. The logarithm of a variable is usually more homoscedastic than the variable itself (ibid). In this case, a logarithmic transformation proves to be a "simple and effective solution" (Allison 1999, 128), effectively remedying heteroscedasticity in the regression model.

Uncorrelated disturbances

In theory, all cases could have different distributions of disturbances. The assumption of uncorrelated disturbances indicates that there should not be correlation between the disturbance terms for any two cases. Panel data, which are used in this thesis, are unfortunately vulnerable to correlated disturbances, due to the fact that observations are given for multiple years. As an example, it is very likely that the value for central bank independence in the United States for 2001 is strongly correlated with the value for 2002 (Allison 1999, 124; 128–129).

The problem of correlated disturbances is smaller if the sample is random, and the population is big (Allison 1999, 129). While the latter criterion is fulfilled in the dataset used here, the former is more ambiguous. It is likely that data are more easily available for some countries than for others, as indicated by the difficulty in finding data on taxation in countries outside of OECD. The consequences of correlated disturbances are similar to the consequences of heteroscedasticity. The main difference is that with correlated disturbances, standard errors are "almost always biased downwards" (Allison 1999, 129). This means that there is a risk for reaching conclusions that are not warranted, i.e. concluding that there are correlations where there are none (ibid).

Autocorrelation occurs because of disturbance from variables not included in the model, but still affecting the dependent variable. If the values are to be independent of each other, they must be "uncorrelated with its value at the time of the previous observation" (Dougherty 2011, 429). The most common type of autocorrelation is "first-order autoregressive autocorrelation, often denoted AR(1)" (Dougherty 2011, 430). Dougherty (2011, 440) argues that there are seldom grounds for more complicated models, and that such models would primarily be necessary if observations were monthly or quarterly.

Using the Wooldridge test in Stata to test for autocorrelation (`xtserial` command), the results indicate that the dataset has a major challenge in this regard. Shively (1993, 233) suggests testing for autoregressive disturbances in these cases. Thus, to remedy the autocorrelation problem, Stata's `xtregar` command will be used for all regression models.

Normal disturbance

This assumption entails that the disturbance term should have a normal distribution, but it does not demand normal distribution of variables, whether dependent or independent (Allison 1999, 130). Allison (1999, 130) describes it as "probably the least important of the five assumptions", as it does not affect efficiency nor unbiasedness.

In this case, we do not need to worry for violations of the normality assumption due to a big sample (Allison 1999, 130; Acock 2014, 279). The central limit theorem suggests that as a sample gets larger, estimations will be accurate even without normal distribution of the disturbance term. Thus, for "moderately large" samples, "we can dispense with the normality assumption entirely" (Allison 1999, 130). Allison (1999, 130) suggests that anything over 200 cases would constitute such a "moderately large" sample. Our sample of at least 1,785 observations should thus be well within the criteria.

A challenge: Sample size

Although a large sample is generally considered an advantage, it may also lead to stronger conclusions than is warranted. Due to biases most likely being present in the data, variables will tend to appear as statistically significant even when there is no real effect. Statistically significant values are thus not sufficient to conclude that there is a substantial effect; in addition, the magnitude of the coefficients must be reviewed. If the effect of a variable is significant, but at the same time has a small coefficient, the effect may still be negligible (Allison 1999, 58–59).

4.3 Choice of regression models

Two models will be compared in order to test the effect the effect of central bank independence on inequality. One model will include the interaction effect, and one will exclude the interaction effect. This way, we may test if the effect of central bank independence is dependent on the interaction effect or not. The model without the interaction effect will be called model 1, while the model with the interaction effect will be called model 2.

In order to test the robustness of the results, the models will also be run with some modifications. First, the inclusion of the education variable reduces the number of observations from 2,445 to 1,785 – a reduction of 27 percent. To control for this, I will see how it affects the results if the education variable is not included.

Second, I will introduce trend variables in order to ascertain if the results are robust to a general trend towards increasing or decreasing inequality.

Third, two different inflation measure will be used, one of which is strongly correlated to the IMF percent-change measure used in the main models, and one of which is not.

Fourth, the central bank independence variable is lagged with one year in the main models. The results will be compared to the results of models with different lags on both the central bank independence variable and the inflation variable.

Fifth, to control for the effect of redistribution, i.e. taxes and transfers, I will compare the results with models with the net Gini, i.e. inequality after redistribution, as dependent variable.

To summarize, the following models will be compared in order to test for robustness:

1. Including and excluding the education variable.
2. Excluding and including trend variables.
3. IMF percent-change inflation measure and two different inflation measures.
4. One year lag on central bank independence variable and different lags for central bank independence and inflation variables.
5. Market Gini and net Gini as dependent variable.

4.4 Chapter summary

The assumptions of a regression model are linearity, mean independence, homoscedasticity, uncorrelated disturbances and normal disturbance. Particular challenges in the model used in this thesis are heteroscedasticity, autocorrelation, outliers and a big sample. The model used is a fixed-effects model taking into account AR(1) disturbances to correct for autocorrelation. The dependent variable (market Gini) is logarithmically transformed to remedy heteroscedasticity. The same approach is used to account for extreme values on the inflation variable. An interaction term is implemented in the model in order to take into account the moderating effect of inflation on the distributive effect of central bank independence. Furthermore, the models are exposed to five different tests of robustness, comparing the results to models excluding the education variable, including trends, with different measures of inflation, with different magnitudes of lag on the central bank independence variable, and with a net Gini measure as dependent variable.

5. Data and measurement

The final models, including and excluding the education variable, contain 1,785 and 2,445 observations in 126 and 134 countries, respectively. On average, this constitutes around 14 and 18 observations per country.

Most of the variables are gathered from the Quality of Government standard dataset. In addition to the wide thematic coverage, it covers around 200 countries over the period 1946–2015. Gathering data from a wide array of reputed sources, such as Transparency International, the World Bank, the Fraser Institute and the United Nations, the dataset collects more than 2,000 variables (Teorell et al. 2017).

Four other datasets have also been used in this thesis. First, I make use of the SWIID dataset (Solt 2016) for the dependent variable (inequality). Second, the central bank independence variable is gathered from Garriga (2016). Third, democracy is measured by use of Polity's dataset (Marshall, Gurr and Jaggers 2016). Fourth, KOF Swiss Economic Institute's globalization index is used as a measure of globalization (Dreher 2006). The four datasets were synchronized and merged with the Quality of Government dataset in order to create one dataset used in the thesis.[7]

[7] In order to synchronize country names across the datasets used, the Stata package `kountry` was used. This package simplifies the process by converting country codes or country names to one common, standardized form (Raciborski 2008). Furthermore, the `encode` command was used to give each country a generic number. This makes it possible to define the `xtset` variables as `ccode` and `year`, i.e. defining country-years as uniquely identifying observations (Acock 2014, 253).

5.1 Dependent variable: inequality

The most frequently used measure of inequality is the Gini coefficient, measuring inequality on a scale from 0 (perfect equality) to 1 (perfect inequality) (Alvaredo 2011; Piketty 2014, 266).

Thomas Piketty (2014, 266–267) argues that the most useful measures of inequality are the highest and lowest income percentiles' share of income. This is partly because this measure makes it possible to compare the effects on the top 10, top 1 and top 0.1 percent. Indices such as the Gini coefficient to a smaller degree take into account the difficulty in comparing data across countries and periods (Piketty 2014, 266–267). Atkinson (2007, 19) makes a similar argument, claiming that the Gini coefficient gives changes in inequality towards the middle higher weight than changes towards either end. This means that an increase in the share of the top richest would cause a smaller change in the total Gini (Atkinson 2007, 20).

The primary disadvantage of income shares is however that data are available mostly for countries with income tax records, i.e. developed countries. Comparability across time and countries may be difficult, due to changing and differing definitions of what constitutes taxable income, as well as the effectiveness of tax enforcement (Galbraith 2016, 56).

In this paper, the Gini coefficient will be used as the measure for inequality. This decision is in large part based on availability of data. The Standardized World Income Inequality Database (SWIID) contains data on 174 countries back to 1960, maximizing comparability across years and countries (Solt 2016, 1267).

The method used in SWIID poses a few problems, especially with regards to comparability and data quality. The more data available, the less certain it is that these data are comparable. The SWIID data include more than 2,800 country-years in 174 countries, but as Solt (2016, 1268) admits, "these Ginis are calculated on the basis of 11 different combinations of welfare definition and income scale". Insisting on maximized comparability would decrease the available data with 60 percent (Solt 2016, 1269).

Both due to its use of imputation in order to deal with missing observations, and due to its use of multiple secondary sources, "some scholars remain skeptical" of SWIID (Galbraith 2016, 56). However, it has still "achieved wide acceptance" and been used in studies by the

International Monetary Fund (ibid). Despite of the shortcomings of the SWIID dataset, it seems to be the best dataset available for the purposes of this paper. As Solt (2016, 1280) argues, SWIID is "ideal for broadly cross-national work". At the same time, it is important to be aware of the fact that SWIID "represents a particular choice in the balance between comparability and coverage: it maximizes comparability for broadest possible coverage of countries and years" (Solt 2016, 1280).

Stephen Jenkins (2015) compares the WIID and SWIID datasets, and concludes that the WIID is better suited from a "data issues perspective". An important reason not to choose the WIID dataset, however, is that it demands a series of choices with regards to sources. As each country-year may have more than one value gathered from different sources, the use of this dataset would be especially time-consuming, while at the same time possibly compromising the integrity of the dataset.

The SWIID dataset is based on the Luxembourg Income Studies, imputing missing observations 100 times (Solt 2014, 8). This poses a challenge in using the dataset, as the `mi estimate` command in STATA must be used (Solt 2014, 21), in effect complicating the testing of model assumptions such as homoscedasticity. In order to more easily work with the dependent variable in Stata, a new variable was generated by computing the mean values of each unit (country-year). Furthermore, as mentioned in the method chapter, the variable has been logarithmically transformed due to a heteroscedasticity problem in the model.

The dataset contains both market and net income data, i.e. both before and after redistribution. The net income data contain data after transfers and taxes, and are gathered by Solt (2016) from the Luxembourg Income Study (LIS) Key Figures. The market income data are gathered the microdata of LIS (Solt 2016, 6–7). In order to control for the effect of redistribution, I will use both variables in the analysis, comparing the results of a model with the net Gini as dependent variable with a model with the market Gini as dependent variable. This will be discussed in more detail in chapter 5.3.2 Taxes/redistribution.

To illustrate the diverging patterns of net and market inequality, follows graphs 5.1 and 5.2. They show the development in net and market Gini, respectively. It seems clear that inequality increased in the period between the early 1980s and the late 1990s, whether measured in market terms, i.e. income before taxes and redistribution, or in net terms, i.e. income after taxes and

redistribution (Solt 2016, 6–7). This is consistent with the consensus in the literature review, claiming that inequality increased between 1980 and 2000. In the following period, the development is more unclear. Although both graphs display a decrease in inequality after 2000, the decrease in net inequality is clearly steeper, going from 39 to 35, as opposed to the minimal change in market inequality, where both the start and end point is around 47.

Figure 5.1. Development in inequality (net Gini) 1980–2012.

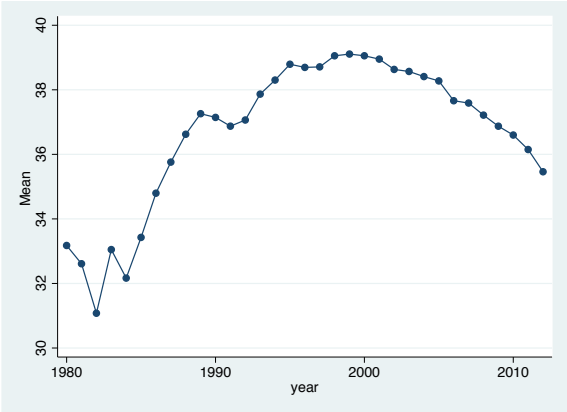
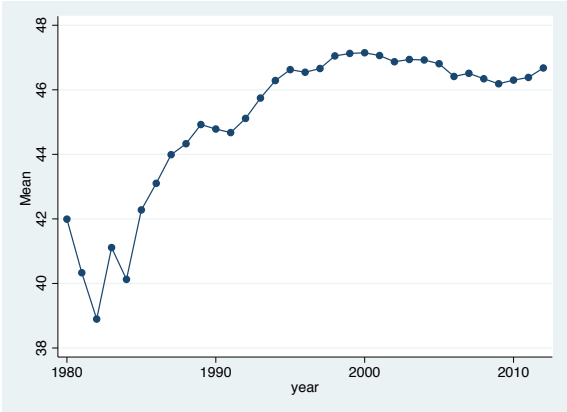


Figure 5.2. Development in inequality (market Gini) 1980–2012.



Source: Garriga (2016). Generated by use of the Stata package `lgraph`.

5.2 Independent variable: central bank independence

Garriga (2016a) has compiled a dataset containing data on 182 countries in the period between 1970 and 2012. This constitutes "the most comprehensive data set on *de jure* central bank independence (CBI) available to date" (Garriga 2016a, 849). A de jure approach, i.e. focusing on how the laws set boundaries for central bank independence, has its limits, but as Garriga (2016a, 852) argues, it makes it possible to perform quantitative analyses, and it is "useful to assess governments' institutional choices".

The dataset contains a number of variables, including variables for central bank reforms and directions. The variable used in this paper is the weighted CBI index ranging from 0 to 1, consisting of four components: central bank CEO (20 percent), central bank objectives (15 percent), policy formulation (15 percent) and central bank lending (50 percent) (Garriga 2016b, 8–11).

The first component – central bank CEO, representing 20 percent – consists of four variables, weighted equally. All four variables are measured from 0 to 1, i.e. from low to high independence. The first variable is a measure of the term of office of the CEO, where less than four years is given a score of 0, while eight or more years is given a score of 1. Second, there is the question of who appoints the CEO, whether it is one or two members of the executive branch (0) or the board of the central bank (1). The third variable measures the provisions for dismissing the CEO, from the executive branch deciding (0) to no provisions (1). The fourth variable measures the degree to which the CEO may hold another government office, from no regulations (0) to prohibition (1) (Garriga 2016b, 8).

The second component is central bank objectives, representing 15 percent. If price stability is the only or major goal, and the central bank has final authority in case of conflicts with the government, the value 1 is given. If price stability is not mentioned in the central bank's charter, the value 0 is given (Garriga 2016b, 9).

Component 3 is policy formulation, consisting of three variables. First, there is the question of who formulates monetary policy, the government (0) or the central bank (1). This represents 25 percent of the index. The second variable and most important variable, representing half the index, is regarding the relationship between government and central bank, and how conflicts between them are solved. If the central bank has final authority, the score 1 is given; if the executive branch decides, the score is 0. The third and last variable is a dummy variable measuring if the central bank is able to take part in formulating government budgets. 1 represents yes, and 0 represents no (Garriga 2016b, 9–10).

The fourth and most important component, representing half of the index of central bank independence, is the role of central bank lending. The first and most important variable in this regard is limitations on advances, from no legal limitations (0) to prohibition of government advances (1). This variable stands for 30 percent of this component. The second variable, representing 20 percent, is limitations on securitized lending, with the same operationalization as the former. The third variable, also with a weight of 20 percent, measures the control of terms of government lending, ranging from the executive branch deciding solely (0) to the central bank deciding (1). The fourth variable is a measure of who benefits from central bank lending, and represents 10 percent of the index. If the central bank lends to both government and public

enterprise, the score 0 is given; if only central government benefits from lending, the score is 1. Further, four variables have a weight of five percent. These are the type of limits, ranging from a percentage of government expenditure (0) to an absolute cash amount (1); maturity of loans, from no upper limit (0) to a limit of six months (1); restrictions on interest rates, from no restrictions (0) to a demand for market rates (1); and last, a dummy variable regarding prohibition on central bank lending in primary market to government, with 1 representing prohibition and 0 representing no prohibition (Garriga 2016b, 10–11).

When analyzing the effect of central bank independence on inequality, it makes sense that this effect may be delayed. In other words, if central bank independence has an effect on inequality, we would not expect central bank reforms to show this effect immediately. In order to account for this delay, the central bank independence variable will be lagged with one year. Whether the lag should be set at one, two, five or ten years is difficult to know for certain. The robustness of the results will be tested by running multiple regression models with varying lags on both the central bank independence variable and the inflation variable (Dougherty 2011, 398).

As most of the research on central bank independence relating to inequality has been indirect, i.e. focused on the distributive effects of inflation, an interaction effect between the two will also be included in some models. An interaction effect is present when "the effect of an independent variable (X) on a dependent variable (Y) varies across levels of a moderating variable (Z)" (Andersson, Cuervo-Cazurra and Nielsen 2014, 1064). In this case, the purpose is to ascertain whether the effect of central bank independence on inequality varies with different levels of inflation.

5.3 Control variables

5.3.1 Inflation

There are a number of ways to measure inflation. This is manifested in the inflation variables in the Quality of Government dataset. Three variables have sufficient coverage with regards to country-years: The International Monetary Fund (IMF) offers two variables, while the World Bank's World Development Indicators (WDI) offers one. Both IMF and WDI have one variable measured in percent change in consumer prices. These are heavily correlated (99.18 percent). The last variable is a consumer price index, comparing the prices at any given point to a price reference period (value 100.0).

A price index is very well suited for comparing across countries at one point in time (Teorell et al. 2017, 410; 646). However, the variable seems to have some weaknesses as to comparing across time. For instance, looking at the index scores for Vietnam, the 1980 value is 0.004, while the 2012 value is 216.396, indicating that the price level has increased 54,099-fold. Even after logarithmically transforming the variable, the 2012 level is still 1,348 times the 1980 value. The percent change inflation variables, on the other hand, feature yearly changes, making them more suitable for the purposes of this analysis. Also, the correlation between the WDI and IMF percent change variables and the index variable is -12.77 and -12.83 percent, respectively.

Based on the arguments above, I will use a percent change indicator for inflation. The high correlation between the WDI and the IMF variable indicates that they will likely give similar results. Due to a higher number of observations in the IMF variable (1,785 compared to 1,659), I will use this in the main model, but I will also run separate regressions with the two other inflation variables in order to test the robustness of the results.

5.3.2 Taxes/redistribution

Data regarding taxes, even as a proxy through public spending, are unfortunately scarce and heavily focused on OECD countries, resulting in a substantially lower number of observations (Martinez-Vazquez et al. 2012, 21; Teorell et al. 2017). The effect of capital tax, which Piketty (2014, 471) claims would have a positive effect on equality, is thus difficult to include as a variable.

However, the SWIID dataset offers as an indirect measure of the effect of taxes through its variables on net Gini as well as market Gini coefficients. The net variable contains Gini coefficients after taxes and transfers, while the market variable contains the coefficients before taxes and transfers. The dataset also features variables measuring the difference between the net and market variable, both in absolute and relative terms (Solt 2014, 6–7). These would be possible to use as proxies for redistribution.

Unfortunately, the use of these variables reduces the number of observations in the model including the education variable from 1,785 to 1,208 – a reduction of a massive 32 percent. In order to avoid this, I will instead make the use of two different models to control for the effect of redistribution, the only difference between them being whether the dependent variable is the net Gini or the market Gini variable.

Although this means that we will not find the effect of redistribution on inequality directly, we will be able to ascertain whether the effect of central bank independence on inequality is robust. If the hypothesis holds in both models, this would imply that central bank independence's effect on inequality is not dependent on the effect of redistribution. On the other hand, if the results differ in the two models, this indicates that redistributive taxation has a significant effect on net inequality.

5.3.3 Globalization

The globalization index compiled by KOF Swiss Economic Institute (Dreher 2006) has been used in more than 100 previous studies, and has become the most used index measuring globalization (Potrafke 2014, 1–2). The index measures three dimensions of globalization – economic, social and political – for 207 countries in the period 1970–2013 (KOF 2017a). It measures globalization on a scale from 1 to 100 (minimum to maximum degree of globalization) (Potrafke 2014, 4).

The economic dimension of globalization is further separated into actual economic flows, measured with data on trade, foreign direct investments (FDI) as well as portfolio investments; and proxies for restrictions on trade and capital, measured through such variables as tariff rates, capital control and international trade taxes (KOF 2017b).

Social globalization is divided into the variables personal contacts, information flows and cultural proximity. The first variable measures the degree to which people living in different countries interact with each other, through measures such as international telecom traffic and letters, bank transfers and tourism. The second measures "the potential flow of ideas and images", e.g. through number of internet users, televisions and international newspapers. The third, cultural proximity, intends to measure to which degree a country's culture is influenced by international trends. Most likely, this influence will be from American culture. This is measured through traded books as well as the spread of McDonald's and IKEA (KOF 2017b).

The political dimension is measured by use of the number of embassies and high commissions, membership in international organizations, participation in UN peace missions and signing of treaties (KOF 2017b).

This variable, both the index and its economic component, is also strongly correlated with economic freedom, making the latter variable redundant.[8]

5.3.4 Democracy

The variable `polity2` in the Polity Index will be used as a measure for democracy. This variable is produced by calculating the difference between the democracy variable and the autocracy variable in the Polity dataset, measuring countries on a scale from -10 (strongly autocratic) to +10 (strongly democratic) (Marshall, Gurr and Jaggers 2016, 16). In addition, some values have been re-coded in order to make the data more suitable for time-series analyses (Marshall, Gurr and Jaggers 2016, 17).

Both the democracy and the autocracy variable are constructed as indices consisting of similar weighted categories. The most important distinctions of a democracy are constraints on the chief executive and competitiveness of political participation, accounting for up to seven points out of a maximum ten. The last three points are related to the degree of openness and competitiveness in executive recruitment (Marshall, Gurr and Jaggers 2016, 14–16).

[8] Using the Fraser Institute's index of economic freedom, available in the QoG dataset (Teorell et al. 2017), the correlation between this variable and the globalization variable is 75 percent. Correlation above 50 percent is considered "a strong relationship" (Acock 2014, 200–201).

Although the Polity index is considered one of the leading in its field, it has also been subject to much criticism. (Coppedge and Gerring, with Altman et al. 2011, 247–248). A fundamental flaw according to some, is the choice of employing an index in the first place, as opposed to a binary, dichotomous variable. Alvarez et al. (1996, 4) argue that the latter would be a better choice, inasmuch as democracy should be defined narrowly. Also, what Robert Dahl (1971) calls "contestation", is considered the paramount distinction of democracy, for which a dichotomous variable would be sufficient.

A different objection to indices might be that they might include unnecessary indicators or exclude important such. Coppedge and Gerring, with Altman et al. (2011, 248) discusses Polity's decision to consider the United States as "fully democratic" for long periods where certain groups, such as women or blacks, were excluded from participation.

Also, the nature of an index is such that it may put very different countries in the same category. For instance, Afghanistan and Uganda both have a score of –1 on the `polity2` variable, even though Afghanistan has high openness of executive recruitment (4) and low competitiveness of political participation (0), while Uganda has the opposite (0 and 3, respectively). In this sense, indices do not take into account that democracies may be "democratic in different ways" (Coppedge and Gerring, with Altman et al. 2011, 249).

However, the `polity2` variable is, together with Freedom House's similar measure, "by far the most commonly used, having been cited hundreds of times according to the Web of Science and thousands of times according to Google Scholar" (Coppedge and Gerring, with Altman et al. 2011, 248). This makes it ideal for comparison with previous research. Also, the coverage of the variable is very good, covering the years from 1800 to 2015 (Marshall, Gurr and Jaggers 2016).

5.3.5 Cultural and ethnical diversity

The Quality of Government dataset contains two variables with sufficient data regarding a country's diversity. Both variables are gathered from James Fearon's extensive dataset (Teorell et al. 2017, 277–278). Fearon (2003, 195) finds that the 160 countries have 822 ethnic and "ethnoreligious" groups representing more than one percent of each country's population. He goes on to create a variable measuring ethnic fractionalization by calculating the probability for two random people in a given country to be from different ethnic groups. (Fearon 2003, 208).

However, Fearon (2003, 211) argues, this measure may have its limits. Although two countries may have the same score for ethnic fractionalization, they may still differ substantially when it comes to the homogeneity of their respective ethnic groups. In order to take this into account, Fearon (2003, 211–212) creates a variable measuring the "cultural distances between groups". As a proxy for cultural diversity, he uses the difference between the languages each group uses as a first language. This difference is measured by counting the number of shared levels of the "tree branches" used to classify languages. For instance, Norwegian and Swedish would share three branches – Indo-European, Germanic, North Germanic – indicating that they have similar cultures. On the other hand, Norwegian and Swedish would not share any branches with Arabic, as the latter belongs to the Afro-Asiatic branch.

The two variables are then combined by withdrawing cultural homogeneity from ethnic fractionalization (Fearon 2003, 212). This means that if the languages in question are not overlapping in any of the tree branches, and thus are very different, the score for cultural fractionalization would be the same as for ethnic fractionalization. Should the languages have clear similarities, however, the score for cultural fractionalization would be lower (ibid).

It could be argued that ethnic groups are difficult to define, but as Fearon (2003, 214) demonstrates, the correlation between different variables with different definitions is quite high, ranging from 0.75 to 0.88. Although the two variables correlate relatively strongly (Fearon 2003, 213), I will use the variable measuring cultural fractionalization in the regression model.

5.3.6 Economic growth

Economic growth is commonly operationalized as growth in Gross Domestic Product (GDP). The GDP measure does have its disadvantages. For instance, it does not take into account production in private homes and black markets, international income flows or environmental externalities. Also, GDP increases when "crime, pollution, catastrophes, or health hazards trigger defensive or repair expenditures", indicating that these are conducive to increasing economic growth (Fleurbaey 2009, 1029). But as Bastiat (2007, 4) would contend, "[t]o break, to spoil, to waste, is not to encourage national labor; or more briefly, 'destruction is not profit.'"

On the other hand, data on GDP are relatively easily accessible for most countries. Due to the extensive use of this measure, it also enables comparisons with previous research using similar measures (Dollar and Kraay 2002, 199). Lastly, there are not really any good alternatives.

There are multiple sources when it comes to GDP variables, with similar data. The choice of variables in this case is unlikely to have effect on the outcome. In this thesis, I will use data from the Quality of Government dataset, which they in turn have gathered from the UN Statistics and their National Accounts Main Aggregates Database. To better be able to compare across countries, the per Capita measure will be used. The variable `unna_gdppc` contains data on GDP per Capita in current US dollar prices (Teorell et al. 2017, 577; 579).

5.3.7 Population

Three variables measuring different aspects of the population will be included: population density, the share of rural population, and the share of population aged 65 or more. All three variables are gathered from the Quality of Government dataset, and are originally part of the World Development Index (Teorell et al. 2017).

Population density is calculated by dividing each country's population with the country's land area. The population numbers include residents without citizenship or legal status, but exclude refugees not permanently settled. A country's land area, measured in square kilometres, excludes "inland water bodies", thereby excluding rivers and lakes (Teorell et al. 2017, 666).

The rural population variable measures the share of the total population living in rural areas. The difference between the total population and the urban population is divided with the total population in order to calculate the rural share. Rural areas are defined by national statistical offices (Teorell et al. 2017, 667).

The share of population above 65 of age is measures as a percentage of the total population. The total population is defined in the same way as in the calculation of population density. (Teorell et al. 2017, 666).

5.3.8 Higher education

Higher education is measured through gross enrolment ratio in tertiary education, i.e. ISCED 5 to 8, in the five years after leaving secondary school. This variable was gathered from the World Development Index (Teorell et al. 2017, 637). ISCED, the International Standard Classification of Education, 2011 levels are defined as follows:

Level 5: Short-cycle tertiary education
Level 6: Bachelor's or equivalent level
Level 7: Master's or equivalent level
Level 8: Doctoral or equivalent level
(UNESCO Institute for Statistics 2012, 46).

Unfortunately, the education variable reduces the number of observations in the model by more than a quarter, from 2,445 to 1,785. As a consequence, I will compare the results of two different models: one with the education variable included, and one without.

5.3.9 Trend

Many "economic time series have a common tendency of growing over time" (Wooldridge 2012, 363). Thus, two variables which may seemingly have an effect on a third, dependent variable, while in reality both variables follow the same time trend due to variables outside of the model (ibid). This is an example of a "spurious regression problem" (Wooldridge 2012, 366).

In order to account for this, a trend variable will be produced in order to test the direction of change with regards to inequality worldwide.[9] This will make sure that the results are not spurious (Wooldridge 2012, 366).

Furthermore, the variable `trend2` is generated by quadrating the trend variable, i.e. multiplying the trend variable with itself. These two variables may be seen in connection, where `trend` will represent the general development in inequality, while `trend2` will show the development of the development, i.e. whether the growth or reduction is intensifying or slowing down (Midtbø 2012, 131–132).

5.4 Chapter summary

Variables from the datasets Quality of Government, KOF Globalization Index, Polity, SWIID and Garriga's central bank independence index are used in the thesis (Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017). The main model features a logarithmically transformed market Gini measure as the dependent variable, gathered from the SWIID dataset. The focus variable uses a weighted index of central bank independence (Garriga 2016), and the moderator variable operationalizes inflation as a percent-change measure. The latter variable is also logarithmically transformed due to extreme values. In addition to control variables, trend variables are generated to account for trends in the development of inequality.

[9] The variable is generated by use of the `egen trend = group(year)` command, generating a number from 1 and up for the years from 1980 and up.

6. Results and analysis

As described in the method chapter (4.4), the results of two models will be compared: One excluding the interaction effect, and one including the interaction term. The former will be called model 1, while the latter will be called model 2. Both models will be exposed to five different tests of robustness, that is the exclusion of the education variable, the inclusion of trend variables, replacement of the inflation variable with different measures of inflation, different magnitudes of lag on the central bank independence variable, and replacement of the dependent variable with a net Gini measure.

As they are essential to the interpretation of the coefficients and the effects of the variables, I will list the ranges as well as the average values of the variables in focus. Since two of the variables are logarithmically transformed, I will also list the original variables in these cases. All numbers are rounded to two decimals.

Table 6.1. Ranges and average values of variables in focus.

Variable	Minimum	Maximum	Difference	Average
Inequality (log)	3.15	4.34	1.19	3.81
Inequality (original)	23.26	76.89	53.63	45.98
Central bank independence	0.10	0.98	0.88	0.53
Inflation (log)	0.24	6.97	6.73	4.45
Inflation (original)	-72.73	992.39	1,065.12	16.51

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

In model 1, the coefficient of the main effect (central bank independence) may be interpreted as the effect on inequality when central bank independence increases with one unit. In other words, the coefficient indicates the effect on inequality when central bank independence goes from absolute dependence to absolute independence.

An alternative approach would be to look at the effect of smaller increments in central bank independence. For instance, we may look at the effect of an increase of 0.1. For both the main effect and the interaction effect, this will merely mean that the coefficients are divided with ten, i.e. the effects are ten times smaller at one tenth of the increase.

The effects of the interaction term in model 2 must be interpreted in a particular way, which also deserves repetition. The coefficient of the main effect may be interpreted as the effect on inequality of central bank independence *when the inflation variable is zero.* This is not a realistic scenario, since the lowest value on the inflation variable is 0.24, corresponding to an actual percent-change inflation level of -73. To calculate the net effect on inequality when central bank independence increases with one unit, the coefficient of the interaction term must be multiplied with a given value of the inflation variable, and then withdrawn from the coefficient of the main effect. What remains, will be the net effect (Allison 1999, 168–169).

All results will be presented with the coefficients of each variable, and the standard errors in parenthesis. Three stars indicate that the results are significant at one percent, two stars indicate significance at five percent, and one star at ten percent.

6.1 Presentation of results

Table 6.2. Effect of central bank independence on inequality.

Variable	Model 1	Model 2
CBI (1 year lag)	.048 (.016) ***	1.778 (.135) ***
Globalization	.008 (.001) ***	.006 (.001) ***
Polity	-.000 (.001)	-.000 (.001)
GDP	.000 (.000)	.000 (.000)
Inflation (log)	.052 (.008) ***	.212 (.014) ***
Population above 65	.105 (.006) ***	.082 (.006) ***
Population density	-.000 (.000)	-.000 (.000)
Rural population	.045 (.001) ***	.036 (.001) ***
Education	.000 (.000)	-.000 (.000)
Interaction (CBI/inflation)		-.391 (.030) ***
Constant	.311 (.006)	.245 (.006)
Observations	1,785	1,785
Countries	126	126
AIC	-6,214	-6,385
BIC	-6,160	-6,325

*) significant at 10 percent, **) significant at 5 percent, ***) significant at 1 percent (two-tailed test)

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

As shown, both models indicate that the central bank independence variable is positive and strongly significant. In the model including the interaction term (model 2), there is also a strongly significant negative interaction effect. The AIC and BIC values clearly indicate that model 2 fits the data better.

The coefficient of central bank independence in model 2 indicate an effect of 1.778 of central bank independence on inequality, implying that one unit's increase in central bank independence would result in an increase of 1.778 in inequality. This is a very substantial effect, inasmuch as the inequality variable has a range of 1.19 (from 3.15 to 4.34). This means that, theoretically, if the inflation variable has a value of zero, the effect of central bank independence on inequality will be greater than the difference between the world's most unequal and the world's most equal country.

Of course, this is not a realistic scenario, since this would only apply in a case with perfect central bank independence and very high levels of deflation. Most of the values of the inflation variable lie between 4.1 and 5, covering the range from -13 to 74 in the original percent-change inflation variable. Assuming a low level of 4.1 on the inflation variable, this would mean that the net effect (main effect minus interaction effect) would be 0.1749.[10] This corresponds to an increase in the Gini coefficient of between 4.5 points and 12, depending on whether the country in question has a very low or very high level of inequality in advance. On both ends of the scale, the increase is in the magnitude of around 19 percent. As an illustration, about five points, or around ten percent, separate the market Gini scores of Norway and the United States. In light of that, a change of 19 percent must be considered quite substantial.

Looking at smaller changes in central bank independence, an increase of one tenth in central bank independence will yield an increase in inequality of around 1.5–2 percent given an inflation rate of -13. As we remember from chapter 2.2, the increase in average central bank independence in the world has increased with around 0.35 in the period 1980–2012, which would indicate an increase in inequality of between 5 and 7 percent.

If we assume a more realistic inflation rate of two percent, this corresponds to 4.33 on the logarithmically transformed inflation variable. The net effect would then be 0.085.[11] This

[10] 1.778 - 4.1 x 0.391
[11] 1.778 - 4.33 x 0.391

corresponds to an increase of 2–6 Gini points, or 9 percent. Again using the example of an 0.35 increase in central bank independence, would in this case mean an increase of around 3 percent in inequality.

The coefficient of the main effect is 4.55 times greater than the interaction effect. This means that if central bank independence is very high, i.e. at a value of 1, the effect of central bank independence on inequality changes from positive to negative a level of around 4.55 on the inflation variable. Keeping in mind that the inflation variable has been logarithmically transformed, a level of 4.5 indicates high levels of inflation. As mentioned, the logarithmically transformed inflation variable ranges from 0.24 to 6.97, compared to a range from -73 to 992 in the original variable, i.e. actual percent-change inflation levels. Using the threshold of the main model, 4.55 on the logarithmically transformed inflation variable corresponds to an inflation level of above 20 percent. Both numbers must be considered quite high. One scholar sets the threshold for high inflation at "above 10%–15%" (Gagnon 2009, 1223). Another paper describes anything over three percent inflation per quarter as high (Mahdavi and Zhou 1994, 410–411). This would correlate to a yearly inflation rate of 12.55 percent.[12]

In any case, we must conclude that in a "normal" situation, where inflation is expected to be somewhat above zero, high central bank independence affects inequality positively, i.e. creates more inequality. The effect becomes weaker when inflation increases, to the point where it turns from positive to negative at an inflation rate at around 20 percent. To be able to see the patterns more clearly, table 6.3 lists the effect of central bank independence at different levels of inflation.

[12] $3^4 = 12.55$

Table 6.3. Effect of one unit's increase in central bank independence on inequality at different levels of inflation.

Inflation (log)	Inflation (%)	Effect of CBI (log)	Effect of CBI (Gini)	Effect of CBI (%)
4.10	-13.2	.1749	4.5–12.0	19
4.20	-7.0	.1358	3.5–10.0	15
4.30	-3.0	.0967	2.5–7.0	10
4.33	2.0	.0850	2.0–6.0	9
4.40	7.5	.0576	1.5–4.5	6
4.50	16.0	.0185	0.5–1.5	2
4.60	25.5	-.0206	-0.5–1.5	-2
4.70	36.0	-.0597	-1.5–4.5	-6

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

The effect in the model excluding the interaction term (model 1) is more moderate, with a coefficient of 0.048. This is in effect more or less negligible. Even at very high levels of inequality, an increase of 0.048 would correspond to an increase of 3.5 points, or around five percent. Even if central bank independence increased with 0.35, as mentioned above, the effect of this increase on inequality would be one point, i.e. less than two percent.

The results of the main regression models thus indicate that there is a positive effect of central bank independence on inequality at levels of inflation below 20 percent. At inflation levels of 0–2 percent, the effect of one unit's increase is around 10 percent. This means that if a central bank moves from perfect dependence to perfect independence, this will lead to an increase in inequality of 10 percent. If central bank independence increases by 0.35, as the world average in recent decades, the effect will be around 3.5 percent.

6.2 Robustness of results

Education variable excluded

The inclusion of the education variable reduces the number of observations from 2,445 to 1,785 – a reduction of 27 percent. This means that if the results differ between the models including this variable and the models excluding it, this discrepancy may in part be caused by the different samples. To test if this is the case, we may compare the results of the models with and without the education variable.

Table 6.4. Effect of central bank independence on inequality, education variable excluded.

Variable	Model 1	Model 2
CBI (1 year lag)	.016 (.012)	.547 (.103) ***
Globalization	.003 (.000) ***	.003 (.000) ***
Polity	-.000 (.000)	-.000 (.000)
GDP	.000 (.000)	.000 (.000)
Inflation (log)	.001 (.004)	.054 (.011) ***
Population above 65	.056 (.005) ***	.051 (.005) ***
Population density	-.000 (.000)	-.000 (.000)
Rural population	.034 (.001) ***	.032 (.002) ***
Interaction (CBI/inflation)		-.118 (.023) ***
Constant	1.775 (.008)	1.655 (.008)
Observations	2,445	2,445
Countries	134	134
AIC	-9,680	-9,706
BIC	-9,628	-9,648

*) significant at 10 percent, **) significant at 5 percent, ***) significant at 1 percent (two-tailed test)

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

When excluding the education variable, the central bank independence variable loses significance in model 1. A P value of 0.162 indicates that the results are significant at 16.2 percent, which is far from satisfactory. In model 2, the results are still significant, but the coefficients indicate that the effects are smaller than in the main model, with coefficients of 0.547 and -0.118, respectively, for the central bank independence variable and the interaction term. On the other hand, the ratio between the two coefficients is 4.64, which means that the turning point is above 29 percent inflation.

Again assuming a realistic inflation rate of two percent, the increase in the dependent variable would amount to 0.036. This corresponds to 1–3 points on the original Gini coefficient variable

An AIC of -9,680 in model 1 and -9,706 in model 2, compared to -6,214 and 6,385 in the main models, indicates that the models without the education variable explain the development in inequality much better than the models including this variable. As we remember from the method chapter (4.1), a difference of ten points is considered strong grounds for choosing one model instead of another. Here, the difference is 3,466 and 3,321, respectively.

To summarize, the results of model 1 are not robust to removal of the education variable, as the central bank independence variable loses significance. In model 2, both the effect of central bank independence and the interaction effect are robust, remaining significant and even increasing the turning point for inflation. However, the size of the coefficients is strongly reduced, meaning that the effect on inequality when going from no independence to perfect independence falls from nine percent to four percent.

The massive decrease in AIC and BIC indicates that the models without the education variable explains the development in inequality better than the models with this variable. Based on this, the following models will not include the education variable.

Trend variables

Two sets of regression models will be run: one set with one trend variable, and one set with two trend variables.

Model 1: Without interaction effect, with one trend variable.
Model 2: With interaction effect, with one trend variable.
Model 3: Without interaction effect, with two trend variables.
Model 4: With interaction effect, with two trend variables.

Table 6.5 Effect of central bank independence on inequality, with trend variables.

Variable	Model 1	Model 2	Model 3	Model 4
CBI (1 year lag)	.015 (.012)	.529 (.103) ***	.001 (.011)	.410 (.100) ***
Globalization	.003 (.000) ***	.003 (.000) ***	.001 (.000) ***	.001 (.000) ***
Polity	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
GDP	-.000 (.000)	-.000 (.000)	-.000 (.000)	.000 (.000)
Inflation (log)	.001 (.004)	.052 (.011) ***	.002 (.003)	.043 (.010) ***
Population above 65	.046 (.000) ***	.044 (.006) ***	.036 (.006) ***	.035 (.006) ***
Population density	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
Rural population	.036 (.002) ***	.034 (.002) ***	.025 (.002) ***	.024 (.002) ***
Interaction (CBI/infl.)		-.115 (.023)		-.091 (.022) ***
Trend	.004 (.002)	.004 (.002) ***	.100 (.007) ***	.097 (.007) ***
Trend2			-.002 (.000) ***	-.002 (.000) ***
Constant	1.672 (.009)	1.570 (.009)	.864 (.010)	.806 (.010)
Observations	2,445	2,445	2,445	2,445
Countries	134	134	134	134
AIC	-9,685	-9,709	-9,876	-9,892
BIC	-9,627	-9,646	-9,813	-9,822

*) significant at 10 percent, **) significant at 5 percent, ***) significant at 1 percent (two-tailed test)

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

The trend variables are strongly significant in all models, showing a positive effect of the trend variable, and a negative effect of the trend2 variable. This indicates that inequality is increasing, but the pace of the increase is slowing down. However, the size of the coefficients in models 3 and 4 show clearly that the trend towards increasing inequality is much stronger than the trend towards a slower increase. In fact, the coefficients of the trend variable are about 50 times the size of the coefficients of the trend2 variable in both models.

In both models 1 and 3, i.e. the models without the interaction effect, the effect of central bank independence is still insignificant when introducing the trend variables. Models 2 and 4, including the interaction effect, produce much better results. The effects of both central bank independence and the interaction term are significant at one percent, and in model 2 the coefficients are similar to the main model. Although the coefficients are somewhat smaller when both trend variables are introduced in model 4, they are still substantial, at 0.410 and -0.091. Both effects are thus robust to trends in the models including the interaction effect.

When it comes to the ratios of the coefficients, they decrease a bit, from 4.64 to 4.60 and 4.51. Yet, the turning points in the two models are still at 25.5 and 16.9, respectively.

There are two general trends with regards to the results in the four models: First, the models without the interaction term (models 1 and 3) show weaker results than the models including the interaction term (models 2 and 4). Second, the models with two trend variables (models 3 and 4) show weaker results than the models with one trend variable (models 1 and 2).

Other inflation variables

As there are different ways to operationalize and measure inflation, two sets of models will be compared to the main model. The first set of models will exchange the inflation variable with a variable operationalizing inflation as an index. This variable has a very low correlation with the inflation measure used in the main model, which could mean that the effect of this variable is very different from the effect of the percent-change inflation measure in the main model. On the other hand, similar results would be a strong argument for the robustness of the results. The results of this set of models may be found in table 6.4.

In addition, the results of a different set of models will be presented in table 6.5. In these models, the main model's inflation variable is exchanged with WDI's percent-change inflation variable. As these two variables correlate strongly, we would expect the results to be quite similar.

Both sets of models are presented with and without trend variables, to be able to compare the robustness of these results to trends with the results of the main models.

Table 6.6. Effect of central bank independence on inequality, with inflation index, with and without trend variables.

Variable	Model 1	Model 2	Model 1 w/trend	Model 2 w/trend
CBI (1 year lag)	.013 (.011)	.201 (.054) ***	.003 (.011)	.177 (.054) ***
Globalization	.002 (.000) ***	.002 (.000) ***	.001 (.000) ***	.001 (.000) ***
Polity	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
GDP	.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)
Inflation (log)	.015 (.005) ***	.032 (.007) ***	.011 (.005) **	.027 (.007) ***
Population above 65	.044 (.005) ***	.045 (.005) ***	.032 (.000) ***	.032 (.006) ***
Population density	.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)
Rural population	.031 (.001) ***	.030 (.001) ***	.025 (.002) ***	.025 (.002) ***
Interaction (CBI/infl.)		-.045 (.013) ***		-.041 (.012) ***
Trend			.074 (.007) ***	.072 (.007) ***
Trend2			-.001 (.000) ***	-.001 (.000) ***
Constant		1.958 (.008)	1.249 (.011)	1.230 (.011)
Observations	2,402	2,402	2,402	2,402
Countries	132	132	132	132
AIC	-9,720	-9,722	-9,802	-9,805
BIC	-9,668	-9,664	-9,738	-9,736

*) significant at 10 percent, **) significant at 5 percent, ***) significant at 1 percent (two-tailed test)

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

Considering the considerable lack of correlation between the inflation index variables and the percent-change variables (-12.77 and -12.83), the results are surprisingly similar. The coefficients are however smaller compared to the models with the percent-change inflation measure, indicating a smaller effect on inequality.

Table 6.7. Effect of central bank independence on inequality, with WDI percent-change inflation measure, with and without trend variables.

Variable	Model 1	Model 2	Model 1 w/trend	Model 2 w/trend
CBI (lagged)	.015 (.011)	.080 (.042) *	.005 (.011)	.065 (.042)
Globalization	.002 (.000) ***	.003 (.000) ***	.001 (.000)	.001 (.000) ***
Polity	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
GDP	.000 (.000)	.000 (.000)	-.000 (.000)	-.000 (.000)
Inflation (log)	-.000 (.003)	.008 (.006)	.000 (.003)	.009 (.006)
Population above 65	.052 (.005) ***	.051 (.005) ***	.040 (.005) ***	.040 (.005) ***
Population density	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
Rural population	.032 (.001) ***	.032 (.001) ***	.027 (.002) ***	.027 (.002) ***
Interaction effect		-.019 (.012)		-.018 (.012)
Trend			.075 (.007) ***	.075 (.007) ***
Trend2			-.001 (.000) ***	-.001 (.000) ***
Constant	1.918 (.008)	1.903 (.008)	1.139 (.011)	1.129 (.011)
Observations	2,264	2,264	2,264	2,264
Countries	126	126	126	126
AIC	-9,338	-9,339	-9,431	-9,431
BIC	-9,286	-9,281	-9,368	-9,362

*) significant at 10 percent, **) significant at 5 percent, ***) significant at 1 percent (two-tailed test)

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

Although both the main effect and the interaction effect lose significance in model 2, the results are stronger than they look at first glance. In the model without trend variables, the P value of the central bank independence variable is 0.057, which means that it is very close to significance at five percent. The p value of the interaction term is 0.110, which is close to significance at ten percent. In the model accounting for trends, both variables are close to a significance at ten percent, with P values of 0.119 and 0.136, respectively.

Nevertheless, the results are clearly weaker than the results of the model featuring the IMF measure of inflation. This is surprising, considering the high correlation between the IMF and WDI percent-change inflation measures.

Comparing the AIC and BIC values of the models featuring different inflation measures, the model with the IMF percent-change inflation measure clearly explains the development in inequality better. Both the AIC and BIC value of this model are much lower than the values of

the other two models, with 61 as the smallest difference. This is well above the threshold of a ten-point difference.

The results in general indicate that the effect of central bank independence on inequality is robust to changes in the operationalization of inflation, but not when trend variables are included as well. Especially the results of the model using the WDI measure of inflation and accounting for trends shows a decrease in significance of both the main effect and the interaction effect. Although both are close to a significance of ten percent, this does not support our hypotheses.

Lagged variables

When analyzing the effect of central bank independence on inequality over time, there is an obvious challenge in ascertaining how long the independent variables should be lagged. In the models used above, the central bank independence variable is lagged with one year. It is however difficult to know whether the lag should be one, two, three, four or five years, or even if lag should be introduced at all. In order to test the effect of lag, I have run the models with different magnitudes of lag on the central bank independence variable. Presenting all the results of this exercise in a table would be too extensive, so the following table only presents the results of the focus variables, i.e. the central bank independence variable and the interaction term. As model 1, that is the model excluding the interaction effect, has been shown not be robust to trends, only model 2 will be included in this exercise. The results are shown both with and without trend variables.

It should be noted that as the magnitude of lag increases, the number of observations decreases. As illustrated in the table below, there is a difference of 22 percent between the number of observations in the model with no lag and the model with a lag of five years.

Table 6.8. Effect of central bank independence on inequality, with different magnitudes of lag on CBI.

		Model 2		Model 2 with trend variables	
Lag	Obs.	CBI	Interaction	CBI	Interaction
0	2,597	.904 (.099) ***	-.199 (.022) ***	.493 (.094) ***	-.113 (.021) ***
1	2,445	.547 (.103) ***	-.118 (.023) ***	.410 (.100) ***	-.091 (.022) ***
2	2,336	.549 (.103) ***	-.122 (.023) ***	.365 (.100) ***	-.083 (.022) ***
3	2,224	.588 (.108) ***	-.132 (.024) ***	.405 (.105) ***	-.093 (.024) ***
4	2,119	.658 (.105) ***	-.149 (.024) ***	.356 (.099) ***	-.084 (.022) ***
5	2,014	1.205 (.119) ***	-.274 (.027) ***	.554 (.111) ***	-.129 (.025) ***

*) significant at 10 percent, **) significant at 5 percent, ***) significant at 1 percent (two-tailed test)

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

Both the central bank independence variable and the interaction term remain significant at one percent up either the lag is zero, five or somewhere in between. This is the case for both the model with and without trend variables. There does not, however, seem to be any pattern in the development of the coefficients as the magnitude of lag increases. In any case, based on this information, the results seem robust to different magnitudes of lag.

However, the ratios between the main effect and the interaction effect may tell a somewhat different story[13]. Disregarding the model without lag, the models not including trend variables have ratios of 4.40–4.64, decreasing with increased magnitudes of lag. This indicates a turning point of 7.5–29.6. When trend variables are included, the ratios decrease to 4.24–4.40, or a turning point of -4.3–7.5. These turning points are quite low, which leads to two conclusions: First, the effect turns negative somewhere between very low inflation (-4.3) and moderately high inflation (7.5). Second, the positive effect will be at best small, even at low levels of inflation, and at worst non-existent, inasmuch as the effect turns negative at a level below realistic levels of inflation.

In other words, the results demonstrate robustness to different magnitudes of lag, but less robustness to different magnitudes of lag *and* trends. It could be argued that the lowest turning point, in the model with a lag of four years, seems to be an anomaly. After all, the models with

[13] See also table 6.10, listing the ratios and turning points for a selection of regression models.

a lag of three and five years have turning points of 3.5 and -1.0, respectively. Nevertheless, the positive effect will in both cases be rather small.

Net Gini as dependent variable

Table 6.9. Effect of central bank independence on net Gini, with and without trend variables.

Variable	Model 1	Model 2	Model 1 w/trend	Model 2 w/trend
CBI (lagged)	.019 (.011) *	.142 (.093)	.006 (.010)	.001 (.090)
Globalization	.002 (.000) ***	.002 (.000) ***	.001 (.000) **	.001 (.000) **
Polity	-.001 (.000) *	-.001 (.000)	-.001 (.000)	-.000 (.000)
GDP	.000 (.000)	.000 (.000)	.000 (.000)	.000 (.000)
Inflation (log)	-.001 (.003)	.011 (.010)	-.000 (.003)	-.001 (.009)
Population above 65	.035 (.005) ***	.034 (.005) ***	.019 (.005) ***	.018 (.005) ***
Population density	-.000 (.000)	-.000 (.000)	-.000 (.000)	-.000 (.000)
Rural population	.032 (.001) ***	.031 (.002) ***	.021 (.002) ***	.021 (.002) ***
Interaction effect		-.027 (.021)		.001 (.020)
Trend			.105 (.007) ***	.106 (.007) ***
Trend2			-.002 (.000) ***	-.002 (.000) ***
Constant	1.903 (.001)	1.881 (.007)	.895 (.009)	.892 (.009)
Observations	2,445	2,445	2,445	2,445
Countries	134	134	134	134
AIC	-10,167		-10,172	-10,390
BIC	-10,115		-10,114	-10,321

*) significant at 10 percent, **) significant at 5 percent, ***) significant at 1 percent (two-tailed test)

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

The results show that all but model 1 lose significance when the dependent variable is exchanged with a net Gini measure. The central bank independence effect is significant at ten percent in model 1. The models accounting for trends, show more or less no significance of either the main effect or the interaction effect, and the coefficients are very close to zero.

Although the AIC and BIC values improve compared to the model featuring the market Gini as dependent variable, these values are not comparable. This is because the models explain different phenomena: In one case, they explain the development in net inequality, and in the other, the development in market inequality.

I will make the argument it makes sense that the results are not robust to exchanging the dependent variable, as a net Gini measure of inequality distorts the effect of central bank independence by including the effect of redistribution through taxation and transfers. Hence, the models using market Gini as the dependent variable are more suitable for the purpose of finding distributional effects of central bank independence.

6.3 Results for control variables

Although not the focus of this thesis, I will shortly summarize the effects of the control variables.

First of all, the effects of the share of population above 65 and the rural share of population are both positive and significant at one percent in all models. The coefficients vary from 0.032 to 0.105 and 0.025 to 0.045, respectively, indicating that the effect of one unit's increase in the population above 65 has a larger effect than one unit's increase in the rural share of the population. Inasmuch as one unit in this case equals an increase of one percentage point, this indicates a quite strong effect.

An increase of 0.105 on the dependent variable corresponds to an increase in the Gini coefficient of 2.7–7.7 points, or 10–12 percent. To put this in perspective, the United States has had an increase in the share of population above 65 in the magnitude of three percentage points between 1980 and 2014. This could potentially manifest itself in an increase in inequality of between 10 and 30 percent, depending on whether the lowest or highest coefficient is used.

The effects of the trend variables are strongly significant in all models where these variables are included. Coefficients range from 0.072 to 0.100, meaning that the logarithmically transformed dependent variable increases with between 0.072 and 0.100 points a year due to trends. The highest coefficient correlates to an increase in the Gini coefficient of 2.6–7.2, or around ten percent per year. The effect of the second trend variable is negative, indicating that the increase in inequality is slowing down. Coefficients between -0.002 and -0.003 indicate a very small, but significant effect.

The effect of globalization is positive and significant at one percent in all models. However, the coefficients are between 0.001 and 0.003, indicating a negligible effect, even if significant. This may sound low, but considering that the globalization variable ranges from 10.6 to 92.6, the coefficients are somewhat misleading. For instance, Norway's score of the globalization index increased with almost 14 points from 1980 to 2013. This would mean an effect of up to 0.042, which corresponds to an potential increase in the Gini coefficient of 1.2–3.2 points, or around five percent.

The results of the inflation variables are somewhat mixed. In model 1, inflation does not have a significant effect on inequality when the education variable is excluded, the WDI percent-change inflation measure is used, or net Gini and trend variables are included. In model 2, all but the latter show significance for the inflation variable. The coefficients are also generally larger in the models including the interaction effect, with 0.212 in main model including the education variable as the highest.

Even a coefficient of 0.212 must however be considered small in this context, since the inflation variable has been logarithmically transformed, resulting in a range from 0.24 to 6.97, as compared to a range from -73 to 992 in the original inflation variable. This implies that an increase in the inflation variable of one unit is quite a leap, inasmuch as somewhere between six and seven units would be equivalent to an increase in inflation of 1,000 percentage points. As an example, an increase from 4.3 to 4.4 on the logarithmically transformed inflation variable would correspond to an increase from 0 to 126 percent inflation.

Education does not seem to have a significant effect on inequality. Although significant at one percent in the models with trend variables included, the coefficients are close to zero. The remaining models do not show significance for the education variable.

Democracy, GDP and population density are not significant in any of the models, and the coefficients are very close to zero.

6.4 Summary of results

Central bank independence is shown to have a positive effect on inequality in model 1, i.e. the model excluding the interaction effect. However, the results of model 1 are not robust neither to the introduction of trend variables nor the exclusion of the education variable. Hence, this model is discarded.

When the interaction effect of central bank independence and inflation is introduced in model 2, both the effect of central bank independence and the interaction effect are shown to have significant effects on inequality. These effects are robust to trends, exclusion of the education variable as well as different magnitudes of lag on the central bank independence variable, and to different measures of inflation. However, they are less robust when the models with different magnitudes of lag and different measures of inflation, respectively, are exposed to trends.

The results are not robust to exchanging the dependent variable with a net Gini measure for inequality and at the same time accounting for trends. I will make the argument that this makes sense, and that the results do not lose strength as a consequence of this. This is because the use of a net measure distorts the effect of central bank policies by including the effect of redistribution.

To compare the results of all models, the following table outlines the ratios of the coefficients of the main effects and the interaction effects for each model. This means that at perfect central bank independence, i.e. a value of 1 on the central bank independence variable, inflation needs to be at the given ratio for the interaction effect to outweigh the main effect. To make the interpretation easier, the last column lists the corresponding percent-change inflation rates.

Table 6.10. Turning points for net effects in different models.

Table	CBI	Interaction	Ratio	Inflation
6.2 Including education	1.778	-.391	4.55	20.7
6.4 Excluding education	.547	-.118	4.64	29.6
6.5 Trend variable	.529	-.115	4.60	25.5
6.5 Trend variables	.410	-.091	4.51	16.9
6.8 No lag	.904	-.199	4.54	19.7
6.8 Lag 2	.549	-.122	4.50	16.0
6.8 Lag 3	.588	-.132	4.45	11.6
6.8 Lag 4	.658	-.149	4.42	9.1
6.8 Lag 5	1.205	-.274	4.40	7.5
6.8 No lag w/trend	.493	-.113	4.36	4.3
6.8 Lag 2 w/trend	.365	-.83	4.40	7.5
6.8 Lag 3 w/trend	.405	-.93	4.35	3.5
6.8 Lag 4 w/trend	.356	-.84	4.24	-4.3
6.8 Lag 5 w/trend	.554	-.129	4.29	-1.0

Source: Dreher 2006; Garriga 2016; Marshall, Gurr and Jaggers 2016; Solt 2016; Teorell et al. 2017

As the table shows, the ratios of the main effect and the interaction effect vary from 4.24 to 4.64, or from -4.3 to 29.6 in actual percent-change inflation rates. Of course, when the turning point is as low as -4.3, this means that the main effect will in all but the most extreme cases be outweighed by the interaction effect, resulting in a negative net effect on inequality.

The hypotheses introduced earlier were as follows: First, that central bank independence has a positive effect on inequality, i.e. producing more inequality, and second, that there is a negative interaction effect of central bank independence and inflation on inequality, i.e. that the effect of central bank independence is stronger at low levels of inflation.

In conclusion, neither hypothesis may be rejected outright. Central bank independence does have a positive effect on inequality at low levels of inflation, giving support the first hypothesis. At a given level of inflation, the effect changes from positive to negative, giving support to the second hypothesis. These results are statistically significant and robust to trends, exclusion of the education variable, use of different inflation measures and different magnitudes of lag.

However, for the results to be meaningful, the effects need to be strong enough to matter, and the turning point must be high enough for the effect to be relevant. These matters are interrelated: The higher the turning point, the larger is the positive net effect at normal levels of inflation. As shown in table 6.10, the turning point in the different models ranges from an inflation rate of -4.3 to 29.6. The former, from the model with four years of lag on the central bank independence variable, seems to be an anomaly, as both three and five years of lag indicate clearly higher turning points.

Even disregarding models with no lag or three or more years of lag, the turning point is in the range of 7.5–29.6. If it is in fact in the lower regions of that range, the positive effect of central bank independence on inequality will be rather miniscule. On the other hand, if the turning point is at an inflation rate of around 17 percent, as in the model accounting for trends, the net effect of going from no central bank independence to perfect central bank independence may be close to ten percent at an inflation rate of two percent. An increase in central bank independence similar to the average increase worldwide in recent decades, would in this case imply an increase in inequality of above three percent.

In sum, there is "no definitive answer" as to which model should be chosen (Treiman 2009, 134–135). Treiman (2009, 135) suggests that if "you have a theoretical reason to prefer one model over the other, choose that one". I have argued that the model excluding the education variable and the model including trend variables are most suitable for the purposes, and these models have turning points of 29.6 and 16.9, respectively. The latter model also has the highest AIC and BIC values, demonstrating that it better explains the development in market inequality.

Based on this, it may be considered likely that central bank independence does have some positive effect on inequality at low levels of inflation, but the effect should not be expected to be enormous. As mentioned, even in the model including trend variables, the effect at normal levels of inflation would be in the magnitude of around three percent if central bank independence increases as much as the world average during the last three decades.

In the next chapter, I will argue that even though the effect may be rather small, the results still have some importance for the ongoing debates regarding remedies to inequality and the balance between central bank independence and democracy.

7. Discussion

In this part, I will discuss the results above as well as their implications. First, the effect of central bank independence on inequality will be discussed. Thereafter, the difference between the results featuring the market Gini and the results featuring the net Gini measure as dependent variable will be addressed. Lastly, I will discuss the implications of the results for the debates regarding policy and democracy.

7.1 The effect of central bank independence on inequality

The results indicate that central bank independence has an effect on inequality, but that this effect is dependent on the level of inflation. The effect of the interaction being negative, this could mean that when inflation is high, the effect of central bank independence on inequality is reduced. However, it may also be the opposite, i.e. a reverse interaction, meaning when we have a situation with a high degree of central bank independence, the effect of inflation on inequality will be reduced. There is no given answer as to which explanation is the correct, and Treiman (2009, 135) thus suggests that "[i]f you have a theoretical reason to prefer one model over the other, choose that one".

It seems plausible that inflation would have a moderating effect on the effect of central bank independence on inequality. An argument mentioned above for the effect of central bank independence on inequality, is that independent central banks have interests not concurring with the interests of society as a whole, and that these interests may not be conducive to equality. In a situation with high levels of inflation, the central bank's priorities are naturally altered, hence reducing the central bank's opportunity to choose policies to its own advantage. In the opposite situation, with low levels of inflation, it may focus more on other ends.

On the other hand, the other argument mentioned for an effect of central bank independence on inequality, namely the argument that independent central banks prioritize inflation targets above inequality, does not seem to strengthen this hypothesis. If inflation targets are the cause of increasing inequality, high inflation levels should strengthen, not reduce, the effect of central bank independence on inequality. After all, high levels of inflation would be an indication of less strict inflation targets. Of course, this presupposes that inflation targets and actual inflation

levels correlate. This is not necessarily the case. According to a study by Stone and Roger (2005, 21), countries with inflation targets have inflation levels outside of the target range more than 40 percent of the time.

An indication that the interaction is not likely to be reversed, is that the results regarding the effect of the inflation variables are generally weaker than the results of the effect of the central bank independence variable in the regression models. In the first model (table 6.2), the effect of inflation has a coefficient of 0.212, and in the model accounting for trends, it has a coefficient of 0.095. This may be interpreted as the effect on inequality when central bank independence has a value of zero.

Also, the coefficients of the effect of inflation are smaller than the coefficients of the interaction effect both in the model accounting for trends and the model not accounting for trends. In the latter model, where the main effect as mentioned has a coefficient of 0.212, the interaction effect has a coefficient of -.0391, implying that the effect of inflation is outweighed by the interaction effect when central bank independence increases with 0.55. As discussed in chapter 6.3, one unit's increase in the logarithmically transformed inflation variable corresponds to an increase of 1,000 percent in the actual inflation rate. This means that for realistic levels of inflation, the effect would be miniscule.

7.2 Market Gini vs. net Gini

An interesting result is that the effect of central bank independence seems to have a stronger impact on market inequality, i.e. inequality before redistribution, than on net inequality. The results were in this case both more significant and more robust. The intention of using both measures of inequality, was, as mentioned in the data and measurement chapter (5.1), that it would test for the effect of taxes and redistribution. The more significant and robust results of the model with a market Gini as dependent variable indicate that redistribution is an important factor when it comes to reducing inequality.

As mentioned in chapter 3.2.12, the graphs of inequality and central bank independence show similar developments, both clearly increasing in the period 1980–2000. However, the development in the market Gini is clearly closer to the development in central bank

independence than the net Gini is. It should thus not come as a surprise that the variable using pre-redistribution measures yields more significant results. The question, then, is whether it makes sense to use the market Gini variable rather than the net Gini variable.

A plausible interpretation of the results, would be that central bank independence has a positive effect on inequality, whereas redistribution through taxation and transfers has a negative effect on inequality. Thus, as net inequality is likely to be smaller than market inequality, the effect of central bank independence will appear weaker in models using the former measure. For instance, a country with an independent central bank might theoretically have very high levels of inequality before redistribution, but very low levels after redistribution. This is consistent with the findings of Apergis, Dincer and Payne (2013). Using measures of inequality after redistribution, would in that case indicate that the country's high degree of central bank independence has not manifested in high inequality, thus falsifying the hypothesis of a correlation between central bank independence and inequality. On the other hand, if pre-distribution measures are used, the it becomes apparent that there are in fact high inequality levels present, although they are remedied after the fact by use of redistributive taxation.

A different side of the argument is that the focus on inequality following the increase in the period 1980–2000 may have led to more or better redistributive taxation. This would explain why the market Gini has remained on the same level since 2000, in the same period as the net Gini has decreased. Alas, data on taxation are, as mentioned, scarce, which makes the proposition difficult to test. However, an indication of such a connection may be found in the SWIID dataset. As mentioned in chapter 5.3.2 (Taxes and redistribution), the dataset offers two variables measuring redistribution in absolute and relative terms. While the former measure lists the difference between the market Gini and the net Gini measures, the latter divides the aforementioned difference by the market Gini, in effect telling us the percentage change in inequality caused by redistribution (Solt 2016, 12). The following graphs may illustrate the development in redistribution, both in absolute and relative terms.

Figure 7.1. Development in absolute redistribution 1980–2012.

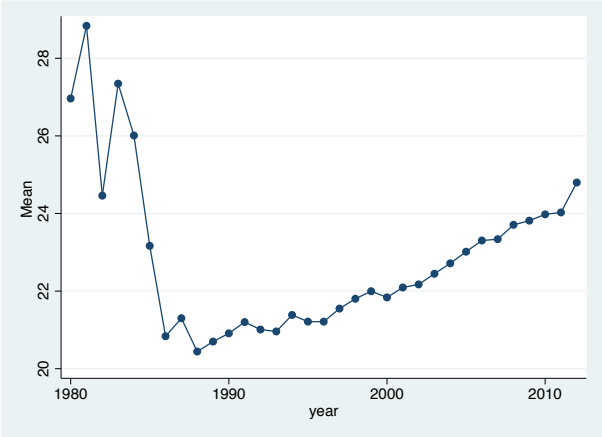
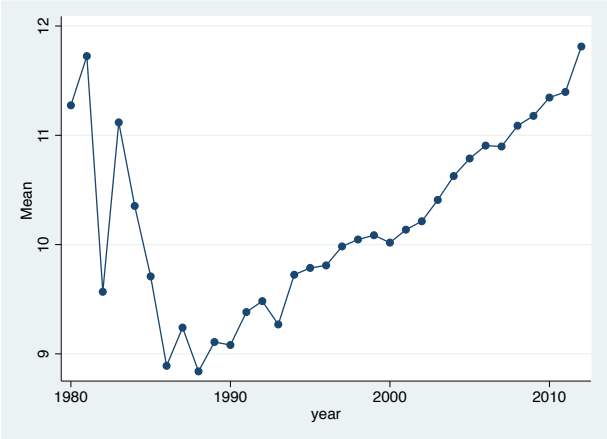


Figure 7.2. Development in relative redistribution 1980–2012.



Source: Garriga (2016). Generated by use of the Stata package `lgraph`.

As illustrated, redistribution has clearly increased since the late 1980s, in the same period as market inequality and central bank independence has increased as well (see figures 2.1 and 5.2). The fact that both market inequality and redistribution increase at the same time, suggest that there are factors increasing inequality at an earlier point than fiscal policy. Based on the results above, my contention is that central bank independence would be a good candidate. In other words, there would be a phased correlation, where central bank independence increases inequality, which in turn increases the demand for redistribution, leading to a situation with high levels of both market inequality and redistribution. The more frequent use of net inequality measures in studies may have contributed to conceal these relationships.

Treiman (2009, 135) suggests that "[i]f you have a theoretical reason to prefer one model over the other, choose that one". In conclusion, it makes sense that the results are stronger and more significant when the market Gini is used as a measure for inequality, suggesting that the model with the market Gini measure as dependent variable should rather be used. The results, indicating that central bank independence has a positive effect on inequality before redistribution, moderated by level of inflation, are thus significant and robust.

7.3 Implications for policy

It follows from the discussion of market and net inequality levels that monetary policies may conflict with fiscal policies, as the former tends to increase inequalities while the latter tends to reduce them. This suggests that while taxation is an efficient remedy for inequality, it does not affect the fundamental causes of inequality. This, in turn, has serious implications for policy. If redistributive taxation and central bank independence are pulling in opposite directions, this begs the question of whether it would be a better solution that both redistributive taxation and central bank independence were reduced. In other words, instead of monetary policies creating more inequality and fiscal policies creating less inequality, an alternative might be to implement monetary policies not increasing inequality in the first place.

In practice, this approach would mean that inequality would be an issue in monetary policies, as well as in fiscal policies. Fontan, Claveau and Dietsch (2016, 341) suggest "three ways in which one might ask a central bank to act on inequalities". First, they suggest a "mild demand" where "distributive concerns act a tie-breakers". This means that even if the central bank's main purpose is to reduce inflation, it may choose the inflation-reducing policy which has the least impact on inequality. This would allow central banks to maintain a focus on inflation control, while at the same time cease to neglect distributional issues (Fontan, Claveau and Dietsch 2016, 341–342).

A second and stricter alternative is that the central bank's mandate is re-defined to include inequality. This may be implemented in two ways. First, there is the "radical proposal", adding "a *permanent* objective of curbing inequalities". This aim would of course need to be weighted up against other aims, such as price stability. There would also be a need for government controls, both with regards to setting the goals for inequality levels as well as controlling in retrospect that the central bank has followed its guidelines. A more moderate suggestion would be that central banks take into account distributive effects when considering "the adoption of extraordinary policy". An example of such policy would be quantitative easing. On the other hand, ordinary monetary policy would still be focused on inflation targets (Fontan, Claveau and Dietsch 2016, 342–343).

Of course, advocates of narrower central bank mandates may object that even though central bank independence may have a distributional effect, the advantages still outweigh the

disadvantages. A similar argument would be that “there is no alternative”. In other words, the positive effects, such as price stability, are more important than the negative effects, such as increasing inequality. While the argument makes sense, it is not entirely convincing. After all, it is not necessarily so that the present paradigm of soaring central bank independence is the only way to achieve such positive effects as price stability. On the contrary, there might very well be a way to achieve price stability having to sacrifice equality. Yet, if central banks do not consider distribution effects of monetary policy, the evaluation of the different alternatives will be deficient. Hence, if not all information is taken into account, the path chosen may not be the ideal one (Fortan, Claveau and Dietsch 2016, 336).

Fontan, Claveau and Dietsch (2016, 337) argue that even if we accept the premise that it is not possible to achieve price stability without increasing inequality, central banks should still care about distribution issues. For instance, assuming that the monetary policies following the recent recession, such as quantitative easing, have distribution effects, the central bank would and should still go through with such policies. However, in that case, central banks should act in a way that minimizes the risk of recessions, so that policies with undesirable distribution effects will not be warranted. The authors suggest that issues like “naked short selling”, separation of commercial and investment banks and “too big to fail” are considered in this respect. Although central banks do not control these issues, they could have substantial impact on the debate if they took part, possibly influencing the government to introduce new regulation. Nevertheless, it does not help to prevent future recessions that they “keep insisting on the idea that inequalities is a task for governments only” (ibid).

To have ends for equality is one thing, but a different question is what means the central bank has at its disposal to achieve these ends. Fontan, Claveau and Dietsch (2016, 343–344) suggest that the central bank may print money and spend it on programs benefitting low-income households. In this sense, it could be possible to make workers “early receivers” (Rothbard 1994, 24) rather than the banking system. A way to achieve this, would be to spend the new money on financing of tax cuts or payments to lower-income housheulds (Fontan, Claveau and Dietsch 2016, 344).

The approach of using monetary policy to reduce inequality would have multiple advantages: First, redistributive taxation is a divisive and polarized issue. The possibility of reducing inequality without increasing taxes, would be appealing to a much wider political spectrum. For

instance, libertarians “claim that redistributive taxation is inherently wrong, a violation of people's rights” (Kymlicka 2002, 103). Indeed, Nozick (1974, 169) describes taxation of labor as “on par with forced labor”. Although this may be seen as a marginal view, even a moderate liberal as John Rawls “opposes progressive income tax, and the extensive redistribution of market income” (Kymlicka 2002, 100). Right-wing parties in general have been skeptical to such policies, either based on libertarian principles, empirical arguments regarding inefficiency of taxation, or distrust in the government’s ability to successfully remedy injustices (Kymlicka 2002, 157). Also, Fontan, Claveau and Dietsch (2016, 346) argue that there is a psychological mechanism giving people a “sense of entitlement” to their incomes, in effect making it more difficult to redistribute income after the fact. Thus, rather than redistributing ex post, the inequalities should not be created in the first place.

Second, taxation may have costs in the form of inefficiency or unfair outcomes (Kymlicka 2002, 157; 81). As to inefficiency, one of the most well-known arguments are based on the Laffer curve, which implies that higher tax rates may, perhaps counter-intuitively, reduce tax revenue. This is because people’s willingness to work decreases the less of their incomes they get to keep. In the extreme example of a 100 percent tax rate, all productive activity would cease to exist (Wanniski 1978, 3). Trabandt and Uhlig (2011, 316) present results suggesting that some countries, such as Denmark and Sweden, are already past the point where increased capital income tax rates would increase tax revenue, implying that they could in fact increase tax revenue by decreasing capital income tax rates. Since taxation obviously affects efficiency negatively through changed behavior, it would be “preferable, all other things equal, to control the generation of inequalities in the first place” (Fontan, Claveau and Dietsch 2016, 345).

With regards to possible unfair outcomes, Dworkin (1981, referenced in Kymlicka 2002, 81) argues that due to the difficulty of assessing each individual's ambitions and endowments, a system of redistributive taxation will inevitably imply that “some people are undeservedly penalized for their unfortunate circumstances, while others are undeservedly subsidized for the costs of their choices”. Especially the latter sentiment has been used by right-wing parties to reduce the magnitude of redistribution, taxation and the welfare state (Kymlicka 2002, 157–158).

Third, governments' ability to use taxation for redistributive purposes is under pressure due to mobility of capital and workers as well as tax competition (Fontan, Claveau and Dietsch 2016, 345). This makes it difficult to increase taxes without losing capital and labor force to abroad.

When it comes to redistribution through monetary policy, the same arguments do not apply. On the contrary, prominent libertarians such as Ron Paul and Murray Rothbard have been vocal with regards to the distributive effects of the central bank system (Paul 2009; Rothbard 1994). In other words, gaining support for the notion of reducing inequality through monetary policy could seem to be more realistic than reducing it through fiscal policies.

Making redistribution a monetary issue as well a fiscal issue would in effect change the scope of redistribution from mere "*ex post* corrections to the inequalities generated by the market" to also including *ex ante* measures (Kymlicka 2002, 82). This would mean that, instead of taking "the existing level of inequality in market income as given", and then remedying it with redistributive taxation, redistribution would take place before the fact (Kymlicka 2002, 82).

A different, and more direct, approach would be that if central bank independence increases inequality, central banks should be less independent. The argument relies on the apparent trade-off between equality and price stability. Assuming that independent central banks contribute to price stability, less independent central banks would imply that equality gets priority over price stability.

7.4 Implications for democracy

The effects of inequality on quality of democracy as well as democratic values have been discussed above, and may suggest that such monetary policies might have a positive impact on democracy. However, this would in effect expand the central bank's mandate from simply controlling inflation to controlling distribution of goods in society. This gives cause to a democratic problem, for as Fontan, Claveau and Dietsch (2016, 342) argue, "unelected central bankers should not be left to decide on the acceptable level of inequalities". In this sense, Rothbard's (1994, 3) argument that independent central banks are secret and unaccountable, gains strength if they receive expanded mandates. If central banks are to be given even greater power, they should be made more accountable to the government, i.e. less independent.

Going back to Levy's (1996, 190) requirements for an independent central bank being democratic, yields a similar conclusion. Arguing that trade-offs such as the one between fighting unemployment and fighting inflation should not be a decision up to an unelected central bank, the same argument could be used for the trade-off between fighting inflation and fighting inequality. If levels of unemployment should be a democratic decision, then surely levels of inequality should be the same.

Likewise, the argument that central banks should have independence in instruments, but not in goals (Fischer 1995, 202), becomes even more important if the central bank has influence over distributive matters. If the central bank had more than one goal, it would be difficult to avoid a situation where, in reality, the central bank had substantial power over how the goals were balanced towards each other. In that sense, it would be difficult to introduce goals of reduced inequality in the mandate of the central bank without at the same time making the central bank more independent when it comes to setting goals of monetary policy. In other words, it would be difficult to increase the central bank's economic independence without at the same increasing its political independence.

However, as Fontan, Claveau and Dietsch (2016, 339) argue, there tends to be a balance between the central bank's level of independence and the extent of its mandates, in the sense that the more independent a central bank is, the more narrow are its mandates. It follows that if central banks gain more power over issues traditionally reserved for fiscal policy, governments will demand a larger degree of democratic control over the central bank's actions. In other words, it would be difficult to argue for expanding the scope of the central bank's mandate to include goals of equality without at the same time arguing for reducing the independence of the central bank.

The system Fontan, Claveau and Dietsch (2016, 342) suggests, involves central banks only considering effects on inequality when they are contemplating on introducing "extraordinary policy". This would not have the same implications for democracy as the more radical approach of weighing inequality and price stability against each other at all times.

A different argument mentioned in the literature review, was that independent central banks are a part of a system with division of power, a system which is fundamentally democratic, even more so than a majoritarian system (Bernhard 2009, 180; Drazen 2002, 11; Lijphart 1999, 46).

In this perspective, it might be argued that it would in fact be a good thing if also issues relating to equality became a part of this power division. However, the argument that monetary policy is "beyond the scope of democratic oversight and control" (Polillo and Guillén 2005, 1793–1794) may not carry the same positive connotations if it has serious distributive implications. The arguments in favor of independent control of inflation, saying that independence leads to conservative monetary policies, do not apply in the same way to independent control of distribution.

7.5 Concluding remarks

During recent decades, the rise in within-country inequality has received widespread attention; even more so after the release of Piketty's *Capital in the Twenty-First Century* in 2014. The considerable rise in the independence of central banks in the same period, has not received anything close to the same attention.

In this thesis, I have argued that central bank independence has a positive effect on inequality, and that this effect is stronger at lower levels of inflation, i.e. moderated by inflation. Using a regression model of 134 countries, I find that there is in fact such an effect. The results are robust to trends, exclusion of the education variable, different magnitudes of lag on the central bank independence variable and different inflation variables, but not to exchanging the dependent variable with a net Gini measure. This last point indicates that central bank independence has a positive effect on inequality, but that this effect is outweighed by the negative effect of redistributive taxation. It is thus possible for countries to end up in a vicious cycle of increasing central bank independence, inequality and redistributive taxation.

On this basis, I suggest that, rather than redistribution being solely within the realm of fiscal policy, monetary policy should include provisions regarding inequality. This way, monetary policy and fiscal policy would not pull in opposite directions, and it may be possible to reduce inequalities earlier in the process. This would have clear advantages with regards to efficiency and justice issues.

7.6 Suggestions for further research

As I believe the preceding 93 pages have illustrated, the distributive effects of independent central banks have been underestimated in the literature. There is thus room for much further research on the topic. I have mentioned some weaknesses of the dataset used in this thesis, such as the scarcity of data on redistributive taxation. The interaction between monetary policy and redistributive taxation and spending should be studied more closely as more and better data become available, in order to find out more about how the two measures may be used and balanced against each other to remedy the challenge of increasing inequality.

As discussed, central banks control many aspects of monetary policy, and theoretically, some of these aspects may pull in the direction of greater inequality, while others may pull in the opposite direction. While this thesis has looked at the question of central bank independence in a bird's-eye view, a different approach might be to decompose each aspect of the central bank's tasks and analyze their respective effects on inequality.

Furthermore, the dataset used here covers the period from 1980 to 2012. This is probably not sufficient to pick up the distribution effects of the monetary policies implemented in 2009 and 2010, in the wake of the recession (Fontan, Claveau and Dietsch 2016; Green and Lavery 2015). Potentially, it is not unlikely that these distribution effects could be greater than the average effects of the 33-year period used in this thesis. Further research into the distributive effects of independent central banks following economic crises should be done when more recent data are available.

The European Central Bank has been mentioned in the theory part of this thesis, as it is considered to be the most independent central bank in the world. However, only national central banks are included in the dataset, excluding the European Central Bank. Yet, the ECB would make an interesting case study, in order to see if the distributional effects are similar at a supranational level.

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Appendix

List of county-years in models excluding education variable

The dataset consists of 134 countries over a period of 33 years (1980–2012).

Country	Period(s)	Obs.
Albania	1997–2008	12
Algeria	2004–2005	2
Argentina	1981–1983, 1986–1988, 1991–2011	27
Armenia	1995–2012	18
Australia	1982, 1985–2012	29
Austria	1988–2012	25
Azerbaijan	1995–2008	14
Bangladesh	1987–2010	24
Belarus	1995–2012	18
Belgium	2000–2012	13
Benin	2004–2006	3
Bhutan	2004–2007	4
Bolivia	1990–2012	23
Botswana	1986–2005	20
Brazil	1981–1988, 1991, 1995–2012	27
Bulgaria	1992–1996, 1998–2012	20
Burkina Faso	1995–2009	15
Burundi	1994–2006	13
Cambodia	1997–2009	13
Cameroon	1997–2007	11
Canada	1981–2012	32
Central African Republic	1993–2008	16
Chad	2003–2005	3
Chile	1981–2012	32
China	1990–2012	23
Colombia	1989–2011	23
Congo	2006	1
Costa Rica	1982–1983, 1986–2012	29
Cote d'Ivoire	1986–2008	23
Croatia	1994–2011	18
Cyprus	2003–2012	10
Czech Republic	1996–2012	17

Dem. Republic of Congo	2006	1
Denmark	1981–2012	32
Djibouti	2001–2005	5
Dominican Republic	1991–2012	22
Ecuador	1993–2011	19
Egypt	1991–2012	22
El Salvador	1992–2012	21
Estonia	1994–2012	19
Ethiopia	1996–2011	16
Fiji	1992–2009	18
Finland	1986–2012	27
France	1990–2012	23
Georgia	1996–2012	17
Germany	1991–2012	22
Ghana	1988–2010	23
Greece	1982, 1986–2012	28
Guatemala	1988–2012	25
Guinea	1995–2007	13
Guinea-Bissau	1998–2005	8
Guyana	1996–2006	11
Haiti	1988–2001	14
Honduras	1989–2012	24
Hungary	1987–2012	26
India	1987–2011	25
Indonesia	1981, 1988–2012	26
Iran	1985–2011	27
Ireland	1988–2011	24
Israel	1986–2012	27
Italy	1981–2011	31
Jamaica	1989–2004	16
Japan	1981–2011	31
Jordan	1987–2010	24
Kazakhstan	1995–2011	17
Kenya	1993–2007	15
Kyrgyz Republic	1994–2011	18
Laos	1996–2008	13
Latvia	1993–2012	20
Lebanon	2005	1
Lesotho	2001–2003	3
Lithuania	2000–2012	13

Macedonia	1995–2012	18
Madagascar	1995–2010	16
Malawi	1990–2011	22
Malaysia	1990–2012	23
Mali	1990–2010	21
Mauritania	1991–2008	18
Mauritius	2005–2006	2
Mexico	1990–2012	23
Moldova	1993–2012	20
Mongolia	1996–2010	15
Morocco	1985–2007	23
Mozambique	1997–2008	12
Namibia	1998–2008	11
Nepal	1996–2010	15
Netherlands	1981, 1986–2012	28
New Zealand	1983–2012	30
Nicaragua	1995–2009	15
Niger	1993–2008	16
Nigeria	1982, 1986–2011	27
Norway	1985–2012	28
Pakistan	1986–2011	26
Panama	1987–2011	25
Papua New Guinea	2001–2005	5
Paraguay	1991–2011	21
Peru	1986–1988, 1991–2012	25
Philippines	1986–2012	27
Poland	1981–2012	32
Portugal	1990–2011	22
Romania	1990–2012	23
Russia	1993–2012	20
Rwanda	1998–2011	14
Senegal	1992–2011	20
Sierra Leone	2001–2011	11
Singapore	1981–2012	32
Slovak Republic	1994–2012	19
Slovenia	1993–2012	20
South Africa	1992–2012	21
South Korea	1981–2012	32
Spain	1986–2012	27
Sri Lanka	1998–2011	14

Sweden	1981–2012	32
Switzerland	1993–2012	20
Syria	2003–2007	5
Tajikistan	1994–2009	16
Tanzania	1992–2011	20
Thailand	1987–2011	25
Togo	2006–2011	6
Trinidad and Tobago	1989–2005	17
Tunisia	1986–2010	25
Turkey	1984, 1988–2012	26
Turkmenistan	1996–2005	10
Uganda	1990–2011	22
Ukraine	1994–2010	17
United Kingdom	1981–2012	32
United States	1981–2012	32
Uruguay	1987–2012	26
Uzbekistan	1993, 1995–2005	12
Venezuela	1981–2009	29
Vietnam	1998–2011	14
Zambia	1992–2010	19
Zimbabwe	2001–2011	11

List of county-years in models including education variable

The dataset consists of 126 countries over a period of 33 years (1980–2012).

Country	Period(s)	Obs.
Albania	1997–2008	12
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Armenia	1995–2012	18
Australia	1982, 1985–2012	29
Austria	1988–2012	25
Azerbaijan	1995–1997, 2006–2008	6
Bangladesh	1987–1990, 1999–2009	15
Belarus	1995–2012	18
Belgium	2000–2012	13
Benin	2004–2006	3
Bhutan	2005–2007	3
Bolivia	1996, 1998–2004, 2007	9
Botswana	1986–1987, 1991, 1993–1996, 1999–2005	14
Bulgaria	1992–1996, 1998–2012	20
Burkina Faso	1995–1997, 1999, 2001–2003, 2005–2009	12
Burundi	1998–2002, 2004–2006	8
Cambodia	1997, 2000–2009	11
Cameroon	1999–2007	9
Canada	1986, 1989–1996, 1998–2000	12
Central African Republic	1999–2000, 2004, 2006, 2008	5
Chad	2003–2005	3
Chile	1982–1988, 1991–2000, 2002–2012	28
China	1990–2012	23
Colombia	1989–2002, 2004–2011	22
Costa Rica	1982–1983, 1986–1992, 2004, 2011–2012	12
Cote d'Ivoire	1987, 1992–1995, 1997, 1999, 2007	8
Croatia	1994–2011	18
Cyprus	2003–2012	10
Czech Republic	1996–2012	17
Dem. Republic of Congo	2006	1
Denmark	1981–1996, 1998–2012	31
Djibouti	2001–2005	5
Dominican Republic	1997, 2003, 2012	3

Ecuador	1995, 1997, 2008	3
Egypt	1991, 1999, 2001–2012	14
El Salvador	1993–1996, 1998–2012	19
Estonia	1994–2012	19
Ethiopia	1996–2005	10
Fiji	2003–2005	3
Finland	1986–2012	27
France	1990–2012	23
Georgia	1996–1997, 1999–2012	16
Germany	1991–1997	7
Ghana	1991–1994, 2005–2009	9
Greece	1982, 1986–2007, 2010–2012	26
Guatemala	1993–1995, 2002, 2007	5
Guinea	1995–1998, 2004–2007	8
Guinea-Bissau	2005	1
Guyana	1996–1997, 2003–2006	6
Honduras	1989–2004, 2008, 2010, 2012	19
Hungary	1987–2012	26
India	1987–1991, 1995–1997, 2000–2011	20
Indonesia	1981, 1988–2012	26
Iran	1995–1996, 1999–2011	15
Ireland	1988–2011	24
Israel	1986–1991, 1993, 1995–1996, 1998–2009, 2011–2012	23
Italy	1981, 1983–2011	30
Jamaica	1989, 1991–1992, 1999–2004	9
Japan	1981–1992, 1994–1995, 1998–2011	28
Jordan	1987–1997, 2000, 2002–2010	21
Kazakhstan	1995–1996, 1999–2000, 2005–2006	6
Kenya	2000–2002, 2004–2005	5
Kyrgyz Republic	1994–2011	18
Laos	1996–2008	13
Latvia	1993–2012	20
Lebanon	2005	1
Lesotho	2001–2003	3
Lithuania	2000–2012	13
Macedonia	1995–2010, 2012	17
Madagascar	1995–2010	16
Malawi	1990–1996, 1999–2007, 2010–2011	18
Malaysia	1990–1995, 1998–2012	21
Mali	1990–1993, 1995–2002, 2008–2010	15

Mauritania	1991–1999, 2001–2008	17
Mauritius	2005–2006	2
Mexico	1990–1991, 1993–2012	22
Moldova	1995–1997, 1999–2012	17
Mongolia	1996–2010	15
Morocco	1986–1995, 1997–2007	21
Mozambique	1999–2000, 2003–2005, 2008	6
Namibia	1998, 2001–2003, 2005–2006, 2008	7
Nepal	1996, 2000–2010	12
Netherlands	1981, 1986–2012	28
New Zealand	1983–2012	30
Nicaragua	1995, 1997, 2002	3
Niger	2003–2008	6
Nigeria	1982, 1986–1989, 1999, 2003–2005	9
Norway	1985–2012	28
Pakistan	1986–1988, 1990, 1992, 2003–2009, 2011	13
Panama	1987–1996, 1998–2011	24
Paraguay	1993, 1995–1996, 1999–2005, 2007–2010	14
Peru	1986–1988, 1991–1997, 1999–2006, 2010	19
Philippines	1986–1992, 1995–1996, 1998–1999, 2001–2006, 2008–2012	22
Poland	1981–2012	32
Portugal	1990–1996, 1998–2011	21
Romania	1990–2011	22
Russia	1993–2009, 2011–2012	19
Rwanda	1999–2011	13
Senegal	1992, 1997, 1999, 2004–2010	10
Sierra Leone	2001–2002	2
Slovak Republic	1994–2012	19
Slovenia	1993–2012	20
South Africa	1992–1994, 2012	4
South Korea	1981–2011	31
Spain	1986–2012	27
Sri Lanka	2010–2011	2
Sweden	1981–2012	32
Switzerland	1993–1996, 1998–2012	19
Syria	2003–2007	5
Tajikistan	1994–1995, 1999–2009	13
Tanzania	1992–2005, 2010	15
Thailand	1988, 1990, 1993, 1995–2011	20
Togo	2006–2007, 2010–2011	4

Trinidad and Tobago	1989, 1991–1993, 1999–2004	10
Tunisia	1986–2002	17
Turkey	1984, 1988–1995, 1997–1999, 2001–2012	24
Uganda	1990–1996, 1999–2004, 2006, 2008–2011	18
Ukraine	1994–1996, 1998–2010	16
United Kingdom	1981–2012	32
United States	1981–1996, 1998–2012	31
Uruguay	1989–1992, 1996, 1998–2010	18
Venezuela	1981–1992, 2000, 2002–2004, 2008–2009	18
Vietnam	1998–2003, 2005–2011	13
Zambia	1998–2000	3
Zimbabwe	2010–2011	2