

# Monetary Policy, Asset Price Inflation and Inequality

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*Academic year 2016/2017*  
Master's Thesis

Let us then first state what is really before us in this controversy much neglected in economic science: neither more nor less than the scientific foundation of a rational economic policy. For it is obvious that any artificial outside interference in the economic sphere will be without sense, unless the preliminary question of whether anything can be accomplished through the influence of “power” in opposition to the “natural economic laws” can be answered in the affirmative. The problem is to gain a clear and correct insight into the extent and nature of the influence of “control” against the natural course of economic phenomena. This is what we must see, or we shall grope in the dark!

— *Eugen von Böhm-Bawerk, Control or Economic Law, 1914*

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<sup>0</sup>I wish to thank Tate Fegley, Karl-Friedrich Israel, Floy Lilley and Dr. Mark Thornton for reviewing early drafts of this paper and making important suggestions. I wish also to thank the Ludwig von Mises Institute and its entire staff whose help and support was essential in the making of this thesis. A version of this work won the Aldrich Graduate Prize for the best graduate student paper at the Austrian Economics Research Conference in Auburn, Alabama the 11th of March 2017.

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# 1 Introduction

Although today high levels of inequality in the United States remain a pressing concern for a large swath of the population, monetary policy and credit expansion are rarely mentioned as a likely source of rising wealth and income inequality. Focusing almost exclusively on consumer price inflation, many economists have overlooked the redistributive effects of money creation through other channels. One of these channels is asset price inflation and the growth of the financial sector. As we will see in this paper, money creation under modern central banking can lead, under certain conditions, to a significant rise in inequality. It will be argued that inflation combined with modern central banking contributed significantly to the staggering rise in inequality since the 1980's.

With the publication of Piketty's *Capital in the Twenty-First Century*, the subject of inequality has gained significant traction in public debates. Thomas Piketty, with some other intellectuals such as Anthony Atkinson, repackaged the old Marxian concern of the concentration and centralization of capital and gave this theory scientific credibility. Increasing inequality, for Piketty and his acolytes, is the consequence of some "fundamental laws of capitalism." The only way to thwart this tendency, they argue, would be to adopt high marginal tax rates, strong trade unions and a high minimum wage.

This thesis offers an alternative explanation for the increase in inequality that occurred in many developed countries for the past 40 years. What will be suggested to the reader is that the rapid increase of top incomes is the result of our inflationary monetary system which expanded the size of the financial sector above what would have been its natural level in an unhampered free-market economy.

But before we continue, we must make it clear that the point made in this work is not that inflation universally increases inequality. This is obviously not the case. To be more specific, the belief in some "general law of capitalism" is misleading. It is true that economics formulates some laws of distribution, but Piketty, as Marx before him, is mistaken to argue that there exist some general laws of distribution that will help us predict what will be the evolution of income and wealth inequality in the future. Economic theory can tell us how the factors of production are remunerated on the free-market but it does not, and cannot, show any tendency toward a reduction or increase in income and wealth inequality on the free market. Economics is the study of the laws of human action and valuation. Whereas the laws of demand and supply are general because they do not depend on the value scales of specific individuals, such is not the case in regards to the distribution of wealth and income. It is impossible to formulate any theory on *a priori* grounds which could predict the evolutions in inequality. This is so, not because the evolution in the distribution of wealth and income partially depends on individual valuations, but because it depends exclusively on individual valuations.<sup>1</sup>

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<sup>1</sup>On this point, Rothbard (2016) rightly points out that "The Austrians thus showed that on the free market there is no separation whatever between 'production' and 'distribution.' The values and demands of consumers determine the final prices of the consumer goods, the goods purchased by consumers, which set the direction for productive activity, and in turn determine the prices of the cooperating units of factors: the individual wage rates, rents, and prices of capital equipment. The 'distribution of income' was simply the consequence of the price of each factor." See also Mises (1912, p.183): "The proposition is as true of money as of every other economic good, that its distribution among individual economic agents depends on its marginal utility."

This is true both for the unhampered market economy and the planned economy; the main difference being that distribution on the unhampered market depends on the consumers' subjective valuations whereas the dictator's own valuations are what command distribution in a socialist economy.

The main goal of this thesis is to understand and test the effects of inflation on inequality. One channel through which inflation is identified as impacting heavily the rich is asset prices. The first political economists, from the beginning of the 17th century onward, were very suspicious of the effects of inflation on the distribution of wealth. As we will see, Cantillon was the first known author to emphasize how money production redistributes wealth and income. Our brief review of the literature therefore starts with Cantillon and finishes with the modern literature (Section 2). Our research being an extension of Cantillon's ideas, we explain how including the idea of Cantillon effects in our analysis could add to the literature.

It is then explained what are the relationships between monetary inflation and asset price inflation on the one hand and asset price inflation and inequality on the other hand. Evidence is given to support our claim that money supply growth inflates the size of the financial sector and engenders asset price inflation. We also explain why this phenomenon benefits mostly the richest in society (Section 3.1). However, the effect of monetary policies on asset prices and, in turn, on inequality, might change with the evolution of the regulatory and tax structure. We explain how in section 3.2.

Finally, we illustrate our model with both time series data for the United States (Section 4.1) and panel data for 10 OECD countries (Section 4.2). The results are interpreted and the conclusion follows. Some ideas for further research are given.

## 2 Review of the debates from Richard Cantillon to today.

### 2.1 A short history of the Cantillon effect

David Hume is often credited for having developed the idea of monetary neutrality -i.e. the idea that money affects nominal prices but does not real prices.<sup>2</sup> By definition, the idea of money neutrality excludes the identification of any causal effect between monetary policy and inequality. Money creation, however, is never neutral (Hayek, 1932), whether it is on macroeconomic variables or on the distribution of wealth and income. It is only because money is not neutral that studying the effect of inflation on inequality is relevant.

It is a predecessor to Hume, the Franco-Irish economist Richard Cantillon (1755), who was among the first to notice the redistributive effects of monetary creation.<sup>3</sup> In his *Essay on the Nature of Commerce in General* (1755), Cantillon writes:

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<sup>2</sup>David Hume (1752) writes: "If we consider any one kingdom by itself, it is evident, that the greater or less plenty of money is of no consequence; since the prices of commodities are always proportioned to the plenty of money." However, a careful reading of Hume makes it clear that he was aware of the redistributive effects of money creation. Thus Hume (1752) writes "When any quantity of money is imported into a nation, it is not at first dispersed into many hands; but is confined to the coffers of a few persons, who immediately seek to employ it to advantage."

<sup>3</sup>For a short introduction to the Cantillon effect, see: (Morgenstern, 1972).

An increase of actual money in a state always causes an increase of consumption and a routine of greater expenditures. But the higher prices caused by this money does [sic] not affect all commodities and merchandise equally. Prices do not rise proportionally to the quantity of money, unless what has been added continues in the same circulation channels as before. (p.157)

For Cantillon, the effects of an increase in the money supply on the price level is gradual and involves a change in relative prices. The first ones to receive the newly created money see their incomes rise whereas the last ones to receive the newly created money see their purchasing power decline as consumer price inflation comes about.<sup>4</sup>

Hence, non-neutrality of money was a key feature of Cantillon's theoretical framework. Cantillon argued, for instance, that the effect of money creation on the interest rate will be completely different whether the newly created money is first handed to the consumers or to lenders. If the newly created money is given first to lenders, Cantillon argued, then the interest rate will be lower as the supply for loanable funds increases. If consumers are the first to receive the newly created money, on the other hand, then the increased consumption will induce entrepreneurs to borrow in order to increase their production capacity, thus increasing the interest rate (Cantillon, 1755, p.178).

Cantillon was also aware that an increase in the number of banknotes was responsible for increases in asset prices. Cantillon, after all, was a banker who lived to see both the Mississippi bubble and the South Sea Company bubble pop.<sup>5</sup> Thus, Cantillon (1755, p.238) writes:

In 1720, the shares of public stock in private companies in London, which were bubbles and scams, rose to the value of 800 million sterling. Yet, purchases and sales of such venomous stocks were carried out without difficulty by the quantity of notes of all kinds that were issued and the same paper money was accepted in payment of interest.

Cantillon not only was conscious of the causal link between inflation and the rise in security prices but also emphasized on the redistributive effects of asset price inflation. Banks with the help of the State can expand credit, lower the interest rate and thus make security prices rise. But, Cantillon (1755, p.243) argued, these policies who "open the door to making large fortunes, are rarely carried out for the sole advantage of the state, and those who take part in them are generally corrupted."

Following Cantillon and contrary to Fisher and other monetary theorists of his time, Mises (1912) emphasized these "Cantillon effects" affecting the distribution of income and wealth. Contrary to his master Eugen von Böhm-Bawerk, who was reluctant to admit the real impact of money because he was used to thinking of

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<sup>4</sup>It should be mentioned here that these redistributational effects depend on the inflation of the money supply rather than on the actual emergence of price inflation. Even in a context of price deflation prices will be higher than they would otherwise have been without an expansion of the money supply and a redistribution of wealth and income from the late receivers to the early receivers is set in motion (Israel, 2016a).

<sup>5</sup>On Cantillon's life as a banker, see: (Murphy, 1986).

money in aggregate terms, Mises showed that money is never neutral. Whereas Böhm-Bawerk argued inflation would merely affect the relationship between debtors and creditors, Mises placed the Cantillon effect at the heart of his monetary theory (Hülsmann, 2007, p.241). Not only, Mises was the first to prove that marginal utility analysis could apply to money as it does for any other goods, but he also became the first economist to explain the Cantillon effect by using subjective utility analysis. In his *Theory of Money and Credit* (p.184), Mises writes:

In a state of affairs corresponding to these suppositions of ours, all economic goods, including of course money, tend to be distributed in such a way that a position of equilibrium between individuals is reached, when no further act of exchange that any individual could undertake would bring him any gain, any increase of subjective value. In such a position of equilibrium, the total stock of money, just like the total stocks of commodities, is distributed among individuals according to the intensity with which they are able to express their demand for it in the market. Every displacement of the forces affecting the exchange-ratio between money and other economic goods brings about a corresponding change in this distribution, until a new position of equilibrium is reached.

In other words, with an increase in the stock of money, the cash balances of the early receivers of the newly created money increase. Correspondingly, the marginal utility they give to money decreases and the individuals in question buy either investment or consumption goods, thus bidding up the prices of those goods and increasing the cash balances of their sellers. With this step by step process, the price of goods will increase only progressively and affect both the distribution of income and wealth as well as the different price ratios.

In both Cantillon's and Mises' works, the emphasis is on the redistributive effects of the production of money rather than of the price level. The modern literature on inflation and inequality, on the other hand, has become rather obsessed with price inflation, thus overlooking most of the problem. Of course, price-inflation, by modifying the expectations of the debtors and creditors on the market, also has its own redistributive effects. These effects, however, tend to disappear in the long run as the originary interest rate cannot be lower than the social rate of time preference forever (Mises, 1949). This is why a special emphasis must be put on the production of money and its effects.

## **2.2 Inflation and inequality according to the first political economists**

In France, John Law's system in the early 18th century and the assignats inflation during the French Revolution brought discredit upon inflation and paper-money. John Law, a Scottish banker, was determined to create a new sort of money that was not gold or silver. At the height of his power, he controlled the Royal Bank, and thus the supply of money. Conducting an expansionist monetary policy, Law fueled what is called the Mississippi bubble -i.e. asset price inflation.<sup>6</sup> As put succinctly by Murphy (1986, p.78): "[Law] had increased the money supply and so oiled the

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<sup>6</sup>On the Law system and the early speculative bubbles, see: (French, 2009).



speculative wheels of the stock market, he promised an extremely high dividend to increase the attractiveness of shares, and he was channeling more shares on to the market.”

It was during the 1720 Mississippi bubble that the word “millionaire” was created, whereas, as stated by Hamilton (1937, p.461), “Law’s system was a catastrophe to the labouring class.” A similar increase in inequality was felt with the assignats inflation during the French Revolution. Andrew Dickson White (1933, p.63) argued that one of the most negative consequences of fiat money inflation during the revolutionary years “was the breaking down of the morals of the country at large, resulting from the sudden building up of ostentatious wealth in a few large cities, and from the gambling, speculative spirit spreading from these to the small towns and rural districts.” John Law’s system and the assignats made the redistributive effects of inflation clear to the eyes of many of the first economists. Inflation, by spurring speculation and making asset prices rise, was seen as increasing inequality.<sup>7</sup>

The 19th Century economists, on the other hand, wrote very little on the effects of inflation and credit expansion on inequality. After Cantillon and some physiocrats, the subject was either left untreated by English and French economists or was the subject of only a few superficial remarks. J.B. Say in his *Traité d’économie politique* for instance, despite dedicating an entire part to the distribution of wealth, does not say anything about the influence of paper money on either speculation or inequality. Similarly, Adam Smith and Ricardo focused on the effect of inflation on public finances and ignored almost entirely its redistributive effects because they tended to believe in the neutrality of money.<sup>8</sup> As we will see, it seems that economists in America favoring sound money were the only ones to truly grasp our subject.

The reasons why the overwhelming majority of classical economists did not bother with the effects of inflation on inequality are many and there is no space here to dwell upon them. But although Ricardo, because of his focus on long term equilibrium and his aptitude to reason in terms of aggregates, could not perceive money otherwise than as a veil, such was not the case of other members of the Currency School, many of whom were highly critical of the effects of paper money on speculation<sup>9</sup> and a few of whom were critical of the effects of an excess of paper money on the distribution of wealth and income.<sup>10</sup> Malthus, in an unsigned review of Ricardo’s first pamphlet, writes:

Whenever, in the actual state of things, a fresh issue of notes comes into the hands of those who mean to employ them in the prosecution and

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<sup>7</sup>For instance, the French physiocrat economist Dupont de Nemours (1790), a fierce opponent to the assignats, writes: “les assignats sont BONS pour LES GENS RICHES qui ont beaucoup de dettes à payer au pauvre peuple, qui voudraient bien lui donner du papier, tel quel, au lieu d’écus, et qui voudraient bien encore lui vendre leur blé et leur vin le double de ce qu’ils valent.”

<sup>8</sup>David Ricardo’s reaction to Henry Thornton’s non-neutral monetary economics led him to defend the idea of monetary neutrality. See: Rothbard (1995, p.193-198).

<sup>9</sup>See for instance: Thornton (1802, p.195), Parnell (1828, p.38) or McCulloch (1851, p.156).

<sup>10</sup>See for instance the American economists quoted below, p.10-11. However generally, the Currency theory “did not enter into a discussion of the way in which the market and the whole apparatus of production and distribution react to credit expansion. This task was accomplished by Austrian theory.” (Mises, 2000, p.126). As for the members of the Banking School, their oversight about the effects of an excess of banknotes and credit on the enriching of speculators and more generally on the distribution of income and wealth was a theoretical necessity. Tooke, for instance, argued that a speculative price rise is always the cause rather than the consequence of an inflation of credit. See: Rist (1966, p.214-219).

extension of profitable business, a difference in the distribution of the circulating medium takes place, similar in kind to that which has been last supposed; and produces similar, though of course comparatively inconsiderable effects, in altering the proportion between capital and revenue in favour of the former. The new notes go into the market as so much additional capital, to purchase what is necessary for the conduct of the concern. But, before the produce of the country has been increased, it is impossible for one person to have more of it, without diminishing the shares of some others. This diminution is affected by the rise of prices, occasioned by the competition of the new notes, which puts it out of the power of those who are only buyers, and not sellers, to purchase as much of the annual produce as before : While all the industrious classes, all those who sell as well as buy, are, during the progressive rise of prices, making unusual profits; and, even when this progression stops, are left with the command of a greater portion of the annual produce than they possessed previous to the new issues. (quoted in: Hayek, 1932).

In America, the 1819 panic became a fertile ground for the development of the hard money Jacksonian movement which, adopting many theoretical elements of the Currency School, emphasized the redistributive effects of money and fiduciary credit creation. In his article *The Credit System and the Aristocracy*, published in 1837, William Leggett denounces the inflationary system of banking monopoly and fractional reserve banking benefiting the few and writes:

We avow ourselves the friend of credit -so much its friend, that we are willing to see it cramped by arbitrary restrictions. We would have it left to the unbounded freedom of nature. We would have it, like the sunshine and dew of heaven, to dispense its blessings equally upon all. We would have it, like a bounding river, to flow wither it listeth in its natural channels, not damned up between artificial barriers, and forced to run only in particular directions, fertilizing the lands of a favoured few, and leaving the rest to be parched with drought, or lie in sterile loneliness. (Leggett, 1984, p. 181)

And further:

[Our State banking system] is instituted to provide sinecures for a band of gentlemen pensioners. It was conceived in the stew of legislative prostitution, born in corruption, and smells to heaven with the rank odour of hereditary rottenness. How long will freemen -or men claiming to be free- consent to have this bastard offspring of fraud and folly for their master? How long will they consent to be the cringing vassals of a feudal system instituted for the support of such a contemptible baronage as our paper-money lords? (Leggett, 1984, p.185)

The hard-money Jacksonians identified correctly the redistributive effects of paper money creation through speculation on the stock market. This was particularly true for William Gouge who saw the redistribution of wealth and income in favor of the reckless speculator as one of the most deleterious consequences of bank induced

credit inflation. Gouge rejected the idea of monetary neutrality and argued that credit expansion was responsible for asset price inflation followed by a crisis. He writes:

The rise of prices that follows an expansion of Bank medium, and the fall that follows a contraction, do not affect all descriptions of labor and commodities, at the same time, in equal degree. Wages appear to be among the last things that are raised by an increase of Bank medium. The working man finds all the articles he uses in his family rising in prices, while the money rate of his own wages remains unchanged. (Gouge, 1833, p.26)

On the other hand, Gouge (1833, p.31) argues, “The reckless speculator, who has no capital [...] has much cause to be pleased with this system.”<sup>11</sup> For Gouge, the redistribution due to credit expansion was decreasing wages while enhancing profits -and especially the profits of the speculators.

The fact that many classical and pre-classical economists saw the relationship between inflation and inequality differently than the way we do today may simply indicate that there was something specific to the monetary regime of their time -i.e. the gold standard- or that other factors such as taxation and State interventionism changed this relationship. But it may also highlight a more general relationship between inflation and the rise in inequality.

## 2.3 Inflation and inequality in the contemporary and modern literature

Many intellectuals and economists continued to see inflation not as a way to reduce inequality but on the contrary as enriching a few speculators and capitalists until the interwar years. Still in 1923, in his *A Tract on Monetary Reform*, Keynes confirms that “it has long been recognized, by the business world and by economists alike, that a period of rising prices acts as a stimulus to enterprise and is beneficial to business men.” whereas, Keynes says, “it has been commonplace of economic textbooks that wages tend to lag behind prices, with the result that the real earnings of the wage-earner are diminishing during a period of rising prices.”<sup>12</sup> As late as in 1931 Keynes argued in his *Essays in Persuasions* that there is a positive relationship between inflation and inequality. He described those who benefit from inflation as “the ‘profiteers’ [...] the entrepreneur class of capitalists, that is to say, the active and constructive element in the whole capitalist society, who in a period of rapidly rising prices cannot but get rich quick whether they wish it or desire it or not. If prices are continually rising, every trader who has purchased for stock [sic] or owns property and plant inevitably makes profits. [...] The profiteers are a consequence and not a cause of rising prices.”

As for the Russian socialist Vladimir Lenin, he himself argued that inflation deepens inequality:

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<sup>11</sup>To learn about Gouge’s ideas on the effect of bank credit expansion on the stock market, see: (Gouge, 1833, p.73-78).

<sup>12</sup>In that respect, Keynes (1923, p.4) believed that the redistributive effects of inflation were worse than those brought by deflation: “Each process, Inflation and Deflation alike, has inflicted great injuries. Each has an effect in altering the distribution of wealth between different classes, Inflation in that respect being the worse of the two.”

Everybody recognizes that the issue of paper money is the worst kind of a compulsory loan, that it worsens the conditions principally of the workers, of the poorest section of the population, that it is the chief evil in the financial confusion. [...] The unlimited issue of paper money encourages speculation, allows the capitalists to make millions, and places tremendous obstacles in the path of the much-needed expansion of production; for the dearth of materials, machines, etc., grows and progresses by leaps and bounds. How can matters be improved when the riches acquired by the rich are being concealed?<sup>13</sup>

Things changed with WWI which gave way to violently inflationist policies. When John Maynard Keynes, changing his former stance on inflation and inequality, wrote in 1936 about “the euthanasia of the rentier,” he was deeply impressed by what he observed around him -i.e. the reduction of income inequality as well as the rise of inflationism. At this point, he thought, inflation was the best way to reduce accumulated wealth.

More recently, some economists argued that it is contractionary rather than expansionary monetary policy which is partly to blame for the rise in inequality since the early 1980s. Coibion *et al.* (2012) argue that contractionary monetary policy shocks have significant long-run positive effects on inequality of income, labor earnings, consumption and total expenditures inequality across households. Similarly, James K. Galbraith (1998) has argued:

Rising wage inequality is neither inevitable nor mysterious nor necessary nor the dark side of a good thing, but was brought on, mainly, by bad economic performance. . . . What caused bad economic performance? Economic policy, and very specifically monetary policy, changed. [...] [T]he government abandoned the goal of full employment and instead turned its attention to a fight against inflation. For this purpose, only one instrument was deemed suitable: high interest rates brought into being by the Federal Reserve. There followed a repeated sequence of recessions. [...] The high unemployment that these recessions produced generated the rise in inequality. For this, the Federal Reserve, under its reputable chairmen Arthur Burns, Paul Volcker and Alan Greenspan, stands primarily (though not solely) responsible.

Of course, Galbraith (1998)’s argument holds only if there is a trade-off between inflation and unemployment -i.e. if there is such a thing as a negatively sloped Phillips curve. This, however, is doubtful, especially in the long run (Israel, 2016a).<sup>14</sup>

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<sup>13</sup>See my article (Rouanet, 2015).

<sup>14</sup>Arguing that employment is improved by an inflation of the money supply has become the main argument used by central bankers against those accusing easy money to foster inequality. In his April 27th 2017 press conference, Mario Draghi stated that “the employment creation should benefit the poorer households. So this is a response to those who are criticizing our asset purchase programme as increasing inequality. There is no better measure to improve equality than increasing employment.” Mr. Draghi’s argument -which is essentially the same as Bernanke’s (2015)- is that asset price inflation fosters investment and consumption and thus improves employment. Interestingly, this argument -which is just a rehash of Keynes’ trickle-down argument- implies the existence of the Cantillon effect. It assumes that relative prices will be changed, that asset holder will benefit from the newly created money generating asset price inflation and will therefore increase their spending. Although Mr. Draghi’s argument might sometimes be valid in the short run, unemployment in the long run will tend to be determined by the structural rate of unemployment.

A more skeptical view on the effect of inflation on the distribution of wealth and income comes from Piketty (2014) who argues that even though inflation can, in some circumstances, reduce inequality, it can also potentially increase inequality. Piketty (2014) argues that there is a tendency toward greater inequality under capitalism as the return on capital ( $r$ ) can be durably superior to the growth rate ( $g$ ). The question then, for Piketty, is to know how much inflation affects both  $r$  and/or  $g$ . If Piketty agrees that in the short run unanticipated inflation might make the distribution of wealth and income more equal, he nonetheless argues that in the long run the return on capital  $r$  -and therefore the dynamic of inequality- is not affected by inflation. Piketty (2014, p.133-134) writes:

The mechanism of redistribution via inflation is extremely powerful, and it played a crucial historical role in both Britain and France in the twentieth century. It nevertheless raises two major problems. First, it is relatively crude in its choice of targets: among people with some measure of wealth, those who own government bonds (whether directly or indirectly via bank deposits) are not always the wealthiest: far from it. Second, the inflation mechanism cannot work indefinitely. Once inflation becomes permanent, lenders will demand a higher nominal interest rate, and the higher price will not have the desired effects.

As Piketty (2014, p.149) explains, “the limited amount of private saving was largely absorbed by enormous public deficits, especially during the wars: national saving, the sum of private and public saving, was extremely low in Britain, France, and Germany between 1914 and 1945. Savers lent massively to their governments, in some cases selling their foreign assets, only to be ultimately expropriated by inflation.” But Piketty (2014, *ibid.*) nonetheless does not see inflation as systematically decreasing inequality since “on the contrary,” he writes, “it probably helps to make the distribution of capital more unequal.”

Other authors have argued that inflation causes - or is likely to cause - a rise in inequality. For instance, Albanesi (2007), using observations from a large sample of countries, finds a positive correlation between inflation and inequality in the post-war period. The causal relationship identified in his work between inflation and inequality is indirect; it does not give any role to Cantillon effects. Albanesi’s hypothesis is that the correlation between inflation and inequality is the outcome of a distributional conflict underlying the determination of fiscal policy. As lower income households are more vulnerable to inflation, Albanesi argues, their bargaining position is weakened in the determination of fiscal policy.

Balir (2001) finds a non-linear relationship between inflation and inequality. Whereas a reduction of inflation from hyperinflationary levels significantly lowers inequality, Balir finds that further reduction toward a very low level of inflation leads to negligible increases in inequality. Balac (2008) finds a positive correlation between inflation of the money supply and inequality in the United States after 1980. Finally, Israel (2016a) argues that inflation increases inequality developing similar arguments as ours but does not give any empirical evidence on this point. Dorobat (2015) also arrives to our conclusions following a similar line of reasoning but focuses mostly on the international distribution of wealth.

Despite their disagreements on monetary theory, the general consensus is that changes in the purchasing power of money redistributes income and wealth. How-

ever contemporary economists, especially since the development of rational expectations theory, tend to believe that only unexpected inflation redistributes income and wealth (Dorobát 2015, p.58-62).<sup>15</sup> But if inflation only redistributes income and wealth when it is unanticipated, then the redistributive effects of inflation can be almost entirely erased by drafting better contracts. The indexing of labor and credit contracts to inflation, for instance, limits the redistribution of wealth from the creditors to the debtors. This kind of redistribution, however, is only one of the many ways monetary changes affect the distribution of income and wealth. It is true that changing expectations will change the channels through which the newly created money finds its way in the economy. Correct expectations, however, do not suppress the Cantillon effects, they merely alter them. As long as changes in the money supply do not affect the cash balances of all individuals at the same time, and as long as monetary changes affect the diverse judgments of value neither to the same extent nor at the same time, money will not be neutral.<sup>16</sup>

Because even with the most perfect expectations, the Cantillon effects do not vanish, one clear problem in the literature on inequality and inflation is that it focuses almost exclusively on consumer price inflation and does not distinguish between the different money creation channels. Consumer price inflation is only one aspect of inflation and to focus only on this aspect can have fatal economic consequences (Brown, 2014). Nonetheless, virtually all empirical work on the distributional effects of inflation gives little consideration to asset price inflation.

### 3 Inflation and Asset Price Inflation, Asset Price Inflation and Inequality

#### 3.1 An elastic money supply as a necessary precondition for asset price inflation

In accordance with the Cantillon effect, inflation can increase inequality depending on the channel it takes, but increasing inequality is not a necessary consequence of inflation. If it happened that the poorest in society were the first receivers of the newly created money, then inflation could very well be the cause of decreasing inequality. In order to study its possible effects we can distinguish at least four

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<sup>15</sup>The attachment of new classical economists to the concept of monetary neutrality obviously excludes the possibility of any Cantillon effect. What is surprising however is that the absence of any Cantillon effect for the new classicals is the result of their unrealistic assumptions rather than of a demonstrated proof. The most striking example of this can be found in Lucas (1972) where his framework includes “N identical individuals” and where “the only exchange which can occur will involve a surrender of output by the young, in exchange for money held over the preceding period” in two “physically separated markets.” In other words, there are no relative prices in Lucas’ model and money is not a medium of exchange but simply a *numéraire*. As the Cantillon effects consist in changes in relative prices, it can easily be seen how Lucas’ descriptively false assumptions leaves those effects aside. It is doubtful that the use of such false assumption instead of the use of abstractions focusing on only a few selected features of reality can ever be useful. On a criticism of these “precise abstractions,” see: (Long, 2006).

<sup>16</sup>We can add other reasons why money can never be neutral, in particular the fact that the production period of different goods is generally different while labor and capital is generally at least partially specific.

different types on consumer price inflation:

- 1) An increase of the money base
- 2) An increase in the amount of bank credit
- 3) Currency devaluation
- 4) A decrease in the demand for money

Each of those four channels have obvious redistributive effects. However, each channel is likely to benefit different groups and thus to affect inequality differently. The effects may be quite opposite depending on whether the additional money comes first into the hands of traders and manufacturers or directly into the hands of salaried people employed by the State. If inflation is used to finance government deficits, then it will benefit mostly the State itself and its suppliers. If inflation is caused by currency devaluation, then there will be redistribution from consumers to exporters.

Under modern central banking, money is created and injected into the economy through the credit channel and first affects financial markets. Under this system, commercial banks and other financial institutions are not only the first receivers of the newly created money but are also the main producers of credit money. This is so because banks can grant loans unbacked by base money. In a free-banking system, this credit creation power of banks is strictly limited by competition and the clearing process. Under central banking however, the need for reserves is relaxed as banks can either sell financial assets to the central bank in open market operations, or the central bank can grant loans to banks at relatively low interest rates. In both cases, central banks remove the limits of credit expansion by determining the total reserves in the banking system (Rothbard, 1983, p.141-160). In other words, commercial banks and other financial institutions are credited with so-called base money that has not existed before.<sup>17</sup> Thus the economics of Cantillon effects tells us that financial institutions benefit disproportionately from money creation, since they can purchase more goods, services, and assets for still relatively low prices.

We can list four main reasons why the growth of financial markets is triggered by an expansion of the money supply:<sup>18</sup>

- (1) because financial titles are often used as collateral in debt contracts;
- (2) because the anticipation of price-inflation, which is a common trait among all fiat money regimes, discourages the hoarding of money thus encouraging both the demand for and the supply of financial titles;
- (3) because the production of money through central banks is a matter of sheer human will and is therefore prone to developing moral-hazard in the financial world.<sup>19</sup> This leads to an artificially high demand for financial titles and increases the supply of such titles by the same token (Hülsmann, 2014).
- (4) because the manipulation of credit by central banks and banks, by lowering the interest rate in the short run, particularly affects the demand for capital and the capital structure during the course of the business cycle (Bagus, 2008). Thus, credit expansion increases the volatility of asset prices and generates many opportunities for investment and arbitrage. In addition to that, an expansion of credit means more funds will be available to make financial transactions. Hence, credit expansion is likely to increase the volume of transactions and benefit the banks and other financial

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<sup>17</sup>On the redistributive effects of credit expansion, see: (Hülsmann, 2013).

<sup>18</sup>The three first reasons are given by Israel (2016a).

<sup>19</sup>In this sense Ludwig von Mises was right when he said that “Gold has one virtue: that it cannot be printed.” in: [https://www.youtube.com/watch?time\\_continue=39&v=1\\_OPSyGc1A8](https://www.youtube.com/watch?time_continue=39&v=1_OPSyGc1A8)



institutions to whom commissions must be paid at every transaction. Other people such as financial advisors will also benefit from this trend.

One of the most visible consequence of this growth of financial markets triggered by monetary expansion is asset price inflation. Piketty (2014) argues that “the average asset price (that is, the average price of real estate and financial securities) tends to rise at the same pace as consumer prices.” There is, however, no reason to believe this is true since, as we have pointed out, in the context of modern central banking the financial sector tends to be the first receiver of the newly created money supply. Asset prices therefore tend to rise faster than consumer prices as a consequence of an inflation of credit to the private sector (Figure 1).

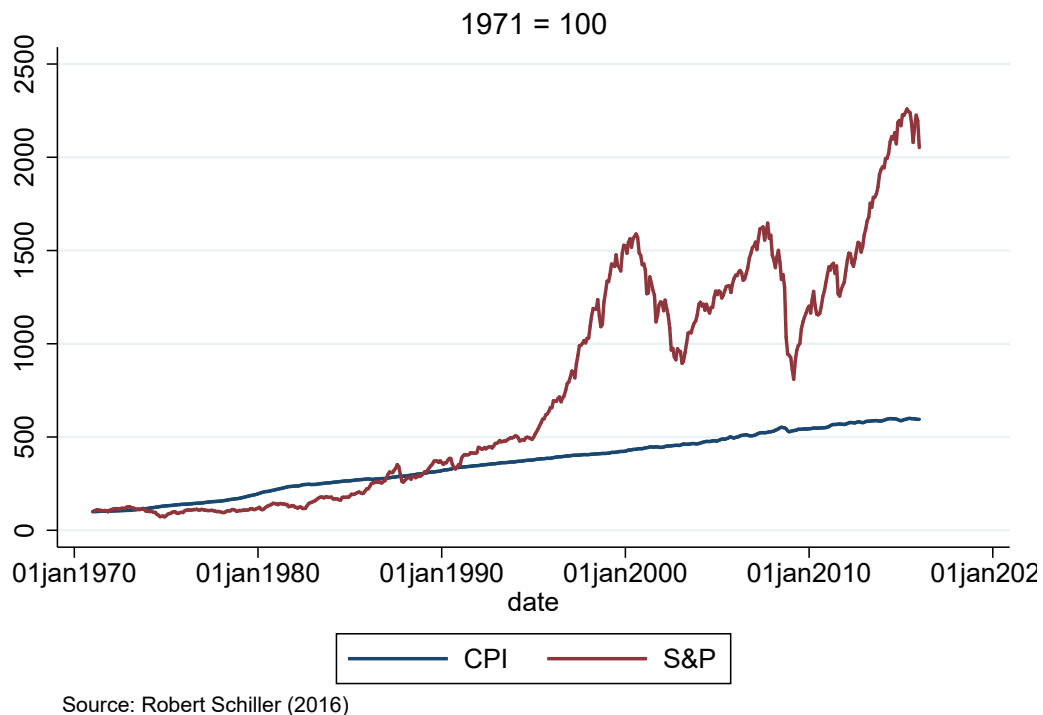


Figure 1: Consumer price inflation and asset price inflation in the United States.

Most monetary economists ignored -and continue to ignore- asset-price inflation and do not see it as a consequence of an inflated money supply. A reader of *A Monetary History of the US* (1963) by Friedman and Schwartz or of Allan Meltzer’s *A History of the Federal Reserve* (2004) will not find one mention of asset price inflation.<sup>20</sup> This oversight leads to the effects of inflation on inequality to be underestimated or ignored. Periods of monetary inflation such as the 1920’s or the 2000’s came with a high rate of asset-price inflation but relatively stable consumer prices.<sup>21</sup> Therefore, to focus on consumer price inflation as the only variable accounting for monetary policy leaves out most of the effects of money creation on inequality.

In a completely sound money system where credit only depends on the amount of saving rather than on fiduciary credit, there is very little room for generalized and persistent asset-price inflation as the amount of funds which can be used to purchase

<sup>20</sup> A notable exception can be found with Alchian and Klein (1973) who make the case for including asset prices in measures of inflation.

<sup>21</sup> On the monetary inflation of the 20’s, see: (Rothbard, 1972).



assets is strictly limited. In other words, the phenomenon of asset-price inflation is a child of credit inflation. In his work on the stock market, Fritz Machlup (1940) showed it was impossible to pursue credit expansion without making stock prices and fixed investments rise. As Machlup (1940, p.90) writes, “[i]t is impossible for the profits of all or of the majority of enterprises to rise without an increase in the effective monetary circulation (through the creation of new credit or dishoarding).” And later:

If it were not for the elasticity of bank credit [...] a boom in security values could not last for any length of time. In the absence of inflationary credit the funds available for lending to the public for security purchases would soon be exhausted, since even a large supply is ultimately limited. The supply of funds derived solely from current new savings and current amortization allowances is fairly inelastic. [...] Only if the credit organization of the banks (by means of inflationary credit) or large-scale dishoarding by the public make the supply of loanable funds highly elastic, can a lasting boom develop. [...] A rise on the securities market cannot last any length of time unless the public is both willing and able to make increased purchases. (Machlup, 1940, p.92)

Similarly, as Huerta de Soto (2009, p.461) writes:

Only when the banking sector initiates a policy of credit expansion unbacked by a prior increase in voluntary saving do stock market indexes show dramatic and sustained overall growth. In fact newly-created money in the form of bank loans reaches the stock market at once, starting a purely speculative upward trend in market prices which generally affects most securities to some extent. Prices may continue to mount as long as credit expansion is maintained at an accelerated rate.

On an empirical level, Bordo and Wheelock (2004) find that “many booms also occurred during periods of relatively rapid growth of the money stock and bank credit.”

At this point, we must distinguish between stocks and bonds which most of the time are affected very differently by inflation. In the case of stocks, their price will most probably increase before consumer prices as fiduciary credit reaches the stock market earlier. As Ludwig von Mises (1912, p.214) writes:

Under the modern organization of the monetary system [the adjustment of commodity prices] is usually first made on the Stock Exchanges. Speculation on the foreign-exchange and security markets anticipates coming variations in the exchange-ratios between the different kinds of money at a time when the variations in the value of money have by no means completed their course through the community, perhaps when they have only just begun it, but in any case before they have reached the commodities that play a decisive part in foreign trade. He would be a poor speculator who did not grasp the course of events in time and act accordingly.<sup>22</sup>

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<sup>22</sup>For some empirical evidence that asset price inflation precedes consumer price inflation, see: (Goodhart *et al.*, 2000).

In other words, the stock market, as Mises pointed out, often reacts quicker to changes in the money supply than consumer prices. On the other hand, the bond market is extremely sensitive to inflation as bonds are fixed-income securities. The coupon interest rate is often fixed in nominal terms until maturity and cannot be adjusted for inflation. Thus, inflation risk is the major type of risk associated with the bond market.

It is therefore not surprising that the return on stocks has been, since at least 1945, far greater than the return on bonds and bills. Whereas the annual geometric average return for the S&P500 was of 10.09% between 1967 and 2016, it was 4.83% for US 3-months T. Bill and 7.08% for US 10-years T. Bonds (Damodaran, 2017). In most countries for which long-run data are available, stocks have out-performed bonds. Nonetheless, bond prices might very well increase if an increase in the money supply lowering the interest rate comes with an increase in the demand for money, thus maintaining the consumer price level stable.

In Table 1, we look at the effect of a growth in the money supply stock prices in the United States from 1980 to 2013. The reason we chose this time period is due to the boom in both asset prices and inequality that occurred after 1980, the goal being to see if the production of money had an impact on this increase.<sup>23</sup> To do so, we use five measures of the money supply. Two of these measures represent the “Austrian” money supply -from now on referred as Ma- and was computed by the author (see: Appendix A). The three other measures are the more conventional money aggregates M1 and M2 and the monetary base.

Table 1: Monetary Inflation and Real Stock Prices.

VARIABLES (obs = 36)	$\Delta$ Real S&P Price (1)	$\Delta$ Real S&P Price (2)
$\Delta$ Ma2	0.3978	0.4376
$\Delta$ Ma1	-0.1737	-0.0839
$\Delta$ M1	-0.1600	-0.0584
$\Delta$ M2	-0.1807	-0.1915
$\Delta$ Monetary Base	-0.3823	-0.0033

Note : The numbers in column (1) represent the Bravais-Pearson correlation coefficients between the growth rates of real stock prices on the one hand and the growth of the money supply on the other hand. The numbers in column (2) represent Spearman’s coefficient between the same variables. We used Spearman’s coefficient because it is more appropriate if the relationship between the growth of the money supply and real asset prices is monotonic but non-linear. The results are for the United States between 1980 and 2015.

Sources: The data for housing and stock prices are from Shiller (2016). The *S&P Real Price Growth* variable was deflated by the CPI to give its real value. The measure of the CPI used was retrieved from Shiller (2016). For the two measures of the “Austrian” money supply, see Appendix A. For M1 and M2 and the monetary base, see: Board of Governors of the Federal Reserve System.

<sup>23</sup>As it will be explained in subsection 3.2, it is likely that as institutional conditions changed in the 1980, the inegalitarian effects of inflation were reinforced.

The results in Table 1 show a moderate positive correlation between the growth of Ma2 and real stock prices.<sup>24</sup> Furthermore, the correlation value between  $\Delta\text{Ma2}$  and the growth in real stock prices is superior to any of the correlation coefficients between the conventional monetary aggregates and real stock prices. The correlation coefficient for the other monetary aggregates revealed themselves to be very weak and negative. This indicates that our results are sensitive to the measure of the money supply we use. There is however a strong case to be made in favor of using the “Austrian” money supply as the correct measure of the money supply.<sup>25</sup>

Any empirical treatment of the relationship between real asset prices and the money supply is however at best illustrative and is not without defects. Most of all, it misses the larger picture, i.e. that it is the instauration of an “elastic money supply” by central banking and fractional reserve banking which makes sustained asset price inflation possible. The impact of an increase in the money supply on asset prices is not constant over time and probably not synchronized in time. But more importantly the effect of credit expansion on stock prices is of counterfactual nature.<sup>26</sup> Monetary easing during a crisis, for instance, leads to higher asset prices than they would otherwise have been and might lead to a future stock market boom. In other words, an increase in the money supply can be associated with a decline in stock prices and vice versa although an increase in the money supply does have a positive effect on stock prices in this period. When it comes to social phenomenon, the counterfactual can never be observed and cannot be accounted for in our regressions.

Increases in asset prices mostly benefit the wealthy for several reasons. First, the wealthy tend to own more financial assets than the poor in proportion to his income.<sup>27</sup> As the wealthy’s net worth increases, securities with continuously rising prices can be used as collateral for new loan requests. Second, it is easier for the richest individuals to contract debt in order to buy financial assets that can be sold later at a profit. Since credit easing lowers the interest rate and therefore funding costs, the profits made by selling inflated assets bought at credit will be even greater. Finally, asset price inflation coming with the growth of financial markets will benefit the workers, managers, traders, etc. working in the financial sector. It will also benefit the CEO’s of the publicly traded companies who will be paid more as the capitalization value of their company increases (Gabaix and Landier, 2008, 2014).

It should also be mentioned that long term inflation is possible only under the institutional framework of central banking. Central banking, nonetheless, can protect the *rentier* class without the manifestation of any intense price or monetary inflation in the long run. This was especially the case during the *belle époque* in France as noticed by Mises (1912, p.378-379):

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<sup>24</sup>We verbally describe the strength of the correlation using the guide that Evans (1996) suggests for the absolute value of the correlation coefficient.

<sup>25</sup>The Austrian money supply (Ma) -called True money supply by Dr. Salerno- is a measure of the quantity of money developed first by Rothbard (1972, 1976, 1978) and then refined by Salerno (2011). There is only one major difference between Rothbard and Salerno. While Rothbard included life insurances’ cash surrender values in the money supply, Salerno does not do so. This explains why we have two different aggregates representing Ma, Ma2 being equal to Ma1 plus cash surrender values. The authors’ computation of Ma are detailed in Appendix A.

<sup>26</sup>On the counterfactual nature of economic laws, see: (Hülsmann, 2003).

<sup>27</sup>This is verified in the data. A CBO report from 2011 shows that capital income and capital gains are highly concentrated and represent a much larger share of income for the top 1% than for any other segment of the population.

The lowness of the rate of discount is of extraordinary importance in French financial policy. In the interest of those classes of the community by which it is supported, the government of the third republic is obliged to avoid anything that might injure the high standing of the *rentes* which constitute the chief investment of those classes. Even a merely temporary high rate of discount is always dangerous to the *rentes* market, for it might induce some holders of *rentes* to dispose of their bonds in order to re-invest their capital more fruitfully, and the disturbance of the market that might result from this would have a disproportionately adverse effect on the quotation of the *rentes*.

It is thus obvious that how money is produced matters at least as much as the rate of increase of the money supply. An increase in the stock of money under a 100% reserves gold standard is not equivalent to a similar increase under a fiat money regime directed by a central bank. With a pure commodity standard, those who benefit from the newly created money are the market participants producing the commodity in question. With fiat money on the other hand, those who benefit from the newly created money are the first-receivers selected by central bankers.

In light of the important discretionary powers they enjoy, central banks fueling both asset price inflation and inequality might simply be the victims of elite capture. Rothbard (1984) argued that the Fed was intended as a cartelization device and succeeded in fulfilling this role. More recently, Acemoglu and Johnson (2012) argued that:

In recent decades, the Fed has given way completely, at the highest level and with disastrous consequences, when the bankers bring their influence to bear [...] As the American economy begins to improve, influential people in the financial sector will continue to talk about the need for a prolonged period of low interest rates. The Fed will listen. This time will not be different.

It can be argued that the rise in income inequality over the past 30 years has to a significant extent been the product of monetary policies fueling a series of asset-price bubbles. Whenever the market booms, the share of income going to those at the very top increases. When the boom goes bust, that share drops somewhat, but then it comes roaring back even higher with the next asset bubble.

After having analyzed the effect of the production of money on asset prices and inequality, the last question we must seek to answer in this section is the following: what would be the reaction of real asset prices if we went from a situation where the financial sector was the first receiver of the newly created money to a situation where the additions to the money stream stopped. Following the analysis of Cantillon effects, it is logical such a development would lead to a reduction in real asset prices as the newly created money continues to circulate away from the financial world and leads to a new equilibrium position where all the money prices have been adjusted. This, however, is merely a short term phenomenon.

It would nonetheless be even more useful if we could know what, counterfactually, will be the real price of financial assets *after* an expansion of the money supply reaching first the financial sector compared to *before*. If we assume constancy in individual preferences, and if the quantities of the different financial securities were

not changing during the money creation process, then it would be impossible to identify a systematic increase or decrease of real asset prices from the period before the production of money compared to the period after the production of money stopped. Quantities however are changed by monetary influences. As asset price inflation comes about as a consequence of the money creation process we described, the supply of financial securities is increased. This means that everything else being equal we can expect real asset prices to reach a lower level than the one prevailing before the change in the supply of money once no additional money is created.<sup>28</sup> This is a particularly important point since, if an expansion of the money supply was followed by an increase in the amount of securities but was not followed by a long term decline in real asset prices, then we could expect, under the assumption that the rich were the first receivers of the newly created money during the boom, that inequality will remain at higher levels after the boom compared to before. As noticed however, asset prices must be lower after the boom in real terms as their quantity increases.<sup>29</sup> Hence, if modern central banking were to end, the impact of the subsequent reduction in real asset prices on the financial position of the richest in society will be strongly negative. Everything else being equal, we should therefore expect the establishment of a truly sound money system not simply to stabilize but rather to reduce income and wealth inequality.

### **3.2 Taxation, Regulation and their influence on the relationship between monetary policy, asset prices and inequality**

Before we can present empirical evidence, we must examine the issue of whether taxation and the regulation of financial activities change the effect monetary policy has on asset prices and inequality. Expansionist monetary policies are likely to increase inequality whenever the first receivers of the newly created money increase their positions on financial markets, thus generating asset price inflation. But if investment in the stock market is deterred by regulations and high marginal tax rates, it is possible that the path of infusion of money and credit creation will not be directed toward investments on financial markets and will therefore neither engender asset price inflation nor inequality.

If we take the case of Sweden which is one country studied in section 4.2, the impact of inflation on inequality is likely to be very different before and after the 1980's. In 1980 Sweden was a highly regulated economy with virtually no stock market activity, regulated capital and credit markets, and with a debate about the so-called "employee investment funds," which were schemes designed to shift corporate ownership over to trade unions by mandating a share of stocks of larger companies be transferred to these funds in proportion to corporate profit. From the 1980's onward however, a number of reforms, starting with the deregulation of capital markets, international capital movements, tax reforms in the mid-1980s and early 1990's, and the abolition of the employee investment funds in the early 1990's,

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<sup>28</sup>This point is an adaptation of Hayek's (1941, p.33-35) demonstration about the self-reversing nature of monetary changes.

<sup>29</sup>It also means that monetary factors have changing long term effects depending on how elastic is the supply of financial securities. This must be kept in mind as it implies that any statistical treatment of the subject will be partly unsatisfactory.

led to a rapid financialization of the economy.<sup>30</sup> Thus, inflation in Sweden before the 1980's probably did not engender the same redistributive effects than in the context of relatively less regulated financial markets.

Consumer price inflation can also indirectly affect inequality negatively through the tax regime of a country. For instance, before 1985, the U.S. income tax brackets were not indexed and inflation pushed income earners with unchanged real income into brackets where they faced higher marginal income tax rates, which discouraged people from making taxable income but could also reduce inequality in a context of high marginal income tax rates.<sup>31</sup>

Inflation distorts all aspects of the taxation of personal income but is particularly harsh on the taxation of capital gains. When corporate stock or any other asset is sold, current U.S. law requires that a capital gains tax be paid on the entire difference between the selling price and the original cost even though much of that nominal gain only offsets a general rise in the prices of consumer goods and services. Taxing nominal gains in this way substantially increases the effective tax rate on real price adjusted capital gains.

Some may argue that since the taxation occurs at the time of selling, high capital gains taxes may encourage investors to hold rather than sell -thereby avoiding the tax indefinitely. However, in the United States as in many other countries, individuals pay a substantial capital gains tax even though, when adjustment is made for the change in the price level, they actually receive less from their sale than they had originally paid.<sup>32</sup> Thus, in a context of inflation, the longer people hold on to an asset, the more inflation affects the value one gets from selling that asset. Although investors might “hoard” assets in a context of price stability, to do so in a context of inflation is very costly as investors are taxed on inflation.<sup>33</sup>

The effect of inflation on inequality is therefore likely to change with the tax rules. When capital gains taxes apply on nominal rather than on real capital gains, the effect of inflation on inequality will be lower or negative. In this context, inflation will increase the effective tax rate and will reduce the expected return on stocks. Consequently, incentives to invest the newly created money in the stock market is weakened and the real price of financial assets will be lower than they would have been otherwise. The higher the top marginal capital gains tax rate, the worse stocks are as hedges against inflation.

On the other hand, when capital gains taxation is indexed by the CPI -as it was the case, for instance, in Australia between 1985 and 1999, consumer price inflation does not weaken the attractiveness of stocks as investments. In this context, inflation will not have a negative effect on inequality through the capital gains taxation channel. On the other hand, the positive effects of asset price inflation on inequality will be lower in countries with high capital gains taxes even if capital gain taxes are indexed to inflation.

As we can see in figure 2, there seems to be a correlation between capital gain taxes and the growth of asset prices. Asset price inflation in the 1920's or the 1990's took place in a period of lower capital gains taxation whereas periods of higher

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<sup>30</sup>On the financial institution changes in Sweden and the role of capital gains in Swedish income inequality, see: (Roine *et al.*, 2012).

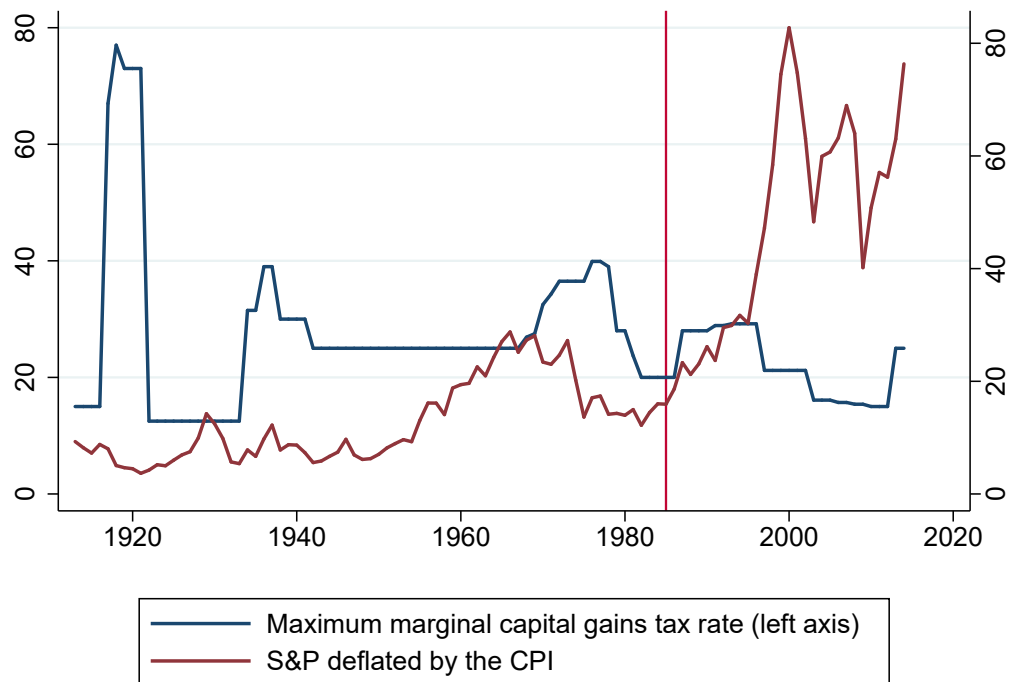
<sup>31</sup>On the distributional effects of inflation through the “bracket creep” effect according to which inflation pushes income into higher tax brackets, see: (Heer *et al.*, 2008).

<sup>32</sup>This is also the case, for instance, in France. See: (Salin, 2014).

<sup>33</sup><http://taxfoundation.org/article/inflation-can-cause-infinite-effective-tax-rate-capital-gains>



capital gains taxation such as the 1970's or during WWI was accompanied with poor stock market performance.



Source: Citizens for tax justice, Robert Schiller.

Note: The vertical line represents the 1985 indexing of personal income tax brackets to inflation.

Figure 2: Capital gain taxation and asset prices in the United States.

The graph above however is misleading in the sense that it tends to underestimate the top marginal tax rate on capital gains at certain periods and overlooks some changes in capital income taxation. For instance, during the 1970's -a period of poor stock market performance- the *Tax Reform Act* of 1969 made several major changes in the tax treatment of capital gains and losses. Among other things, it restricted the deductibility of long-term losses and increased the alternative tax rate on large amounts of capital gains income. Thus, not only the maximum rate on long-term capital gains rose from 25% under prior law to 35% but 50% of capital gains were included in taxable income taxed at a 70% rate. This change was phased-in over a three-year period and was fully in effect by 1972.

Reductions in capital gains taxation happened in most developed countries in the 1980's and 1990's. During the same period, top marginal income tax rates were reduced and some countries such as Australia between 1985 and 1999 or the United Kingdom between 1982 and 1998 indexed their capital gains tax to inflation.<sup>34</sup>

In the United States, capital gains taxation was reduced drastically in the early 80's. The 1981 *Economic Recovery Tax Act*, because of reductions in the top personal income tax rate from 70% to 50%, also reduced the maximum tax rate on long-term capital gains income from 28% to 20%. The proportion of capital gains included in taxable income had already been lowered from 50% to 40% in 1979.<sup>35</sup> Furthermore the 1981 Act enacted tax indexing of tax brackets -which took effect in 1985. As an important portion of capital gains are subject to the tax rate on personal income,

<sup>34</sup>On capital gains taxation in the United Kingdom, see: (Seely, 2010).

<sup>35</sup>On the legislative history of Individual capital gains taxation, see: (Esenwein, 1998).

this further reduced the effective tax rate on capital gains and reduced the increase of taxation induced by consumer price inflation.<sup>36</sup>

These changes in taxation and regulations most probably changed the channels taken by the newly created money and thus changed the impact inflation has on inequality. As Oskar Morgenstern (1972) brilliantly explains, inflation will have widely different effects depending on the “paths of infusion” of the newly created money. Morgenstern writes:

Consider an inflationary, or as a matter of fact, any increase in the total quantity of money. If no account is given where this additional money originates from, where it is injected, with what different magnitudes and how it penetrates (through which paths and channels, and with what speed), into the body economic, very little information is given. The same total addition will have very different consequences if it is injected via consumers’ loans, or via producers’ borrowings, via the Defense Department, or via unemployment subsidies, etc. Depending on the existing condition of the economy, each point of injection will produce different consequences for the same aggregate amount of money, so that the monetary analysis will have to be combined with an equally detailed analysis of changing flows of commodities and services.

In other words, the redistributive effects of inflation depend on the path of infusion of the new money supply. In an economy with high marginal tax rates, individuals will prefer consumption to saving and investment. In such an economy, inflation will not follow the same “path” and will not have the same effects on the distribution of income compared to a fiscally freer economy where incentives to invest in the stock market are stronger.

Another issue concerns international capital controls. In the case of a world with free capital movements, an inflation of credit in one country will affect the interest rate and the price of assets in the rest of the world. This means that an inflation of credit in the United States, for instance, might very well increase inequality in Europe through the asset price inflation channel. Thus, during the Bretton Woods system, the impact of inflation on national inequality might have been quite different than in a flexible exchange rate regime.

Finally, we must finish this part by noting that the negative correlation existing in many countries during the 1945-1970 period between income inequality and inflation might at least partially be spurious. Röpke (1957) argues that high marginal tax rates act as a third factor causing both low levels of inequality and inflation.<sup>37</sup> High

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<sup>36</sup>It should be noticed that net short-term capital gains are subject to taxation as ordinary income at graduated tax rates. Furthermore, with the *Tax Reform Act* of 1986, both short-term and long-term capital gains income were included in taxable income and taxed in full at regular income tax rates. The indexation of tax brackets on inflation therefore significantly lowered the effective capital gains tax rate in contexts of inflation.

<sup>37</sup>Röpke (1957, p.99) writes: “When we turn our attention to the vast expansion of national budgets, and to the consequent increase in taxation which forces savings below the level necessary to finance the investment essential to any economic growth free from an inflationary expansion of credit we find ourselves face-to-face with what might be called the sixty-four-dollar question: what share does this fiscal elephantiasis have in chronic inflation? It has, of course, a direct share in so far as an additional demand is created by the budget itself, whether it is in deficit, as in France, or whether, as in Germany, there is a sterilized budget surplus, which must inevitably be



marginal tax rates, Röpke argues, by obliterating the capitalist class and reducing savings, makes it impossible for an economy to maintain its capital stock without financing investment through inflation. At the same time, as wealth belonging to the richest is depleted, the tax revenues produced by high marginal tax rates drop and governments are forced to finance themselves through inflation.

Hayek also identified a positive relationship between progressive taxation and inflation using a sensibly different argument than Röpke's. Hayek (1960, p.328) rightly notices that "because under a system of progressive taxation inflation tends to increase tax revenue proportionately more than incomes, the temptation to resort to inflation becomes very great." Hayek (1960, *ibid.*) adds that inflation may increase the demand for welfare measures. This increase in demand could also lead to a reduction in inequality, thus creating the false impression that it is inflation which is reducing inequality.

Two points must be remembered from this section. First, that the redistributive effects of inflation -i.e. the Cantillon effects- depend also on the regulatory and fiscal regime of a country. In an economy where all the markets but the money production market are unhampered, inflation will probably foster inequality as asset prices rise. This need not be the case however in an economy with high tax rates and hampered financial markets. Thus, the effect of a growth in the money supply on inequality will probably be stronger after 1980, when political reforms led to a substantial reduction of marginal tax rates and to a relative "liberalization" of financial markets. The second point is that a negative relationship between inflation and inequality might not necessarily be causal but instead be the result of confiscatory taxation or the welfare state. This must be kept in mind when we interpret the results given in sections 4 and 5.

## 4 Empirical illustrations

### 4.1 Time Series Evidence for the United States, 1914-2015

During the post WWI period, the United States experienced two episodes of inflation. The first was inflation immediately after the war and was interrupted by the 1921 crisis. Government deficits characterized this first inflation period. The second period of monetary inflation was the credit boom that resulted in the 1929 crisis. As we could expect, both inflationary periods had very different effects on inequality. In the case of the first period, inflation was a means for the government to yield revenue. State officials did benefit from money creation but they scarcely were part of the top 1%. As a result, the top 1% income share decreased. Credit expansion during the 20's, on the other hand, leads us to an entirely different story as it fueled an intensive asset price inflation.

In his bestseller on the causes of the "Great Crash" of 1929 and the subsequent Great Depression in the United States, John K. Galbraith (1954) mentions "the bad distribution of income" as the first of "five weaknesses which seem to have had an

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liquidated in due course, thus causing a disbursement indistinguishable from that occasioned by a budget deficit. The higher the proportion of the national income confiscated by the State through taxation, the more depressed the level of savings becomes; the lovely conception of taxation as a balancing mechanism has long since been shattered by the facts of politico-social life."

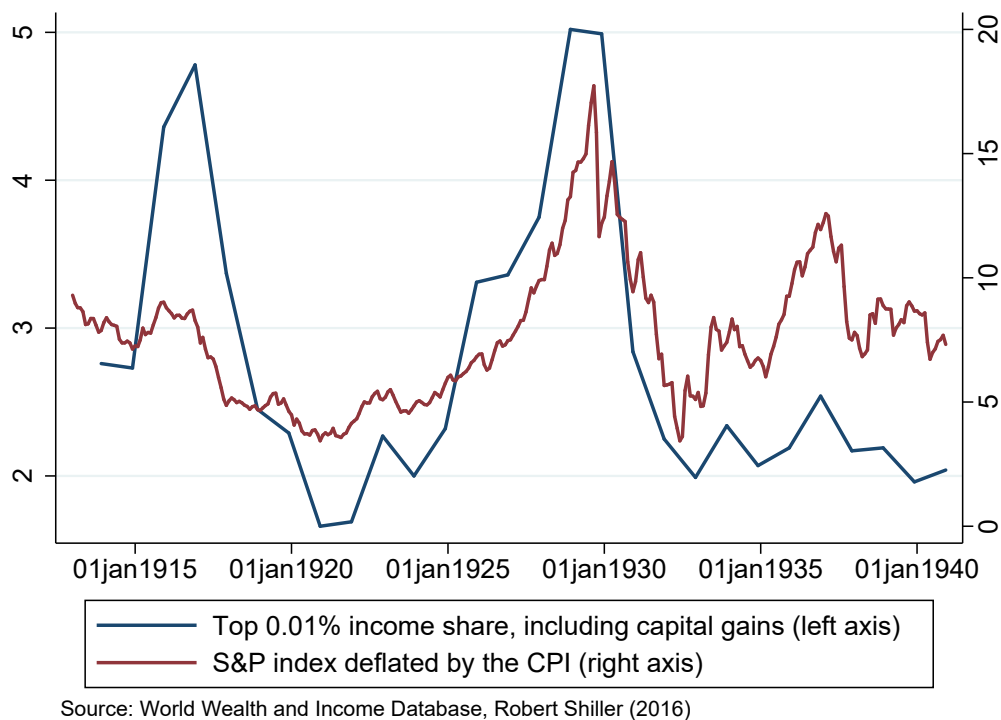


Figure 3: Asset Price Inflation and Inequality in the United States, 1913-1940

especially intimate bearing on the ensuing disaster” (Galbraith, 1954, chapter IX). Similarly, the former chairman of the Federal Reserve Bank, Marriner S. Eccles, points to the rising inequality financed by credit expansion during the 1920s, when, “as in a poker game where the chips were concentrated in fewer and fewer hands, the other fellows could stay in the game only by borrowing. When their credit ran out, the game stopped” (Eccles, 1951, p. 76).<sup>38</sup> Inequality in the 20’s is, as expected, correlated to asset prices (see: Figure 3).

The same correlation between the share of income concentrated by the top of the distribution and asset price inflation seems to be valid for the post WWII period (see: Figure 4).

It is noticeable that steep asset price inflation did not occur during the 50’s and 60’s. Real stock prices rose during this period but at a relatively slow pace. It is often thought of those decades as a period of high inflation because of the “Keynesian consensus.” In relative terms, it is not true. One of the effects of fixed exchange rates during the Bretton Woods system was to put a check on the central banks’ money creation power. Thus, the geometric mean of the inflation of Ma1 was of 5.19% between 1946 and 1970 and of 5.32% for Ma2 during the same period. Comparatively, the geometric mean of the money supply growth rate was of 6.62% for Ma1 between 1971 and 2010 and of 7.09% for Ma2. Even when we exclude the inflationist 70’s, the growth rate of the money supply remains superior between 1980 and 2010 than during the Bretton Woods period. During this period, Ma1 increased in average by 5.69% and Ma2 by 6.37%. The idea that the Fed, with Volcker, suddenly adopted policies conform with the principles of sound money in

<sup>38</sup>Nobody denies that the credit boom of the 20’s did exist and Austrians as well as some Keynesian economists see in this credit boom a cause of the 1929 crisis. See: (Eichengreen, 2004).

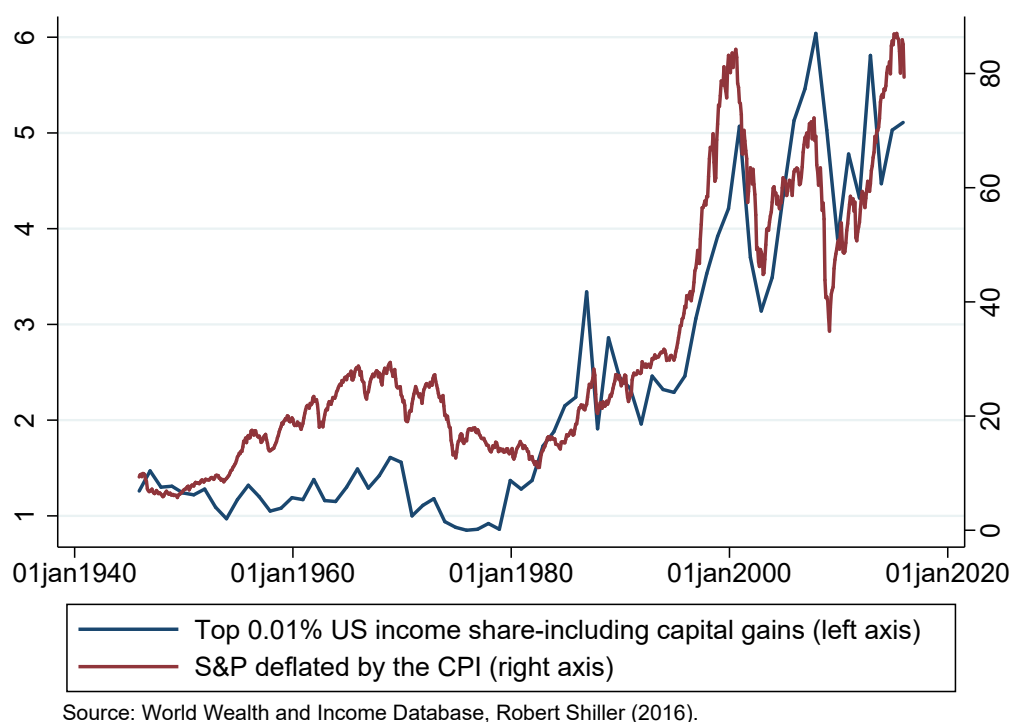


Figure 4: Asset Price Inflation and Inequality after WWII in the United States

the 80's is wrong. First, the monetarist experiment was never about sound money. The main goal of monetarism was to implement a Fed policy based on the quantity theory and suggesting that the money supply should grow at a constant, although lower, rate. Second, the monetarist experiment was more brief than what is often imagined. Already in 1985 the monetarists had pretty much lost the political battle when the mostly Keynesian James R. Baker took over the Secretary of Treasury from the monetarist friendly Donald Regan. It is true that disinflation occurred in the 1980's. The money supply nonetheless continued to increase at a rapid rate during this period.

More interesting however is the transmission channel of the newly created money. During the 60's and early 70's, the American government made an extensive use of inflation to finance the Vietnam war as well president Johnson's Great Society programs. Consequently, the situation of financial markets worsened and inequality reached an historical low in the 70's. The situation changed drastically with the end of the Vietnam war and the changing regulatory framework imposed upon the financial world.<sup>39</sup> The financial sector started to benefit from the money creation process while inequality rose dramatically.

Focusing on movements in the federal funds rate, some authors such as Coibion *et al.* (2012) find that contractionary monetary policy shocks increase inequality. These authors, however, overlook that it is the production of money which is responsible for most of the redistributive effects of inflation. The role of the federal

<sup>39</sup>This is what is often abusively called the "deregulation" of the financial sector. In reality, the Fed and the US government mostly increased the inflationary powers of banks. The most obvious example of this is the *Depository Institutions Deregulation and Monetary Control Act* of 1980 which raised the deposit insurance of US banks and credit unions from 40,000\$ to 100,000\$.

funds rate, on the other hand, is indirect and only secondary.

The last puzzle concerns the 2000's. Indeed, inequality at the height of the boom in 2007 was even higher than inequality at the height of the dot-com bubble. Real stock prices, on the other hand did not recover their 2000 levels during the boom preceding the great recession. How, then, to account for this large increase in inequality despite the smaller increase in asset prices than during the 1990's boom. At least three reasons can be invoked. The first is that there is no constancy in the relationship between the inflation of the money supply and the asset prices growth rate. This is so because as noticed earlier the supply of financial securities depends on their relative price. In other words, the extent to which asset prices will rise with an inflation of the money supply will partly depend on how elastic is the supply of financial securities. In the case of the United States, stock market capitalization went from 146.16% of GDP in 2000 to 137.36% of GDP in 2007.<sup>40</sup> But as the real GDP of the United States increased by about 18.4% during this same period, this means that the stock market capitalization, in real terms, increased by about 11.3% over the period.<sup>41</sup> The second reason is that the redistribution of wealth through the asset price inflation channel depends on how much money was produced. It happens that Ma2 increased by 34.7% between 1995 and 2000 and by 42.8% between 2002 and 2007 -i.e. slightly more in the period preceding 2007. It is therefore not surprising that the increase in inequality was at least as sustained in the years before 2007 than during the dot-com bubble despite a lower rate of asset price inflation. Finally, the third reason why inequality increased in enormous proportions during the 2000's despite a relatively lower increase in real asset prices compared to the 1990's may be related to the treatment of capital losses in the tax code. As realized capital losses are reportable as deductions on the investor's tax return in the subsequent tax years, it is possible that capital losses operated during the bust following the dot-com bubble had the effect of reducing the effective tax rate of the richest during the boom of the 2000's.

In Table 2, we use time series data for the United States between 1914 and 2015. The variables that one might consider using to assess inequality are many. Here, we are using the income share of the top 0.01% and the top 1% of the income distribution.<sup>42</sup> By doing so, our goal is to study the impact of inflation and asset price inflation on the very top of the income distribution. To avoid problems of time specific unobserved variables, we use first differences. First-difference transformation serves a dual purpose in that it might get rid of autocorrelation and might also render

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<sup>40</sup>World Bank Global Financial Development Database, <https://www.worldbank.org/en/publication/gfdr/data/global-financial-development-database>.

<sup>41</sup>Data for Real GDP is from FRED <https://fred.stlouisfed.org/series/GDPC1>.

<sup>42</sup>In this sense, we follow the method defended by Piketty (2014) who argues in favor of using the top of the income distribution as a means to measure inequality. Comparatively, other measures such as the gini coefficient tend to be biased toward changes in the income of the middle class. Our goal here, on the other hand, is to account for the effects of money production and asset price inflation on the top of the income distribution. Of course, the choice of one measure of inequality over another will always be at least partly arbitrary and depends on many contestable assumptions. Thus, the statistical increase in inequality since the 80's might very well be much greater than the actual increase in inequality, especially when we account for regional price disparities (Geloso and Horwitz, 2017). Such disparities however might be, and probably are at least partly, the consequence of the money production process and we therefore discuss them no further.

the time series stationary.<sup>43</sup> Our model is the following:

$$\Delta Y_t = b_0 + b_1 \Delta CPI_t + b_2 \Delta S\&P_t + b_3 \Delta HOUSING_t + b_4 \Delta MTR_t + b_5 \Delta Trade_t + e_t \quad (1)$$

Where  $\Delta Y_t$  corresponds to the measure of the change in income inequality. The parameter  $b_0$  is an intercept term capturing the income inequality trend.  $\Delta S\&P_t$ ,  $\Delta HOUSING_t$  and  $\Delta CPI_t$  represent respectively the percent evolution of the S&P index, the real estate prices and the consumer price index.  $\Delta MTR_t$  is the first difference, of the highest marginal income tax rate.  $\Delta Trade_t$  is the first difference of trade in % of GDP. Finally,  $e_t$  is a white noise error term.

$b_1$  is expected to be negative as we control for asset price inflation which, we argue, is the main channel through which inflation increases inequality. In the short run, unanticipated CPI inflation will impact the incomes at the top of the distribution negatively as the real income of fixed income assets decreases.

$b_2$  is expected to be positively correlated to income inequality when income includes capital-gains. But, one can also imagine that asset-price inflation tends to improve the relative position of the wealthiest individuals even when excluding capital gains, in that it enhances the importance of financial managers and intermediaries. Furthermore, the increase in market capitalization of the large US companies can explain the increase of CEO pay as shown by Gabaix and Landier (2008, 2014). It is therefore likely that asset price inflation is positively correlated with CEO pay and thus increases income inequality when excluding capital gains.

Concerning  $b_3$ , it is not clear what sign we should expect. Bonnet *et al.* (2014) argue that increasing real estate prices are responsible for the increase in the capital to income ratio but do not imply a long run increase in wealth inequality. On the other hand, one might argue that rising real estate prices reduces the income share at the very top of the distribution as real estate often represents a good part of the wealth owned by the middle class.

$b_4$  is expected to be negative as higher marginal tax rates are expected to reduce the income share at the top of the distribution, especially for the Top 0.01% incomes.

Finally,  $b_5$  is expected to be positive. The inclusion of the variable  $\Delta Trade_t$  enables us to control for the impact of globalization on inequality. It is also possible that the capitalization value of large firms increased because their size increased with the economies of scale implied by a larger market. If it is the case, asset price inflation might be, at least partially, the result of globalization. This is equally controlled by the use of the variable  $\Delta Trade_t$ .<sup>44</sup>

Table 2 reports our results:

<sup>43</sup>We used the augmented Dickey–Fuller test for all the variables in table 2. The augmented Dickey–Fuller test reveals whether or not a variable follows a unit-root process. The null hypothesis is that the variable contains a unit root, and the alternative is that the variable was generated by a stationary process. We find that we can reject the null hypothesis of a unit root at the 1% significance level for all the variables used. We can therefore be more confident about the results in our regressions. For the issue of serial correlation, we used the Durbin-Watson test. For all the regressions in table 2, there is no evidence of positive first order serial correlation at all the conventional significance levels.

<sup>44</sup>Although there is a strong rationale to include the variable  $\Delta Trade_t$  in our regressions, to do so is not without its problems. The main one is that inflation, asset prices and foreign trade are not independent variables (Dorobat, 2015, p.90-191). The evolution of foreign trade follows closely the business cycle and monetary disturbances result in an international Cantillon effect. Dorobat (2015) argues that a significant part of the increase in foreign trade since the 1970's is caused by monetary policy.

Table 2: Inflation, Asset Price Inflation and Inequality for the US, 1914-2013

VARIABLES	Top 0.01% income share		Top 1% income share	
	With Capital Gains (1)	Without Capital Gains (2)	With Capital Gains (3)	Without Capital Gains (4)
$\Delta CPI_t$	-0.02151** (0.00942)	-0.01497** (0.00597)	-0.06935*** (0.02424)	-0.05555*** (0.01530)
$\Delta S\&P_t$	0.01392*** (0.00299)	0.00506*** (0.00157)	0.03650*** (0.00692)	0.01083*** (0.00397)
$\Delta HOUSING_t$	-0.00114 (0.01153)	-0.00358 (0.00742)	0.02468 (0.02523)	0.01898 (0.01391)
$\Delta MTR_t$	-0.01067** (0.00494)	-0.01093*** (0.00281)	-0.00131 (0.01570)	-0.00889 (0.01077)
$\Delta Trade_t$	0.14949*** (0.04531)	0.06936*** (0.01931)	0.33000*** (0.11925)	0.16679** (0.07386)
Constant	-0.02462 (0.06637)	0.02419 (0.03373)	-0.15067 (0.15253)	0.01098 (0.09291)
Observations	100	100	100	100
R-squared	0.36497	0.35912	0.34722	0.24133
Prob > F	0.0000	0.0000	0.0000	0.0000
Durbin-Watson	2.517835	2.12519	2.363874	1.97578
Robust Standard errors in parentheses				
*** p< 0.01, ** p< 0.05, * p< 0.1				

Note: Standard errors are corrected for heteroskedasticity. The left-hand side variable is the change, in points, of the top 0.01% and top 1% US income share between year t and year t-1. The variable  $\Delta S\&P_t$  is a proxy for asset price inflation. It is a measure of the growth rate, in percent, of the S&P index between year t and year t-1. The variable  $\Delta CPI_t$  is a measure of the CPI inflation rate. The variable  $\Delta MTR$  represents the change, in point, of the highest marginal income tax rate between year t and t-1. Finally, the variable  $\Delta Trade_t$  is the first difference of Trade, Trade being equal to  $((exports + imports)/GDP) * 100$ . We use the Durbin-Watson test to detect the potential presence of autocorrelation in our regressions. For all the regressions in this table, there is no evidence of positive first order serial correlation at all the conventional significance levels.

Sources: For the Income share of the 0.01%, see: World Wealth and Income Database. For Inflation and the S&P, see Robert Shiller (2016). For the Highest marginal income tax rate, see Piketty (2014). Finally, the  $\Delta Trade_t$  variable was calculated by the author using data from Jordà *et al.* (2017).

In accordance with our model, we find that asset price inflation affects positively inequality in all the regressions at the 1 percent significance level. As expected consumer price inflation affects negatively the income share of the top 0.01% and the top 1% in all regressions at the conventional significance levels. Finally, there is no evidence that real estate prices affect the income share at the top of the distribution. As for the evolution of the highest marginal tax rate, the results are statistically significant only for the top 0.01% income share.

The results suggest that there is a real relationship between asset price inflation and inequality. Despite having controlled for a number of factors, it is still possible that our results suffer from an omitted variable bias if we omitted an important variable correlated with both our dependent and independent variables.<sup>45</sup> For instance, we left out the unionization rate which could significantly be correlated with both inequality and inflation.

Now that we have seen that asset price inflation has had a significant effect on the evolution of inequality, we must verify if the production of money does indeed increase inequality. As explained in section 3.2., the effect of monetary inflation on inequality are expected to be stronger in the 80's. To test this, we use the Austrian money supply (Ma2) as an independent variable in Table 3. We use the same regression strategy as in Table 2 by using first differences.

Our results confirm what we said in section 3.2. -i.e. that there may be something particular about the 1980-2013 period. Indeed, we fail to measure any statistically significant effect of money production and credit expansion on inequality for the 1914 to 2013 period (columns 1 and 2). The impact of an increase in Ma2 on inequality from 1980 to 2013, on the other hand, is both statistically significant and large. None of the conventional monetary aggregates had a statistically significant impact on inequality measured by the Top 1% and Top 0.01% income share and were therefore not included in table 3. To account for the potential effects of an expansion of credit to the non-financial private sector, we included the variable  $\Delta Loans_t$ . Although there seem to be no significant relationship between the amount of loans to the non-financial private sector and inequality during the 1914-2013 period, there is moderate evidence that the impact of credit expansion on inequality is positive since the 1980's.

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<sup>45</sup>In preliminary regressions, we also included variables such as war, the percentage of military personnel in the total population, GDP growth and government expenditure in percent of GDP in the baseline equation. As the coefficients of these variables came out insignificant, we decided subsequently to omit them from the regression.

Table 3: Inequality and the Austrian Money Supply in the United States

	1914-2013		1980-2013	
VARIABLES	(1)	(2)	(3)	(4)
$\Delta Ma2_t$		0.02244 (0.03419)		0.23871** (0.10611)
$\Delta Loans_t$	0.00653 (0.01409)		0.10605* (0.05421)	
$\Delta MTR_t$	-0.02256 (0.01625)	-0.02306 (0.01687)	-0.02952 (0.07958)	-0.02989 (0.08484)
$\Delta Trade_t$	0.25444** (0.12176)	0.25389** (0.12431)	0.37433** (0.17055)	0.55791*** (0.15087)
Constant	-0.04837 (0.19404)	-0.15105 (0.27966)	-0.43759 (0.40737)	-1.41317* (0.71609)
Observations	100	100	34	34
R-squared	0.0832	0.0869	0.2250	0.2662
Prob > F	0.0943	0.1078	0.0016	0.0035
Durbin-Watson	2.09508	2.07285	2.58927	2.55164
Robust standard errors in parentheses				
*** p< 0.01, ** p< 0.05, * p< 0.1				

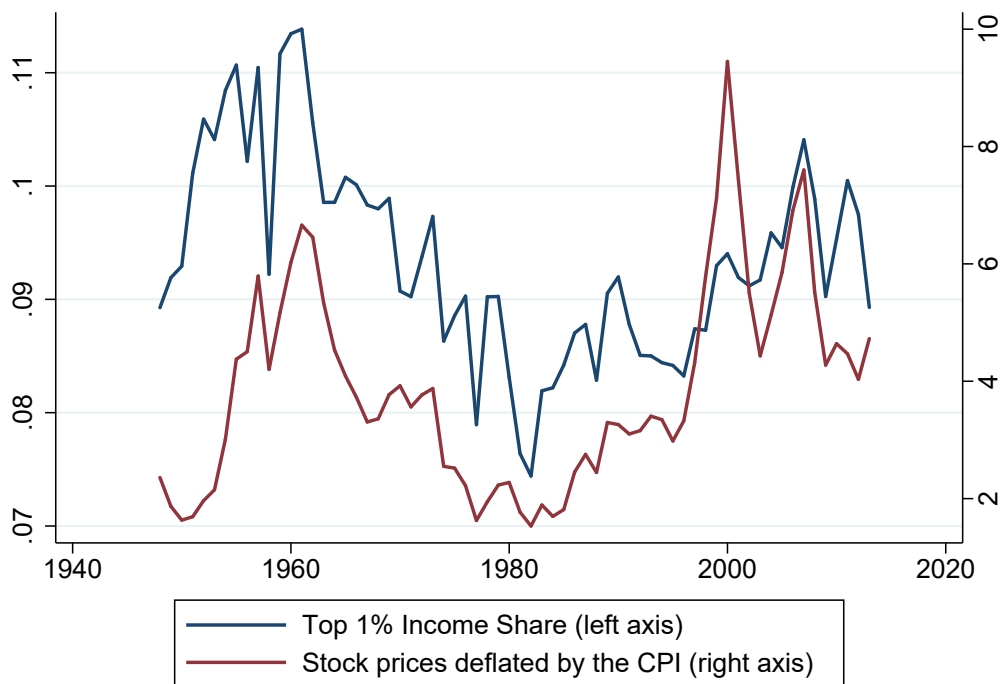
Note: The dependent variable is the income share of the top 1% of the income distribution including capital gains. Standard errors are corrected for heteroskedasticity. We use the Durbin Watson test to detect the potential presence of autocorrelation in our regressions. For all the regressions in this table, there is no evidence of positive first order serial correlation at all the conventional significance levels. We also used the augmented Dickey–Fuller test for all the variables in this table. All our variables are stationary at all the significance levels. For the sources, see table 1 and table 2. The variable  $\Delta Loans_t$  represents the total amount of loans to the non-financial private sector (Jordà *et al.* 2011). Similar results were found when we replaced the Top 1% by the Top 0.01%. If we take the Top 1% excluding capital gains, the variable  $\Delta Loans_t$  is not statistically significant at any of the significance levels but the impact of the variable  $\Delta Ma2_t$  is positive and statistically significant at the 10% level.



## 4.2 Cross Country Evidence, 1950-2010

The correlation between stock prices and inequality is not limited to the United States but can also be observed in most developed countries despite their diversity. Asset price inflation affects inequality whether it is in Scandinavian countries, in the Anglo-Saxon world or in continental Europe (see Graphs 5, 6, 7, 8, 9, 10, 11, 12, 13).

In this section, we focus on 10 developed countries: France, Switzerland, Sweden, Norway, Denmark, the United Kingdom, the United States, Canada, Australia and Japan. Our analysis is limited to those countries only because of the poor data existing for other countries concerning inequality measured by the income share of top 1% of the income distribution.



Sources: Jordà et al. (2011). World Wealth and Income Database

Figure 5: Income Inequality and Asset Price Inflation after WWII in France

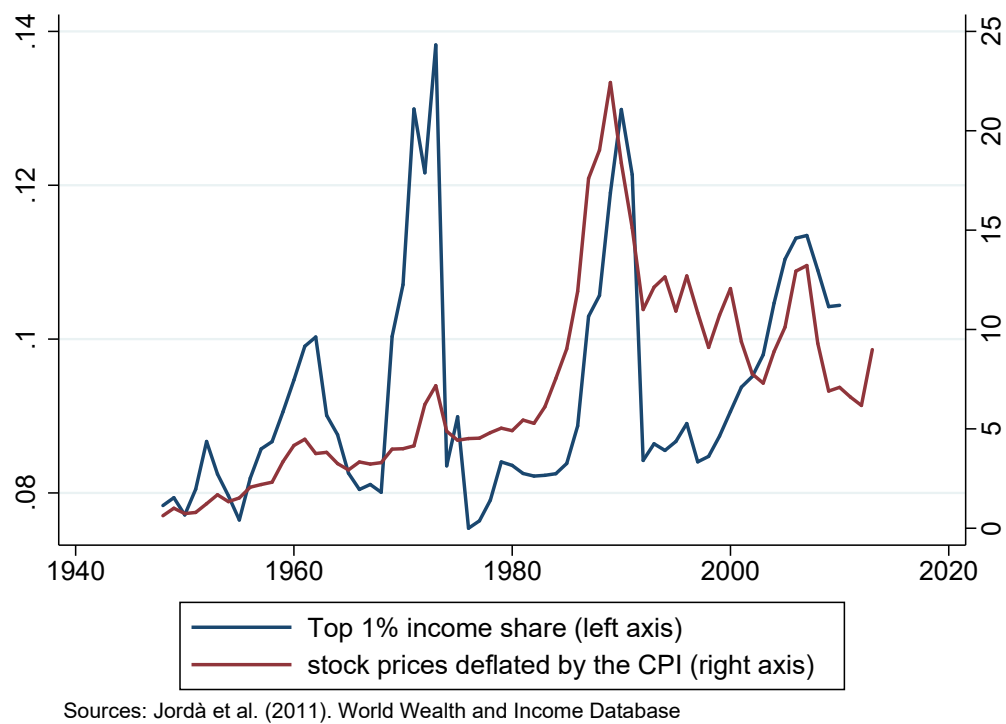


Figure 6: Income Inequality and Asset Price Inflation after WWII in Japan

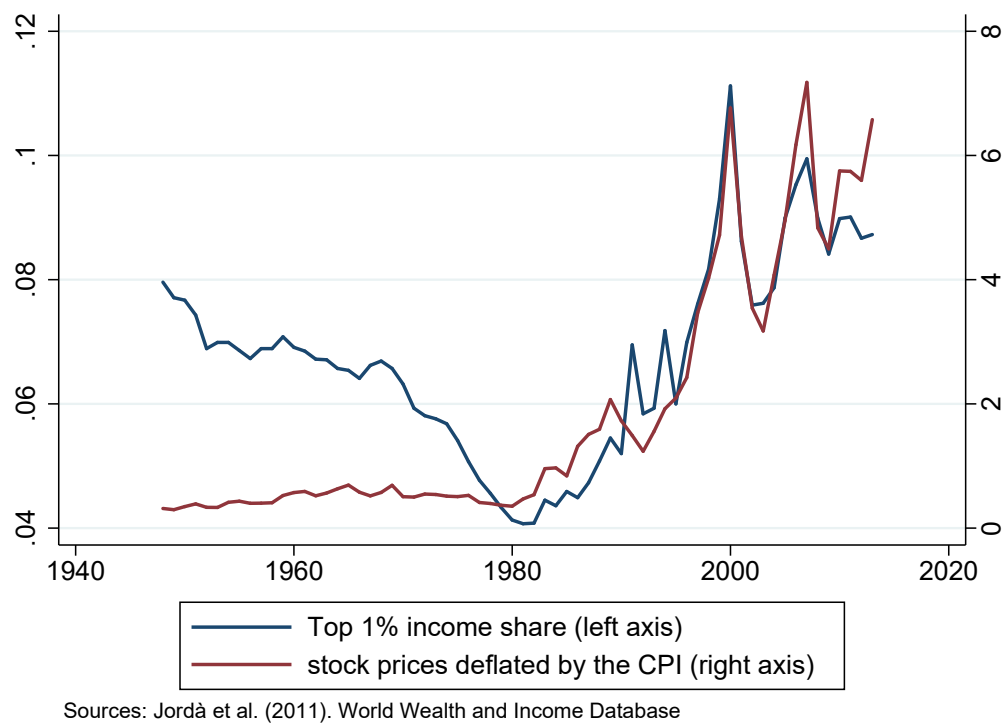
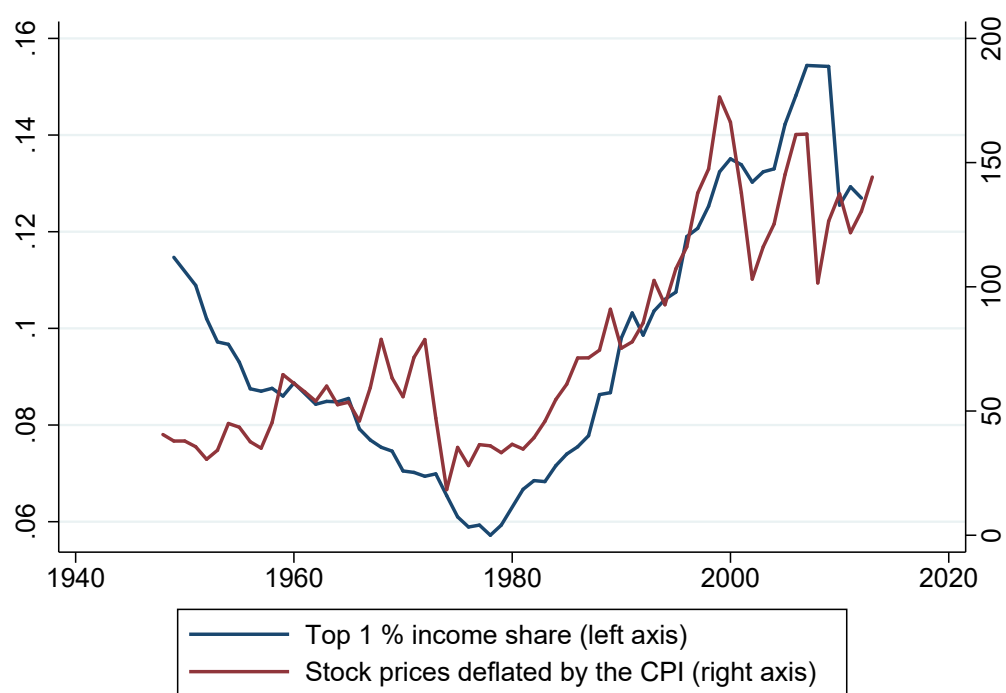
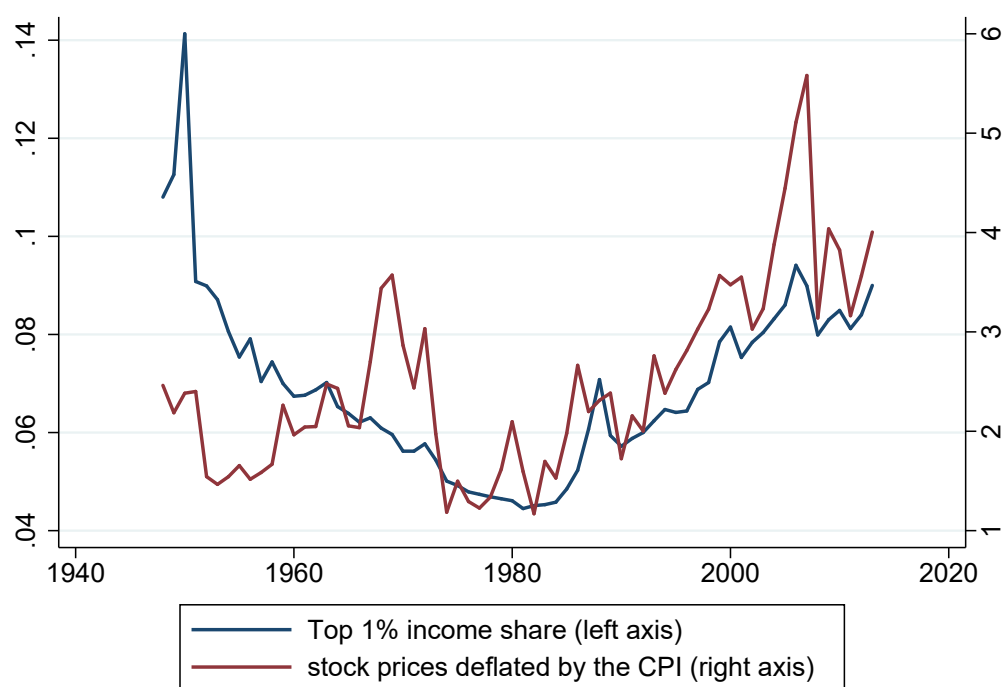


Figure 7: Income Inequality and Asset Price Inflation after WWII in Sweden



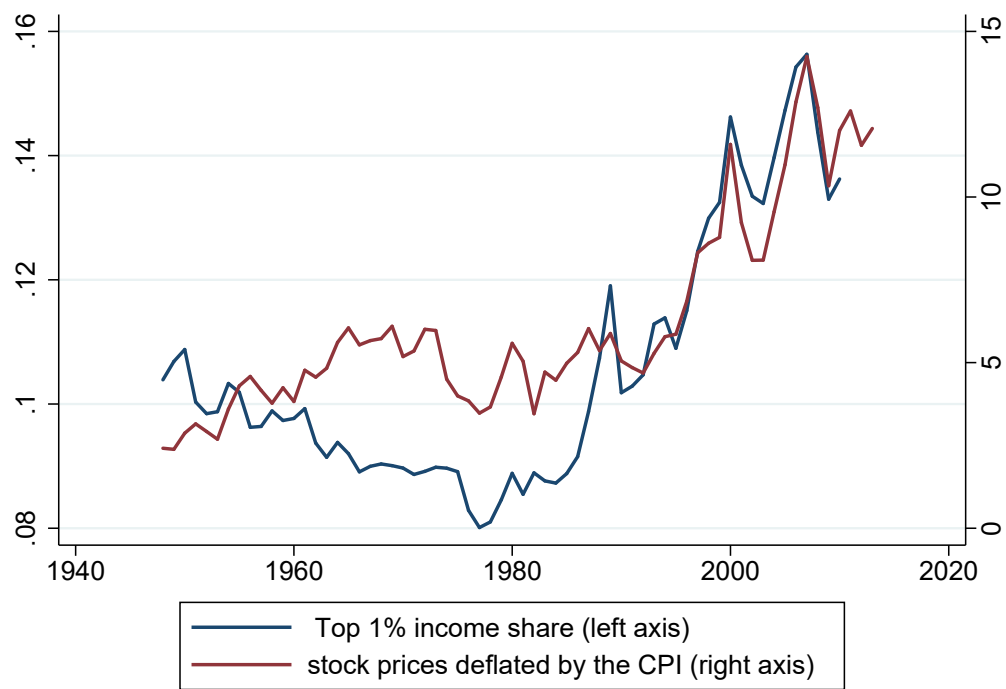
Sources: Jordà et al. (2011). World Wealth and Income Database

Figure 8: Income Inequality and Asset Price Inflation after WWII in United-Kingdom



Sources: Jordà et al. (2011). World Wealth and Income Database

Figure 9: Income Inequality and Asset Price Inflation after WWII in Australia



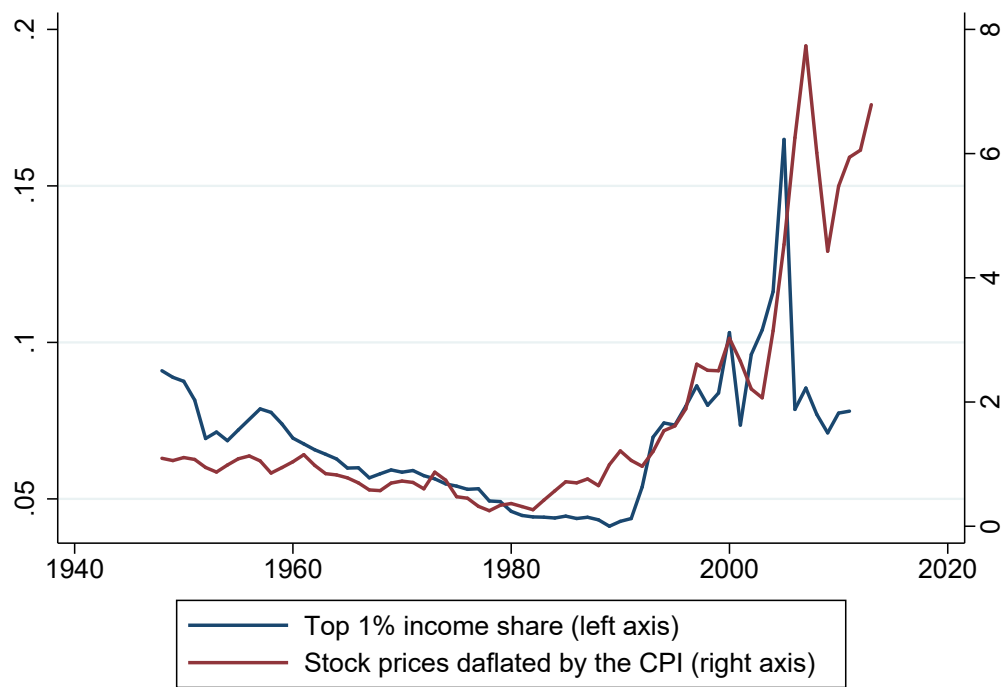
Sources: Jordà et al. (2011). World Wealth and Income Database

Figure 10: Income Inequality and Asset Price Inflation after WWII in Canada



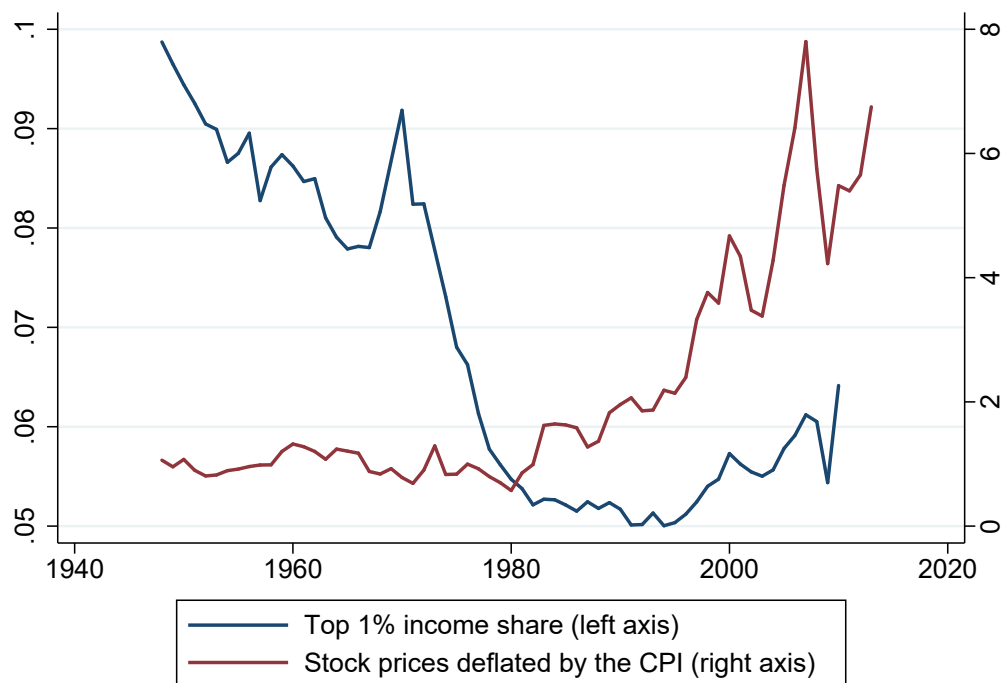
Sources: Jordà et al. (2011). World Wealth and Income Database

Figure 11: Income Inequality and Asset Price Inflation after WWII in Switzerland



Sources: Jordà et al. (2011). World Wealth and Income Database.

Figure 12: Income Inequality and Asset Price Inflation after WWII in Norway



Sources: Jordà et al. (2011). World Wealth and Income Database

Figure 13: Income Inequality and Asset Price Inflation after WWII in Denmark

The following analysis uses a fixed effect (within estimate) ordinary least squares (OLS) regression model which controls for cross unit heterogeneity. The panel is strongly balanced and is composed of 10 OECD countries. The specification used is appropriate because of the presence of between group inequalities and because the presence of a subject-specific confounding factor cannot be ruled out.

Our analysis also contains countries and variables which are likely to display temporal and sectional dependence as there is a close economic inter-relationship between the countries selected. An increase of the money supply in, for instance, the United States, may affect the interest rate and the price of assets in European countries. Similarly, countries may experience common patterns of exposure to economic shocks. To account for these issues, we use Driscoll–Kraay standard errors which are robust to heteroskedasticity, autocorrelation and cross-sectional dependence (Hoechle, 2007). Finally, being aware of issues related to non-stationarity, Appendix B reports panel unit root diagnostics.

The dependent variable is the share of income, including capital gains, accruing to the top 1%, obtained from the World Top Incomes Database (WTID) (Alvaredo *et al.*, 2016).<sup>46</sup> As independent variables, we use data from different databases. Obtained from the Macrohistory Database (Jordà *et al.* 2017), we use the log of the consumer price index, the log of the “Broad Money” supply (M3) and the log of the “Narrow Money” supply (M1), the log of stock prices, the log of house prices and the log of real GDP. From Scheve *et al.* (2016), we use yearly data on the top marginal income tax rate (MTR) for a legal individual as one of the independent variable. Finally, we use a human capital index from the Penn World Table version 9.0 (Feenstra *et al.*, 2015). Summary statistics can be found in table 4.

Table 4: Summary Statistics

VARIABLES	(1) Obs	(2) Mean	(3) SD	(4) Minimum	(5) Maximum
Top1	610	0.0886	0.0296	0.0407	0.235
Log CPI	610	3.872	0.900	2.029	5.119
Log Broad Money	610	7.985	3.615	0.284	14.63
Log Narrow Money	610	6.604	3.430	-0.221	12.98
Log Stocks	610	3.180	1.928	-1.041	8.092
Log House Prices	604	3.607	1.355	-1.250	5.997
MTR	608	49.76	21.90	8	97.50
Log Real GDP	610	7.100	3.261	1.405	12.24
Human Capital	610	3.010	0.378	2.118	3.703
Number of Countries	10	10	10	10	10

Our goal is primarily to identify whether or not there is any a relationship between rising asset prices and inequality but also to see if money supply inflation and consumer price inflation affect inequality in a significant manner. The regressions in

<sup>46</sup>The dependent variable Top1 takes a value between 1 and 0. If Top1 equals 0.20, for instance, it means the top 1% of the income distribution concentrate 20% of the national income including capital gains.

Table 5 also include a number of explanatory variables to control for other possible contributing factors. As in Table 2, we include house prices and the top marginal income tax rate in our regressions. However, and because we want to avoid omitted variable bias, we add two other covariates compared to the time series evidence in section 3. First, we had an index for human capital. Braun (1988) finds that educational attainment is the strongest predictor of inequality between 19 socio-economic variables. More recently, Gregorio *et al.* (2002) find that a higher educational attainment make the income distribution more equal. Since then however, it has been argued that increasing returns to education in a context of skill-biased technological progress will increasing earning inequality as the supply of skilled workers is not keeping pace with demand (Castello *et al.*, 2014). As the human capital index used from the Penn World Table is based on the average years of schooling but also accounts for the rate of return to education, it is particularly adapted to our analysis. The second new covariate we use in our regressions is the log of real GDP. This variable controls for transfer effects linked to stronger economic performance. Including the log of real GDP might however lead to overcontrol as during the boom and bust cycle engendered by credit expansion, asset prices and production follow common patterns. Thus, we include the log of real GDP only in half of the regressions in Table 5.

Table 5 is composed of 8 regressions. As we have noticed before, the focus on consumer price inflation can be misleading. Thus, only the first two regressions use the log of the CPI. The rest of the regressions use two different logged measures of money supply. Unfortunately, we do not have the necessary data concerning the Austrian money supply. Finally, regressions 5 and 6 do not take into account stock prices and house prices. Indeed, as our hypothesis is that credit expansion and the inflation of the money supply increase inequality by spurring rising asset prices, regressions 1, 2, 3, 4, 7 and 8 do not give us the impact of inflation on inequality but rather the impact of inflation on inequality excluding the asset price inflation channel. On the other hand, regressions 5 and 6 look at the entire impact of an inflation of the broad money supply on inequality.

Our results provide strong evidence of the direct link between asset price inflation and inequality. The results show a strongly significant and positive relationship between stock prices and inequality. An increase of 1% in stock prices is estimated to increase the income share of the top 1% by between 0.00967 and 0.01521. Contrary to our time series evidence, the relationship between house prices and inequality is positive and significant in regressions 1 and 2 but is not significant in regressions 3 and 4 and is statistically significant but negative in regressions 7 and 8. We therefore lack evidence to establish a strong relationship between house prices and inequality.

Concerning inflation of consumer prices and of the broad money supply, the effect is, as expected, negative in addition of being statistically significant at the conventional levels.<sup>47</sup> This should not be surprising as we include the evolution of stock prices in our regression -the main channel through which inflation engenders

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<sup>47</sup>We should not conclude from the coefficient estimate in Table 5 that consumer price inflation has a larger effect on inequality than an increase in the broad money supply. Indeed, among the ten countries we chose for our analysis, the broad money supply was multiplied in average by 197.56 against 137.56 for narrow money, 14.24 for the CPI, 83.28 for stock prices and 105.19 for house prices. We have to keep those proportions in mind if we want to correctly interpret the results. The change in percent of the CPI, broad money supply, narrow money supply, house prices and stocks prices are given in Appendix C, TABLE C1 for each country.



Table 5: Inflation, Asset Price Inflation and Inequality, 1950-2010

VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log CPI	-0.04334*** (0.00402)	-0.05100*** (0.00374)						
Log Broad Money			-0.01478*** (0.00419)	-0.02548*** (0.00707)	-0.0035059*** (0.0009916)	-0.01339** (0.00638)		
Log Narrow Money							-0.00126 (0.00238)	0.00033 (0.00357)
Log Stocks	0.01521*** (0.00187)	0.01494*** (0.00174)	0.01159*** (0.00219)	0.01071*** (0.00247)			0.00967*** (0.00252)	0.01011*** (0.00250)
Log House Prices	0.00838*** (0.00207)	0.01286*** (0.00253)	0.00334 (0.00471)	0.00551 (0.00494)			-0.01015*** (0.00273)	-0.00920*** (0.00336)
MTR	-0.00106*** (0.00012)	-0.00089*** (0.00012)	-0.00080*** (0.00015)	-0.00078*** (0.00014)	-0.0009106*** (0.0001624)	-0.00080*** (0.000166)	-0.00070*** (0.00015)	-0.00076*** (0.00015)
Log Real GDP		-0.01962*** (0.00484)		0.01532 (0.00955)		0.01188 (0.01222)		-0.00144 (0.00874)
Human capital		0.04623*** (0.01216)		0.02106 (0.01797)		0.031510* (0.016107)		-0.01213 (0.01633)
Constant	0.23005*** (0.01328)	0.23721*** (0.03692)	0.19808*** (0.01894)	0.10481* (0.06190)	0.1619375*** (0.0112996)	0.05619 (0.07237)	0.13728*** (0.01298)	0.17155*** (0.05658)
Observations	602	602	602	602	608	608	602	602
Within R-squared	0.45375	0.47580	0.32853	0.34042	0.2473	0.2635	0.30284	0.30481
Number of countries	10	10	10	10	10	10	10	10
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Robust Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Note: We use Driscoll-Kraay standard errors which are robust to heteroskedasticity, autocorrelation and cross-sectional dependence. The interpretation of the coefficients, taking as an example the first line of the first column, is the following: in average, an increase of 1% of the CPI reduces the income share of the top 1% by 0.04334 points.

inequality. There is, however, no statistically significant relationship between a rise in the supply of money in the narrow sense and inequality. This is not surprising for two main reasons. First, the M1 money supply often increases in times of crisis -when asset prices and inequality both decrease- as the central bank conducts “contra-cyclical” monetary policies. The second reason is that asset prices are much more sensitive to the expansion of credit than to an increase in the money base.

To test for the whole effect of an inflation of the broad money supply, we do not include stock prices and house prices in regressions 5 and 6. Although the coefficient estimates of the log of broad money remain negative and statistically significant, they went from -0.01478 in column 3 to -0.0035059 in column 5 and from -0.02548 in column 4 to -0.01339 in column 5. This gives us an indication that monetary inflation does indeed increase inequality through the asset price inflation channel.

The coefficients estimate of the variable log of the CPI being negative in both column 1 and 2 and the coefficients estimate of the variable log of the broad money supply being negative in column 3, 4, 5 and 6, it is therefore likely that whether: (1) Our measure of the money supply does not account for the true money supply. This is especially likely since we do not have sufficient data so as to use Ma; (2) Monetary and consumer price inflation reduces inequality through other channels, some of which we have seen in section 3.2; (3) That, as we also have seen in section 3.2., and following Röpke (1957)’s argument, there might be an inverse correlation between inequality and inflation which is not due to the redistributive effect of inflation but to the level of taxation affecting both inflation and inequality. Röpke’s argument being that high marginal tax rates discourage savings and make it impossible to sustain a sufficient level of investment without inflation, we have controlled our regressions by including a measure of the highest marginal income tax rate. This might however not be enough as this variable is highly problematic. First, it fails to take into account important changes in the tax code as, for instance, the indexation of tax brackets to inflation. Second, we could not control for capital gains taxation which has, have we have said earlier, an important impact on both inequality levels as well as on the stock market, especially in times of high consumer price inflation. Finally, the regulatory framework and especially financial regulations might also condition what are the effect of inflation on inequality and is not taken into account in our regressions.

But even if we could take all these factors into account in our regressions, the coefficient estimate measuring the impact of a growth of the broad money supply on inequality will probably underestimate its real impact. The reason can be found in Austrian business cycle theory. Indeed if banks or central banks want to delay the bust brought upon by easy credit, they must furnish credit at an ever increasing rate (Huerta de Soto, 2009, p.459-466). But once credit growth does not increase fast enough, the malinvestment of the boom becomes visible and a stock market collapse ensues.<sup>48</sup> But despite that credit expansion is responsible for asset price inflation, this does not mean that a collapse in the stock market is associated with low levels of credit and money supply growth compared to other periods. On the contrary, central banks might decide to keep stock prices from falling too low by engaging in easy money policies. The M3 money supply in the United States, for instance, was growing by more than 10% in January 2009 -i.e. much faster than during the

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<sup>48</sup>For an Austrian take on asset prices and the business cycle, see: (Bagus, 2008).

pre-crisis boom- despite a sharp decrease in asset prices of about 38% compared to January of the previous year. It would be absurd to argue that the increase in M3 growth was responsible for the decrease of the top 1% income share that took place during the crisis or for the sharp decline in asset prices. This is a distinction that our regressions do not make, thus biasing the results.

This brings up the question of moral hazard created by central banks in the financial sector which is favorable to asset price inflation. If Central banks are expected to keep asset prices from falling and preventing the financial sector to collapse, then the present value of financial assets will be affected. In other words, present asset prices are affected by central banks' future policies. This also creates a bias in our regression that might lead to underestimate the positive effects of inflation on inequality.

Finally, an asset price bubble might start before an increase in credit growth if the supply of credit is made artificially elastic by the central banks. Indeed although credit expansion is a necessary condition for a sustained asset price boom, financial assets are used as collateral for new loans. Thus an initial increase in stock prices that would have been only temporary without an elastic supply of credit can result in a sustained bubble as the money supply later increases. Therefore, it is once again unlikely that the evolution of asset prices and an inflation of credit are synchronized in time.

By grouping statistics from different countries at different points in time, we implicitly assume that the impact of one variable on another is constant both in magnitude and in time. But this is never the case in the realm of human action (Mises, 1957, p.10-12) as each historical event is unique and cannot be reproduced. It is this uniqueness which cannot be accounted for in regressions and can bias our results in a significant manner (Israel, 2016b). Thus, although our results can give us clues about the relationship between asset prices, inflation and inequality, they must be interpreted carefully. It is not at all excluded that inflation might, on balance, increase rather than decrease income inequality.

## 5 Conclusion

In this paper, we have tried to show how inflation can, under certain circumstances, increase inequality through the asset price inflation channel. An alternative story to the one developed in this paper is that higher saving rates for the incomes at the top of the income distribution are responsible for asset price inflation and inequality. Thus, Atkinson and Morelli (2010, p. 58) argue that “inequality could have had an indirect effect in contributing to the asset bubble” and Kumar (2016) argues that “[h]ouseholds in the top income fractiles have in essence absorbed a huge chunk of household net worth by saving more than others and earning incomes that, in index terms, grow faster than national income and consumption.” These arguments, however, do not falsify the argument that monetary policy caused asset price inflation and inequality.

If it is indeed true that the gap between the saving rate of the wealthiest and the saving rate of the poorest increased, it still does not disprove that monetary policy is responsible for asset price inflation. On the contrary, it rather illustrates the Cantillon effect. Indeed, as we explained, the Cantillon effect implies that the first to receive the newly created money will be able to buy assets of better quality

at a relatively lower price and will benefit from higher rates of return from their investments. But as we have seen, the richest are more likely to be among the early receivers of the newly created money and therefore, as they benefit from higher rates of returns, it is predictable that their saving rate would be greater during periods of asset price inflation.

A lot is left to be said on the relationship between monetary policy and inequality. Among other things, monetary policy probably has an impact on the capital/income ratio as argued by Hülsmann (2014).<sup>49</sup> Credit expansion through monetary creation, by lowering the interest rate, probably increases the capital/income ratio. Another subject that should be studied is the impact of monetary policy on the composition of the top income and wealth fractiles. Freund and Oliver (2016), for instance, find that the number of financial sector billionaires grew quicker than the number of billionaires in the US. This should not be surprising since, as we have said already, expansionary monetary policies can contribute to the financialization of the economy.

Since the 2008 financial crisis, the so-called unconventional monetary policies have often been justified on the ground that something must be done in the short run since, as would have said J.M. Keynes, "In the long run, we are all dead." Thus, the long term destabilizing effects of expansionist monetary policies have been downsized or ignored. Our research, on the other hand, suggests that the costs and benefits of money production under modern central banking differs whether one is poor or in the top of the income distribution. As the production of money by central banks increased inequality levels during the past 40 years, and if the goal is to benefit the least well-off in society, then central banking and artificial monetary creation may be more costly than usually assumed by policy-makers. It is also likely that the constant interventionism of central banks, by generating rising inequality levels, spurs egalitarian sentiments among the voters. Consequently, egalitarian politicians have a greater chance to be voted into office and this, in turn, may lead to further political intervention in the free-market. In other words, political interventionism in the market order generates its own demand for further interventionism (Mises, 1977). This means that the long term costs of our current modern monetary system may once again be underestimated as the subsequent government interference in the economic system will lead to greater economic inefficiencies.

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<sup>49</sup>On the role of the capital/income ratio in the study of inequality, see: (Piketty, 2014).

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# Appendices

## A The Austrian money Supply

Any empirical treatment of monetary issues suffer from the difficulty of both measuring and defining what the money supply really is. In the 1990's for instance, Alan Greenspan was noticing that the Fed had been unable to control or even accurately measure the money supply for years." (quoted in: Salerno, 2011, p.541).

Although it is impossible to account for measurement errors in our empirical treatments, it is nonetheless possible to seek for the most satisfactory definition of the money supply. This is why the "Austrian money supply" (Ma) was computed and used.

As Dr. Salerno (2011, p.115) writes, "The 'True' Money Supply (TMS) [i.e. the Austrian money supply] [...] is an admittedly imperfect attempt to provide statistical measure of money that is consistent with the theoretical definition of money as the general medium of exchange in society." The Austrian money supply, in other words, try to measure what actors on the market subjectively value as the generally accepted medium of exchange. The standard monetarist definition, on the other hand, focuses on whatever monetary aggregate correlates the most to national income (Friedman & Meiselman, 1958). There is no place for a lengthy discussion about the merits of the Ma aggregate over other conventional aggregates. Thus, we will content ourselves with a depiction of what is the composition of the two measures of the Austrian money supply -Ma1 and Ma2.

Ma1 = Currency + Demand Deposits + Saving Deposits + Small Time Deposits + Money Market Deposit Accounts + Deposits at Thrifts + Government Deposits

And:

Ma2 = Ma1 + Cash Surrender Values of Life Insurance Policies

Compared to M2, Ma1 and Ma2 do not include: Travelers checks, MMMFs and other retail money market funds. Compared to M3, the Austrian metric does not include large time deposits, Euro Dollars and repurchase agreements (RPs) in addition to the non-included M2 components. In theory, as argued by Salerno (2011), overnight RPs and overnight Euro Dollars are included in the Austrian Supply but for lack of data, we do not include them.

The sources used to compute the Ma1 are:

Raymond Goldsmith (1955). A Study of Saving in the United States. Vol.1. p.441 United States. Bureau of the Census. (1949). Historical Statistics of the United States 1789-1945. (U.S. Department of Commerce, 1949).

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Federal Reserve Board, <https://www.federalreserve.gov/datadownload/Review.aspx?rel=H6&series=af422c3d05aa7ddebec980c853c04469&lastobs=&from=&to=&filetype=sheet&label=include&layout=seriescolumn>

Additional sources were used to compute Ma2. Following Rothbard (1972)'s method, we estimate the cash surrender values of life insurances by subtracting the amount of policy loans by the amount of policy reserves of life insurances. The additional sources are the following:

Pfeffer. Irving. (1954). On the Relationship between Policy Loans and the Level of Prosperity. Review of Insurance Studies.

The Life Insurance Fact Book, American Council of Life Insurance. Washington, DC.

The results in term of money supply growth can be seen in figure 14.

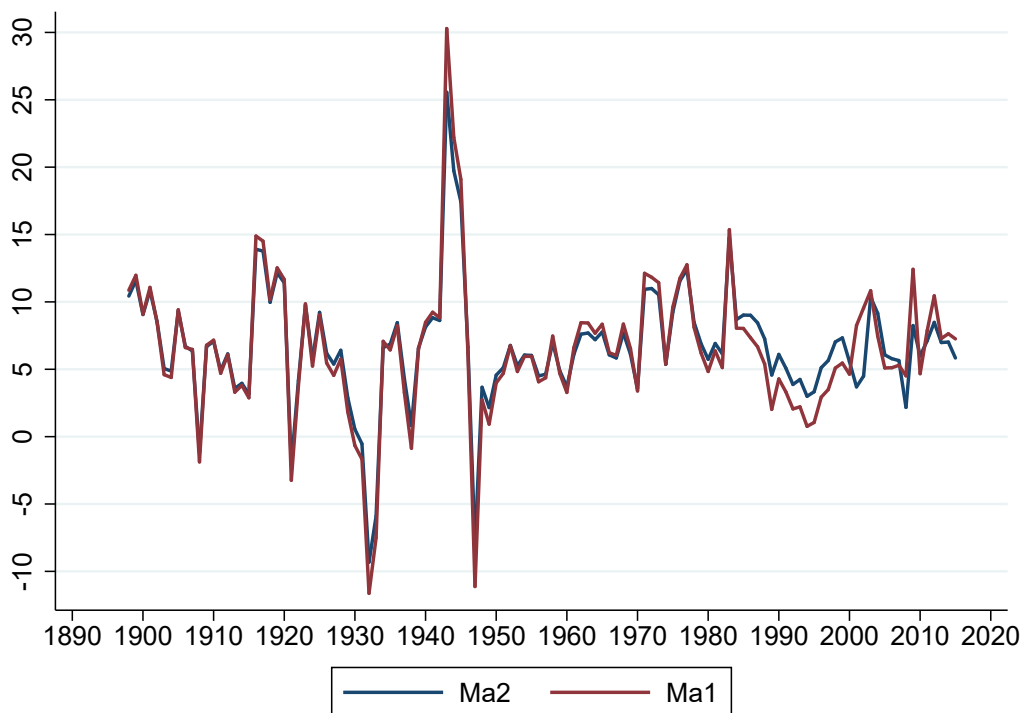


Figure 14: Austrian Money Supply Growth in the United States, 1898-2013

## B Unit root diagnostics

Table 6 reports panel unit root tests for all relevant interval variables included in the model. Unit root tests were performed using the Augmented Dickey-Fuller (ADF) sub-selection of Fisher-type tests. The following tests assume an AR1 autoregressive process and are repeated using demeaned variables to account for cross-unit heterogeneity. For all tests,  $H_0$ : all panels contain unit roots;  $H_a$ : at least one panel is stationary. The results indicate that although unit root processes appear in a few select number of variables, the diagnostics respond favorably to demeaning. These results lend further credence to the utility of a within-estimator, as the demeaned adjustment also subtracts cross-section averages from individual series. Most variables —as well as the demeaned dependent variable, log Stocks and log Narrow Money— indicate absent evidence of a unit root amongst all panels.

Table 6: Unit root diagnostics

VARIABLE	Inverse chi-squared ( $X^2$ )	Inverse normal (Z)	Inverse chi-squared, demeaned ( $X^2$ )	Inverse normal, demeaned (Z)
Top1	62.1578***	-4.8022***	77.1266***	-5.5439***
Log CPI	35.0165*	-2.8340**	45.6155***	-3.2679***
Log Broad Money	52.9864***	-3.7485***	56.5077***	-3.8145***
Log Narrow Money	25.2605	-0.1888	52.0845***	-3.2582***
Log Stocks	30.8485	-1.8510*	56.4333***	-4.4001***
Log House Prices	48.8168***	-2.9914**	83.1785***	-5.7769***
MTR	42.3854**	-3.5966***	75.4568***	-5.9778***
Log Real GDP	102.8394***	-7.4381***	50.4763***	-3.3545***
Human capital	45.1862***	-3.4278***	99.7292***	-6.2335***
*** $p \leq 0.001$ , ** $p \leq 0.01$ , * $p \leq 0.05$				

## C Inflation and Asset Price Inflation from 1950 to 2010

Table 7: Evolution, in percent, between 1950-2010

COUNTRY	CPI	Broad Money	Stock Prices	Narrow Money	House Prices
Australia	2 196.9	32 070.1	3 525.3	8 046.1	10 077.7
Canada	932.4	12 425.8	3 899.7	13 451.8	-
France	1 740.6	29 955.0	4 945.2	14 292.6	36 515.7
Japan	801.4	58 370.6	7 694.7	63 652.3	20 466.0
Sweden	1 705.4	9 529.1	28 321.7	2 713.7	4 421.5
United States	906.4	4 782.9	6 286.2	6 056.2	1 196.3
Norway	1 732.1	14 018.8	8 574.0	2 624.1	6 569.4
Switzerland	479.8	3 305.7	3 991.4	2 958.9	804.8
United-Kingdom	2 070.8	17 789.9	7 501.3	3 885.6	9 160.8
Danemark	1 672.9	15 310.0	8 539.5	19 573.3	5 461.2