Assignats or Death: Inflationary Finance in Revolutionary France*

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Abstract

Between 1794 and 1796, France experienced an unprecedented hyperinflation fueled by an explosion of paper money called the *assignat*. In September 1795, the French adopted the Constitution of Year III, which we use to demonstrate how changes in the "rules of the game" and in the "political equilibrium" can have important effects on the monetary phenomena that are critical to the study of inflationary finance. We find that the new regime had a structural effect on the demand for money that substantially weakened the link between real money balances and inflation, and that failing to account for this effect results in substantially different estimates of the seigniorage-maximizing rates of inflation. If we ignore this effect, we find that the seigniorage-maximizing rate of inflation was 35% per 10 days, but once we incorporate the effect of the new regime, this rate falls to 19.5%. Lastly, we also find that the new regime increased the volatility of inflation, suggesting that the previous regime was more effective at anchoring the public's inflation expectations. Taken together, these results lend credence to the constitutional perspective's primary theoretical insight.

Keywords: Constitutional Political Economy, Demand for Money, Inflationary Finance, French Revolution

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Let the French people know well
that they need assignat or death.

Edmond Louis Alexis
Dubois-Crancé
In front of the National Assembly
Ventôse 4, Year IV

1 Introduction

Throughout history, governments have relied on money creation to raise revenue, especially during periods of political instability. While there is a tendency to think of such episodes as a relatively recent phenomenon, the first known case of hyperinflation occurred long before the widespread adoption of discretionary fiat standards in the 20th century (Bernholz, 2016, p. 15). Between 1794 and 1796, in the midst of a revolution precipitated by unsustainable government deficits, France experienced an unprecedented hyperinflation fueled by an explosion of paper money called the *assignat* (Sargent & Velde, 1995; White, 1995). Despite a longstanding tradition of using episodes like the *assignat* to study inflationary finance, there has been comparatively little research on this topic incorporating constitutional political economy, which emphasizes the importance of the "rules of the game" in determining the strategies adopted by the public and government officials (Brennan & Buchanan, 1980). We think the *assignat* hyperinflation can help fill this gap.

In September 1795, the French adopted the Constitution of Year III. The new constitution established the French Directory, which came to power in November 1795 and subsequently abandoned the *assignat* four months later. The new constitution also included provisions intended to address the public finance crisis that had led to hyperinflation in the first place. For example, while under the Convention, a multitude of parliamentary committees appropriated public funds without much regard for the deficit and without much consent from the assembly, sometimes without a prior vote or during a time when the assembly was not in session. The new constitution, however, forced the executive branch to stipulate the use of funds before they could be allocated by the parliament (Sciout, 1895, p. 455). More importantly, this constitutional

change considerably weakened the political support for the *assignats* and made their demonetization more likely. In this paper, we use the constitutional reform to demonstrate how changes in the "rules of the game" and in the "political equilibrium" can have important effects on the monetary phenomena that are critical to the study of inflationary finance.

The basic insight that emerges from the inflationary finance literature is that there is a limit to how much revenue the monetary authorities can derive from money creation, and that the limit is reached when the demand for real money balances is unit elastic, provided the authorities can create nominal money balances at zero cost (Bailey, 1956; Cagan, 1956). This insight is analogous to the distinction between the tax rate and tax base. The monetary authorities select an inflation rate which generates a corresponding amount of inflationary tax revenue – known as seigniorage. The amount of seigniorage which can be collected, in turn, varies depending on how sensitive to inflation the public's demand for real balances is.

The problem with framing the issue this way is that it essentially assumes the inflationary tax base, i.e., the quantity of real balances held by the public, is independent of the rules governing the monetary authorities' behavior, which is not likely to be the case. The public's willingness to hold positive quantities of real balances will depend on the credibility of the monetary authorities' commitment to not engage in surprise inflation. Without a rule, either formal or informal, binding the monetary authorities to a particular policy, it will generally be in their interest to behave opportunistically (Brennan & Buchanan, 1980; Calvo, 1978; Sjaastad, 1976). Only when the monetary authorities internalize some of the costs of inflation is it no longer in their interest to maximally inflate (Barro, 1983).

The obvious empirical implication of the constitutional perspective is that estimates of the demand for money during hyperinflation are likely to be biased unless they account for regime or political changes. If a political regime is unstable, which seems likely since political instability is one of the primary drivers of inflationary finance (Aisen & Veiga, 2008; Cukierman et al., 1992), the demand for money will be unstable as well. Despite an extensive empirical literature applying the standard approach to recent periods of hyperinflation, including those in Venezuela

(Pittaluga et al., 2020) and Zimbabwe (Miller & Ndhlela, 2020), we still know very little about the effects of constitutional change on inflationary finance. The available evidence we do possess lends credence to the relevance of the constitutional perspective. For example, Thomas Sargent's (1982) analysis of the factors that contributed to the end of hyperinflation in Austria, Germany, Hungary, and Poland indicates that it was the rules governing the monetary authorities, rather than the quantity of money, that stopped prices from rising. Likewise, in their analysis of the German hyperinflation, Michael et al. (1994) argue that the observed breakdown in the demand for money near the end of that episode was caused by a failure on the part of researchers to account for the effects of regime change.

We contribute to this literature in several respects. First, we construct weekly series of real balances and inflation using de Nogaret's (1800) estimates of the quantity of outstanding *assignats* and Caron's (1909) estimates of the *assignat* price of gold that span the final two years of the *assignat's* existence. Using these series, we look for evidence of a breakdown in the money demand relationship during the *assignat* hyperinflation, and find that there was in fact a structural break in the relationship between real balances and inflation that coincides with the establishment of the Directorial Regime in early November 1795. Next, using Taylor's (1991) method of estimating the demand for money during hyperinflation, we find a considerable weakening of the inverse relationship between real balances and inflation once the Directory came to power, which we argue was likely the result of the regime's eventual abandonment of the *assignat*.

Moreover, we find that failing to account for the new regime's effect on the demand for the *assignat* biases the parameter estimates, leading to substantially different implied seigniorage-maximizing rates of inflation. For instance, if we ignore the regime change, our estimates imply a seigniorage-maximizing rate of 35% per 10 days; however, once we account for the regime change, the implied seigniorage-maximizing rate decreases to 19%. Next, we use Grier & Perry's (1998) method to estimate inflation uncertainty on either side of the structural break, and find that inflation was less predictable under the Directorial Regime than it was under its

predecessor, suggesting that - perhaps surprisingly - the previous regime was more effective at anchoring the public's expectations of inflation than was the Directory. Taken together, these results lend credence to the constitutional perspective's primary theoretical insight.

We are not the first to apply the inflationary finance framework to the French Revolution. In their analysis of the *assignat* hyperinflation, Brezis & Crouzet (1995) found that actual inflation exceeded the seigniorage-maximizing rate by a wide margin, and conclude from this result that the government's budget deficit was much too large to finance with seigniorage. However, we think their analysis is problematic for several reasons. First, their sample spans the period between 1792 through 1796, but as Sargent & Velde (1995) have argued, only the period between 1794 and 1796 appears to be consistent with the standard hyperinflation model of money demand. The results of our structural break analysis suggest that even this restricted sample is too large, and that only the period between the end of the Terror in July 1794 and the start of the Directorial Regime in November 1795 appears to be consistent with the standard hyperinflation model.

Another issue with Brezis & Crouzet's analysis is that they used domestic prices to measure inflation, which introduces an additional source of measurement error since governments often interfere with domestic prices during hyperinflation (Petrović & Mladenović, 2000). Using the price of gold to measure inflation avoids this issue because it is akin to using the exchange rate, which has been found to be a much better measure of inflation when estimating the demand for money during hyperinflation (Frenkel, 1976; Mladenović & Petrović, 2010). Finally, Brezis & Crouzet's analysis assumed the French public formed their expectations of inflation adaptively, which leads to a number of identification problems (Salemi & Sargent, 1979; Sargent, 1977). We avoid this issue by using Taylor's (1991) approach, which is agnostic with respect to the formation of inflation expectations. Contrary to Brezis & Crouzet, we find that between 1794 and 1795, the inflation rate was, with few exceptions, below the seigniorage-maximizing rate, indicating that a larger budget deficit may have seen sustainable, albeit at the cost of even higher inflation.

We proceed as follows. In the next section, we discuss the role of the *assignat* in the

French Revolution. Section 3 contains a simple model of the demand for money that highlights the strategic nature of inflationary finance that yields important implications for our empirical analysis. In Section 4, we describe the data. Our empirical strategy is describe and our results are reported and analyzed in section 5. Section 6 concludes.

2 The Role of the *Assignats* During the French Revolution

The French revolution was first triggered by a fight between the King and the parliament of Paris regarding public finances. By 1788, government deficits were no longer sustainable, with more than 20% of government revenue coming from borrowing while nearly 50% of government spending consisted of repaying the debt and the interest payments necessary to service it Braesch (1934). In a desperate attempt, the King summoned the Estates Generals. Yet, things went from bad to worse, and a member of the Committee of Finances Montesquiou (1791 8) declared that in 1789 "loans, fatal and last resource of our finances, had even become impossible."

Even though political institutions changed radically with the third-estate declaring themselves the National Assembly on June 17, 1789, the government's fiscal situation remained dire. Over the course of the next decade, the successive governments tried to reduce the budget deficit using any means available to them: expropriations, new taxes, the looting of military occupied regions and, more significantly, inflation. The "unpleasant fiscal arithmetic" (Sargent & Velde, 1995) that gripped the *Ancien Régime*, combined with the changes in the tax system, operated by the revolutionaries, led to no other recourse but inflation.

In November 1789, Montesquiou (1789) detailed in front of the National Assembly how the debt due amounted to 557 million, more than one entire year of tax revenue. Worse, the government seemed on the wrong side of the bond finance Laffer Curve. In August 1789, Jacques Necker, the minister of Finances, tried to open two loans, one of 30 million pounds at 4.5% interest and the second of 80 millions at 5% interest. Both failed to raise the money announced, and on September 24, Necker recognized his mistake in a report to the Assembly,

declaring that "New loans can only increase the current deficit" (*Archives Parlementaires* 9:143).

To address the deficit, some members of the newly created National Assembly suggested that the assets owned by the clergy could be seized by the State. On November 2, 1789, the Assembly voted for the nationalization of the ecclesiastic properties, 568 votes for and 346 against. While expropriating the Church's assets helped the government remain solvent, resources were still needed to pay the due debt as the Church's properties were relatively illiquid. Only one solution remained: paper money. The public being sceptical of the new paper-money, created towards the end of 1789 and called *assignats*, the National Assembly had to provide guarantees that it would not constantly inflate its way out of trouble.

Since the *assignats* were, in theory, created to help with the liquidation public debt, not to finance government's budget deficit, they were to be used in the auctions of the national assets. The *assignats* were then either cancelled immediately, if they had been used to purchase national assets, or redeemed into gold. The gold was generated from the sale of Church land or its returns.

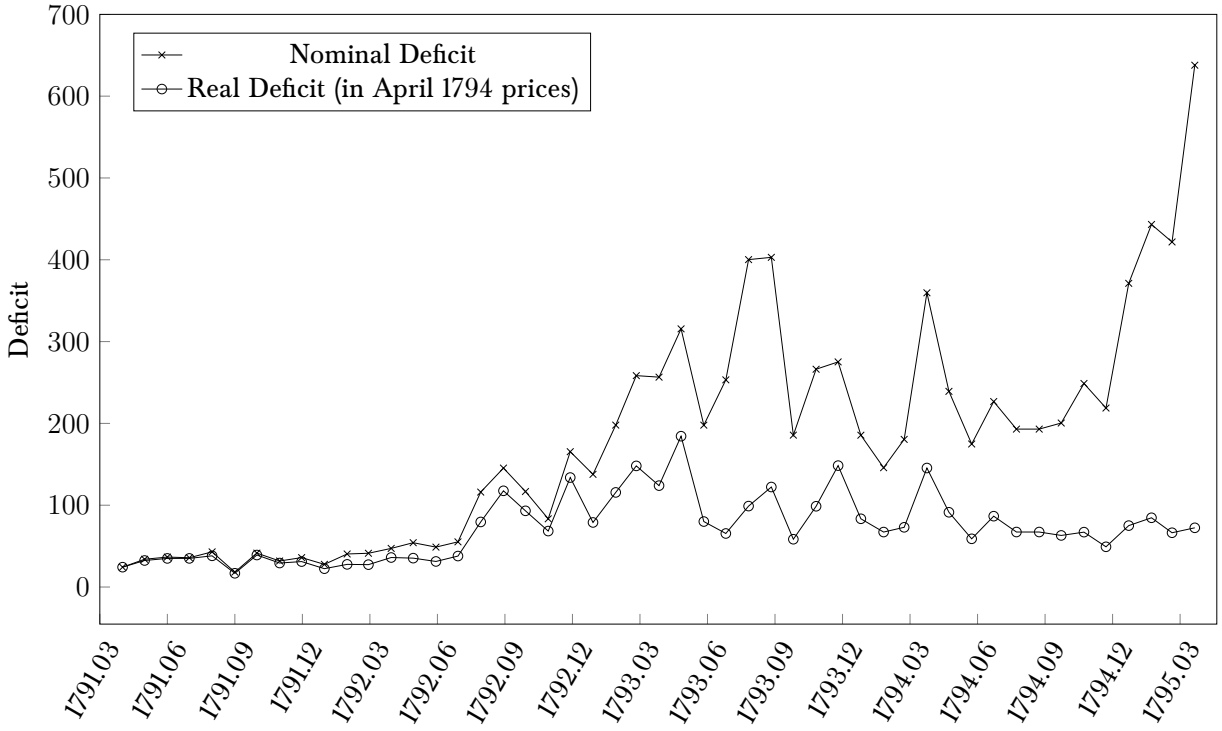
As Sargent and Wallace (1981) argue, it is possible for the effects of anticipated future monetary changes to offset present changes in the money supply. If the *assignats* had indeed been used only to liquidate the public debt, for which the expropriated assets of the clergy were supposed to be the collateral, the money supply would have gradually decreased. This is because the national assets would have been sold in auctions and the *assignats* used in the purchase would have been subsequently burnt. Hence, the cancellation of banknotes after the selling of expropriated properties was, at least in theory, a way to anchor inflation expectations by guarantying a future contraction of the money supply.

Opponents of the *assignats* such as Stanislas de Clermont-Tonerre[1] or the economist Dupont de Nemours[2] one the other hand, argued that burning *assignats* used to buy the Church's assets was not sufficient to limit inflation. Following the quantity theory of money, they warned that a doubling of the money supply would lead to a doubling in prices.

[1] *Archives Parlementaires.* vol.19, p.276.
[2] *Archives Parlementaires.* vol.19, p.224-237.

According to Sargent & Velde (1995), the primary function of the *assignats* –liquidating the public debt– was respected until April 1792, when public spending surged following the beginning of hostilities against the first coalition. Indeed, the declaration of war in April 1792 was followed by an almost ten fold increase in the "real" deficit (Figure 1).

Figure 1: Monthly Government Deficit



Source: Archives Parlementaires.

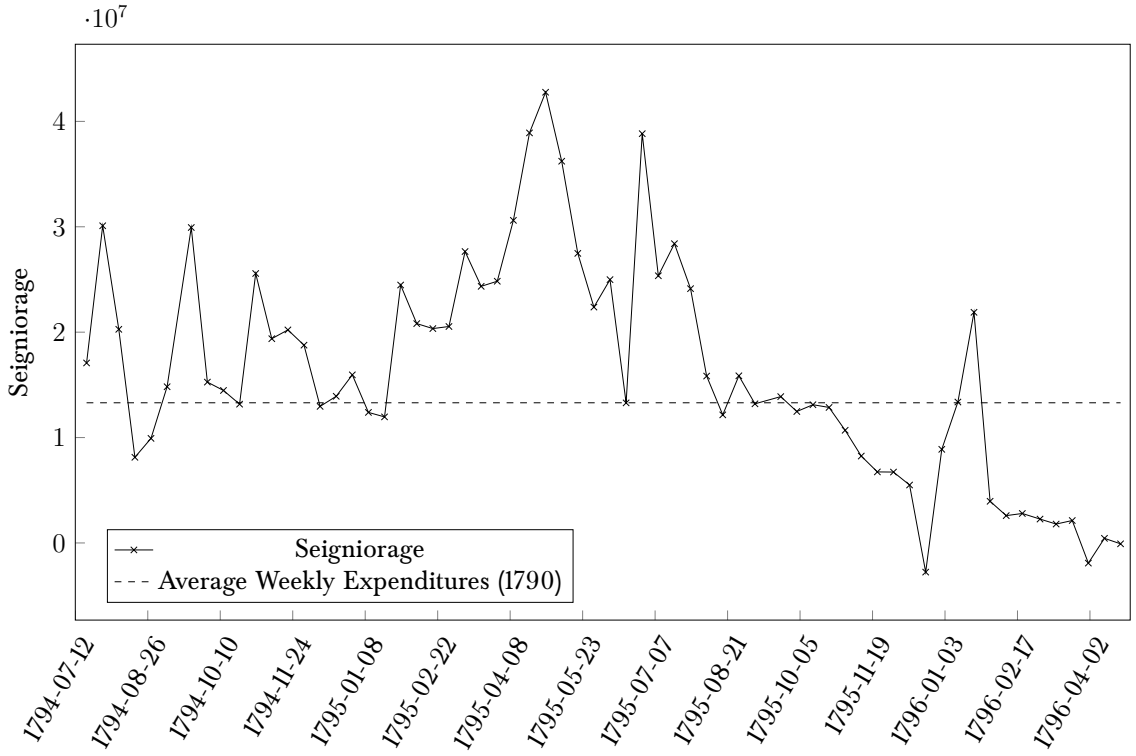
Once it became clear that the *assignats* were used to finance the deficit, inflation soon started to increase. As early as in 1793, one of the most radical revolutionary in the assembly, Saint-Just argued in a letter that France was already in an hyperinflation dynamic:

> The enormous creations of assignats that we have made have their source mainly in the acquisition of numéraire. The more assignats we create, the more the relative value of the currency increases, and the more the currency increases, the more assignats must be created. (Gross et al., 1962, p. 225)

Although we do not have data about the monthly deficit after April 1795, we do know the extent to which inflationary finance was used. In Figure 2, we calculate weekly real seigniorage

expressed in December 1790 prices.[3] The French government raised real seigniorage equivalent to 15.2 million pounds from December 1790 in average. In comparison, in 1790, the French government spent 690.7 million pounds (Braesch, 1934), or an equivalent of 13.3 million pounds per week –represented by the horizontal line in Figure 2. In other words, inflation alone was able to finance a level of public spending greater than the entire 1790 budget for most of the period studied.

Figure 2: Real seigniorage in December 1790 pounds.



Inflation started to increase only after the beginning of 1795 and especially following the Fall of Robespierre (June 28, 1794), marking the beginning of an hyper-inflationary dynamic which lasted until April 1796. By the end of 1794, the deficit was out of control, tripling from 219 to 638 million pounds from December 1794 to April 1795 (Figure 1). Tax collection at that point was virtually non-existent. Taxes covered only 12% of total government spending in February

[3]Following Sargent & Velde (1995), we estimate real seigniorage as being equal to $\frac{M_t - M_{t-1}}{0.5(P_t + P_{t-1})}$. Weeks here are "revolutionary" weeks differ from the Gregorian calendar in that they are 10 days long instead of 7.

1795, 9.9% in March and 6.4% in April.[4]

This hyperinflation episode is unique in that it overlapped with a constitutional change. A new regime, with a new Constitution and a new legislature, was established in the beginning of November 1795. This regime change is characterized by the unfolding of a long and turbulent struggle between different factions in the National Assembly, and especially between the *Girondins* and *Jacobins*.

The establishment of the Directorial regime established in November 1795 was characterized by a change of attitude toward the *assignats* (Levasseur, 1903; Crouzet, 1993). Political support for the paper money weakened as *jacobins*, who had been relentlessly supportive of the interests of notes bearers, lost their grip on power. Hence with the establishment of the Directorial regime, agents increasingly saw a "default" on the *assignats* as a possibility and the demand for money collapsed.

Sargent & Velde (1995) argue that the French Revolution can be characterized roughly by three different monetary theories: (1) The Real-bills doctrine, (2) Legal Restriction Theory and (3) Classical hyperinflation *á la* Cagan. Only after the fall of Robespierre, Sargent and Velde argue, was the relationship between real money balances and inflation matching the process described by Cagan (1956).

We argue, on the other hand, that applying the Cagan approach to the period aforementioned can be misleading if the effect of the introduction of the Directory on the public expectations is not taken into account. Our econometric exercise in section 5 suggests that the Cagan approach seems to describe the relationship between real money balances and inflation between the fall of Robespierre and the establishment of the Directorial regime in November 1795 but does not apply to the period following the establishment of that new political regime. As we show in section 5, there is at least one structural break in the relationship between real money balances and inflation around November 12, 1795. This break corresponds to the establishment

[4]For the month of February, see *Le Moniteur Universel*, n°165, March 5 1795, p.595. For March see: *Journal des débats et des décrets*, n°912, p.134-135. For April see: *Collection générale des décrets rendus par la convention nationale* Vol. 61 (Floréal an III; 20 avril-19 mai 1795), p.58-59.

of the Constitution of Year III establishing the Directorial regime (1795-1799). We suggest that the change of political regime was responsible for the breaking apart of the Cagan relationship.

The idea that, during late 18th century France, the public took into account constitutional changes in its decision to hold money balances, far from being only a theoretical possibility, seems supported by both quantitative and qualitative evidence. Numerous police reports and newspaper articles refer to the impact of a change in the Constitution on the value of *assignats*. For instance on June 28 1795, the *Courrier français*, links constitutional change to inflation:

> We must believe that the hope of a new Constitution would bring consolation in the hearts and would reduce the price of commodities. Whatever the cause, the price of goods and particularly that of edibles has increased by almost a third. This circumstance should hasten the debates to which the new plan of Constitution will give rise, and above all determine the government to put a very prompt economy in its finances. (Aulard, 1899, p. 42).

Similarly, a police report declares on June 20, 1795 that "organic laws occupy people's minds, as well as the restoration of finances" (Aulard, 1899, p. 26) and on June 23, 1795, the police reports how Parisians in coffee shops, after having talked of the rise in the price of gold and silver, declare that "Courage and patience is needed; it is only gradually [...] that the Constitution will be organized, that the price of foodstuffs will decrease and abundance will be reborn with trust." (Aulard, 1899, p. 31).

Monetary "policy" did get a significant amount of attention by politicians at the end of the Convention. Already in February 1795, Cambon was proposing a plan to burn 3 to 4 billion pounds of *assignats*.[5] During the last weeks of the Convention, leading politicians became worried that inflation being out of hand, a coup would occur and their heads would quite laterally be lost. The president of the Committee of Public Safety, Cambacérès declared during a session that if inflation continues "well, we run the risk of being hooked to the lantern."[6]

[5] *Le Messager du Soir*, n°921, February 26, 1795.

[6] Lamp posts served as an instrument to mobs to perform improvise lynchings and executions in Paris during the revolution.

"Assignat or death," was not simply a rhetoric trick, it was a grim possibility for politicians at the time. Consequently, reestablishing balance in public finances, limiting inflation and reinstating confidence among the public became primordial concerns during the Constitutional debates preceding the establishment of the Directory. Following the debates over the institutions of the new Directorial regime, the Constitution of Year III specified the functioning of the Treasury to avoid the abuses that had existed during the Convention where a multitude of committees increased public spending without regard to the overall health of public finances. One of the first act the new parliament took was to name a commission to find solutions for going back to a stable currency.

3 Rules, Seigniorage, and the Demand for Money

Before proceeding to our empirical analysis, a discussion of the relationship between inflationary finance and the rules that constrain the government's ability to create money is in order. The intuition behind our discussion in this section is straightforward: the seigniorage-maximizing rate of inflation depends on the rules governing the monetary authorities' behavior. Different rules will produce different tax rate and base structures. Thus, the empirical analysis of inflationary finance must account for the effect that institutions and institutional change have on the public's demand for money, otherwise estimates of the relevant parameters will be biased.

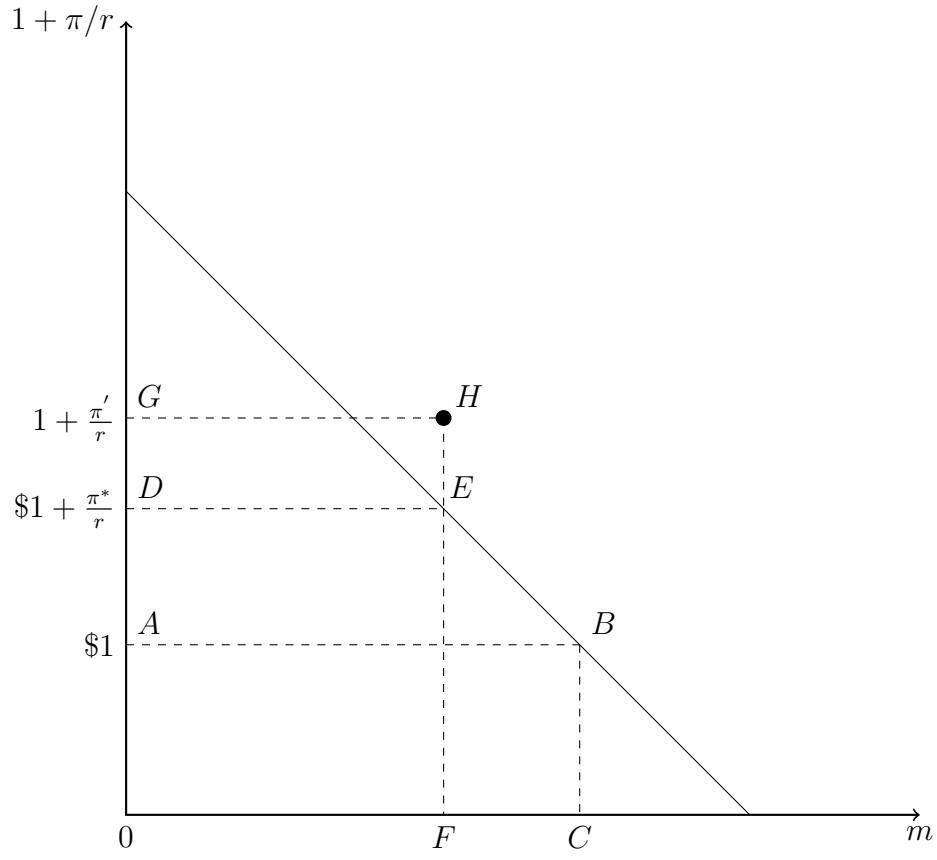
We use a model similar to that found in Brennan & Buchanan (1980, pp. 138-144). In this model, the time horizon is infinite, the economy is closed and in a state of stationary equilibrium, and the government possesses a monopoly over money creation.[7] In the first period, the government creates a stock of non-interest bearing money that it offers to the public in exchange for real resources. To induce the public to accept this offer, the government permits citizens to use this money to pay their taxes in subsequent periods, conferring a benefit to the government in the form of an interest-free loan worth the real value of the money stock.

More formally, the government earns $r \cdot m$ each period, where r is the real interest rate and

[7] See Friedman (1971) for a model of inflationary finance in a growing economy.

m is the stock of real money balances, i.e., $m = M/P$ where M denotes the stock of nominal balances and P the price level. Since the government receives this benefit in perpetuity, the present value of its monopoly franchise is $r \cdot m/r$, or simply m. This relationship can be expressed graphically. Consider the demand curve for real balances depicted in Figure 3. The horizontal axis measures the quantity of real balances (denominated in initial period dollars) and the vertical axis measures the capitalized cost of holding different quantities of those balances in perpetuity. In the zero-inflation case, the price of a dollar's worth of liquidity services provided by a unit of real balances is simply \$1; a dollar's worth of real balances must yield a dollar's worth of liquidity services at the margin. Since the monopoly franchise entitles the government to the present value of those liquidity services, the capital value of its franchise is depicted in Figure 3 as either the area $0ABC$, or simply $0C$.

Figure 3: The Demand for Real Money Balances



To make this point more concrete, suppose the government exchanges \$100 worth of newly-

created money for an equivalent amount of real resources from the public in the first period. Had the government borrowed via traditional means, it would have to return the principal plus interest. But, because the public gave up the \$100 worth of real resources in exchange for the liquidity services the government-issued money provides, the government need only return the principal. At an interest rate of 10%, the monopoly franchise confers a benefit to the government worth \$10 per period in perpetuity, or \$100 - the real value of the money stock. Thus, even with zero inflation, the present value of the government's monopoly franchise is positive.

With inflation, the price of holding a unit of real balances is higher because maintaining the same stock requires additional resources. If the inflation rate, π, is constant and accurately predicted by the public, the present value of the additional cost that must be incurred to maintain a unit of real balances in perpetuity is:

$$\frac{\pi}{1+(\pi+r)} + \frac{\pi(1+\pi)}{[1+(\pi+r)]^2} + \cdots + \frac{\pi(1+\pi)^{n-1}}{[1+(\pi+r)]^n} = \frac{\pi}{r} \tag{1}$$

Thus, with inflation the price of maintaining a dollar's worth of liquidity services in perpetuity is:

$$\$1 + \frac{\pi}{r} \tag{2}$$

How does inflation affect the value of the government's monopoly franchise? Like the zero-inflation case, the capital value of the government's money-creation powers is equal to the quantity of real balances the public holds times the price the government charges the public for those balances, except now this price includes the capitalized cost of inflation:

$$m \cdot (\$1 + \frac{\pi}{r}) \tag{3}$$

To maximize the present value of its monopoly franchise, the government must select a rate of

inflation consistent with ensuring that:

$$\frac{\partial}{\partial \pi}\, m(1+\pi/r) = 0 \tag{4}$$

In other words, the government must select the rate of inflation, π^*, where the demand for real balances is unit elastic (assuming the government can costlessly produce nominal balances). At π^*, the capital value of the government's monopoly franchise is equal to the area $0DEF$ depicted in Figure 1.

Thus far, our analysis presumes the government is bound to whatever inflation rate it selects - a commitment that the public must regard as credible. To see why, suppose the government announces that it will pursue the seigniorage-maximizing inflation rate, π^*. Once the public adjust their money balances in response to this announcement, the government is in a position to reap a capital gain by creating more inflation than the public expect. For instance, suppose it selects the inflation rate $\pi^{'}$. As Figure 1 illustrates, the government will earn a capital gain equal to the area $DGHE$. Indeed, the additional seigniorage revenue the government can collect from higher-than-anticipated inflation in this scenario is limited only by the government's ability to issue nominal balances.

If the public believed that such a deception was an isolated event, the capital value of the government's monopoly franchise would be substantially larger than that indicated in our earlier analysis. The public, of course, are unlikely to be this myopic. What sort of expectations might they adopt in this setting? The answer depends on the public's perception of the government's objective, what, if anything, constrains its money-creation powers, and the time horizon over which the public expects the government-issued money to exist.

We start off by assuming the government's sole objective is to extract the maximum amount of seigniorage revenue possible, and that there is nothing constraining its ability to create nominal balances. If the public are aware of these conditions, then their dominant strategy is to hold positive real balances if, and only if they believe the government will not renege on its

prior commitment regarding the future path of the money supply. Table 1 depicts the the sort of game the public and the monetary authorities are playing.

Table 1: Strategic interaction between the public and the government

	Government	
Taxpayer	Maximum Inflation	Restraint
Hold cash	$(-a, +c)$	$(+a, +b)$, $c > b$
Zero Money Balances	$(0, 0)$	$(0, 0)$

Suppose b in Table 1 reflects the capital value of the government's monopoly franchise when $\pi = \pi^*$, and c the one-shot payout it can earn by reneging on its commitment to the public, who will never accept government-issued money again if cheated. In this case, cooperation can only be sustained when the present value of the government's monopoly franchise sufficiently exceeds the revenue from maximally inflating. Formally, cooperation can be sustained when the rate at which the government discounts future seigniorage revenue is greater than or equal to $1 - b/c$. The trouble is c may be quite large relative to b. As Figure 3 illustrates, the government can temporarily push the public off their money demand curve and reap the corresponding amount of revenue. If there is nothing constraining the government's ability to create money, c approaches infinity. Thus, any equilibrium where the public hold positive real balances is extremely tenuous as even slight deviations from the expected future path of money growth may signal to the public that the government is trying to fool them, potentially causing the public's demand for money to fluctuate widely.

Even during the most severe episodes of hyperinflation - including the case of the *assignat* - the observed quantity of real balances is positive, which suggests something must constrain the government's ability to create money, whether that be resource limitations, interest-group pressures, etc.[8] The point we want to emphasize here, however, is that the tenuousness of any monetary equilibrium under such a scenario makes estimating the public's money demand

[8]Two examples that illustrate this point are the recent hyperinflation in Zimbabwe, where the monetary authorities ran out of the paper necessary to continue printing at the rate they needed, and the U.S. Civil War, where Confederate lawmakers responded to political pressure to reduce quantity of money (Cutsinger & Ingber, 2019).

extremely difficult precisely because it is unclear what sort of expectations would be rational in this context. As we explain in the next section, this insight requires first determining whether the monetary regime was reasonably stable during the period under investigation, and second utilizing an estimation technique that does not require strong assumptions about how the public form their expectations of future inflation.

However tenuous the existing monetary equilibrium is, cooperation can nevertheless be sustained provided the time horizon over which the public expects the money to exist remains indefinite. What happens if there is a known end date? In this case, cooperation becomes impossible. The public, aware the government's dominant strategy is to maximally inflate in subsequent periods, will be unwilling to hold any of the government-issued money. This insight also has an important empirical implication for the study of inflationary finance. When it becomes evident to the public that the government is going to abandon the currency - as it did in the case of the *assignat* - they will try to reduce their holdings of the currency to zero. Thus, our framework predicts that once such an announcement is made, the relationship between real balances and inflation will cease to exist.

4 Data

To test for the constitutional approach, we use data from Ramel de Nogaret (1800) on the money supply from April 30, 1794 to June 9, 1796 and from Caron (1909) on the price level. We use the data copied from the Treasuries registers by de Nogaret (1800), who argues that the money supply can be derived from the difference between the number of *assignats* burnt and the number of *assignats* issued by the Treasury. Previous scholars have used the data given by de Nogaret (1800) in monthly form (Sargent & Velde, 1995), even though his data are given at weekly intervals by Nogaret.[9] As weekly data is better suited for identifying the effect of constitutional change on money demand, we use Nogaret's data in its original form.

[9]The revolutionary week is not exactly a week. The idiosyncrasies of the French revolutionary calendar means that each week is 10 days long.

In that sense we follow Mladenović & Petrović (2010) work on Serbian hyperinflation where the authors argue that agents during hyper-inflations adjust their behavior at a higher frequency than monthly.

The data given by de Nogaret (1800) is also almost identical, when converted into monthly data, to the data used by White (1987). The correlation coefficient between the too series being equal to 0.999 and the correlation coefficient between their growth rates is 0.973.[10]

Table 2: Summary statistics

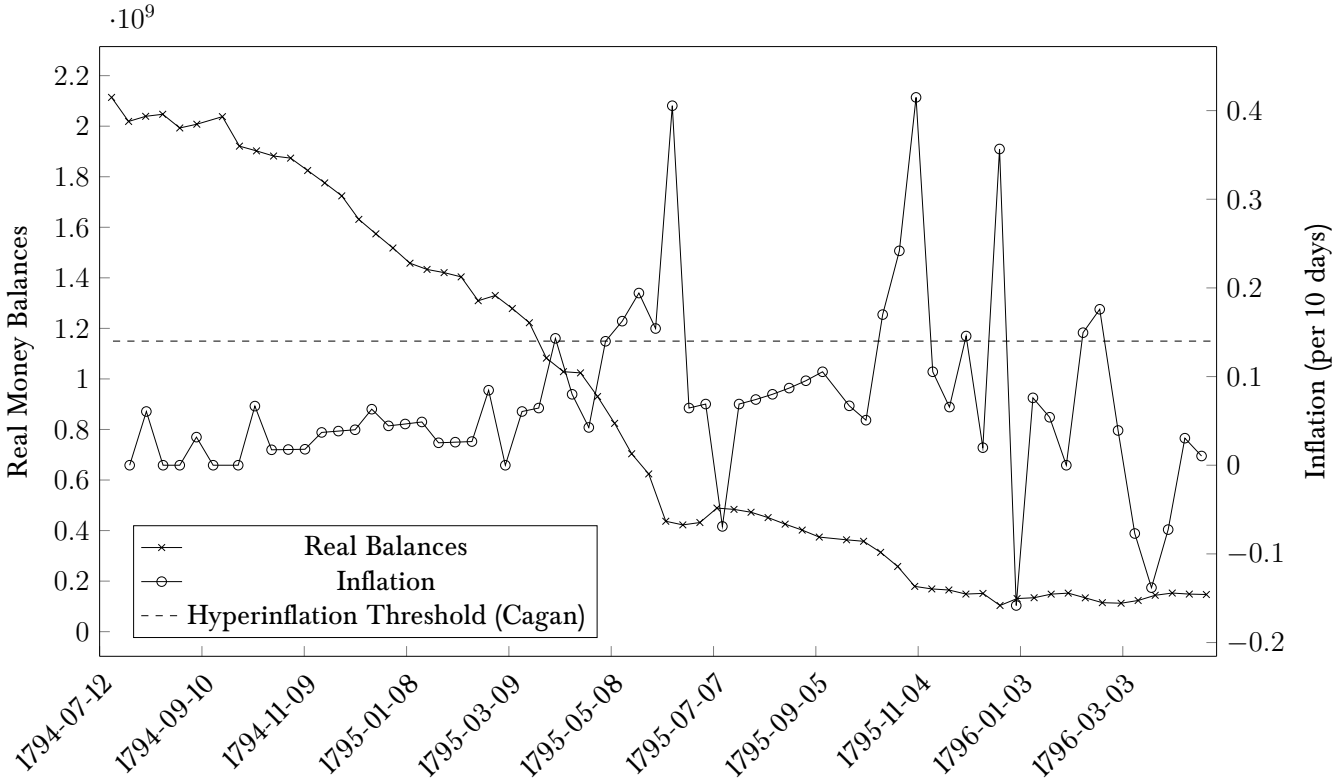
Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
	Whole period (May 10 1794 to May 10 1796)				
log(Real Money balances)	73	20.24178	1.089679	18.45577	21.47849
$\Delta log(Prices)$	73	.065968	.0986267	-.1582222	.4149466
	First period (May 10 1794 to November 2 1796)				
log(Real Money balances)	54	20.77258	.7093434	19.00384	21.47849
$\Delta log(Prices)$	54	.0688343	.088452	-.0689907	.4149466
	Second period (November 12 1796 to May 10 1796)				
log(Real Money balances)	19	18.73318	.1431112	18.45577	18.94592
$\Delta log(Prices)$	19	.0578215	.1256089	-.1582222	.3566732

Caron (1909)'s data gives the quantity of nuéraire that could be purchased with 100 pounds of *assignats*. The data from those *Tableaux de Dépréciation* was collected to enable debtors who contracted their debt in *assignat* to settle their debt. The law of June 23, 1797 ordered each department to produce a table accounting for the depreciation of the paper money based on the price of: a) gold, b) foodstuff, c) real estate and d) other commodities. (White, 1991, p. 245) argues that those tables are "a fairly accurate measure of inflation [...], particularly during the last and most rapid phase of inflation." We use the data for prices in the department of the Seine (i.e. Paris).

Over our period of interest, which lasted 2 years, prices increased by more than 11,000%.

[10] In fact, the two series have a one day lag. While de Nogaret (1800) reports the money supply data on the 1, 11, and 21 day of the month, White (1987) reports the money supply on the last day of the month, (the 30th). To calculate the correlation coefficients, we matched the data from the 30th with the data from the 1st.

Figure 4: Real Balances and Inflation



Prices increased by an average of 6.6% every 10 days between May 10 1794 and May 10 1796.[11] Although it is hard to know to what extent departmental figures, drawn by local authorities, reflect the price of gold, gold and commodity prices closely followed each other, giving more credibility to our measure of the price level. On a theoretical level, using the price of gold is adequate during periods of significant inflation, agents have an incentive to separate the medium of account and the medium of exchange. For instance, while goods and services may have been denominated in gold, the *assignats* was used as the medium of exchange until 1796 –at least in Paris. For instance a police report from December 9 1795 describes how "if they [Parisian Merchants] sell for *assignats*, it is only after having calculated the numéraire they worth at the stock exchange." (Aulard, 1899, p. 489).[12]

[11]The average inflation rate is a geometric mean. Thus, the price index is equal to 277.778,in the first period, and 34285.699 on the last. Hence, $34285.7 = 277.8e^{73x}$, where 73 is the number of periods and solving for x gives the geometrical average of the inflation rate per period.

[12]See also Aulard (1899, p. 508)

Although data about commodity prices are relatively scarce, we compare daily gold prices to daily data about a few commodities published in *Le Moniteur* between August and December 1795.[13] Those price series confirm that commodity prices closely followed the price of gold (Appendix 7.1).

5 Empirical Analysis

5.1 Structural Break in the demand for money and the Directory

A key implication of the theoretical approach we discussed in Section 3 is that regime change *may* affect the demand for money.[14] If this conjecture is correct, estimates of the demand for money that fail to account for such changes will yield misleading results. Thus, the first step in our empirical analysis is to determine whether the constitutional reform affected the demand for *assignats*. To do so, we test for a structural break in the relationship between the real balances and inflation series without imposing a known break date, by combining the test statistics computed for each possible break date in the sample.[15] Using the supremum Wald test, we find that there is, in fact, a structural break in the series that occurs around November 12, 1795, which coincides with the start of directorial regime a few days earlier. Table 3 reports the results of our structural break analysis.

One worry could be that our results are sensitive to the choices over both the start and end dates. Hence, we use both a restricted and more comprehensive sample in everyone of our econometric exercises. The more comprehensive sample starts on May 10th 1794 and ends on May 10th 1796, after which it was announced that the *assignats* would soon loose their legal tender status. Sargent & Velde (1995) claim that the *assignats* can be analyzed as an hyperinflation *á la* Cagan only for the period after the execution of Robespierre and ending in

[13] Those data are consistent and completed with the data published in the *Journal de Paris* during the same period.

[14] We say "may" here because some cases of reform may be nothing more than a change in the de jure rules leaving the de facto rules unchanged.

[15] See Andrews (1993), Kim & Siegmund (1989), and Quandt (1960) for additional details on this approach.

March 1796. Hence we restrict our sample from July 29th 1794 (the first observation after the fall of Robespierre) to March 22th 1796 (after which date the supply of *assignats* started to fall). Our results are robust to changes in both the start and end dates. The structural break test is also corroborated visually. The directorial regime's effect on the demand for *assignats* can be seen in Figure 5, by the divergence of periodic observations of demand.

Table 3: Evidence for Structural Break

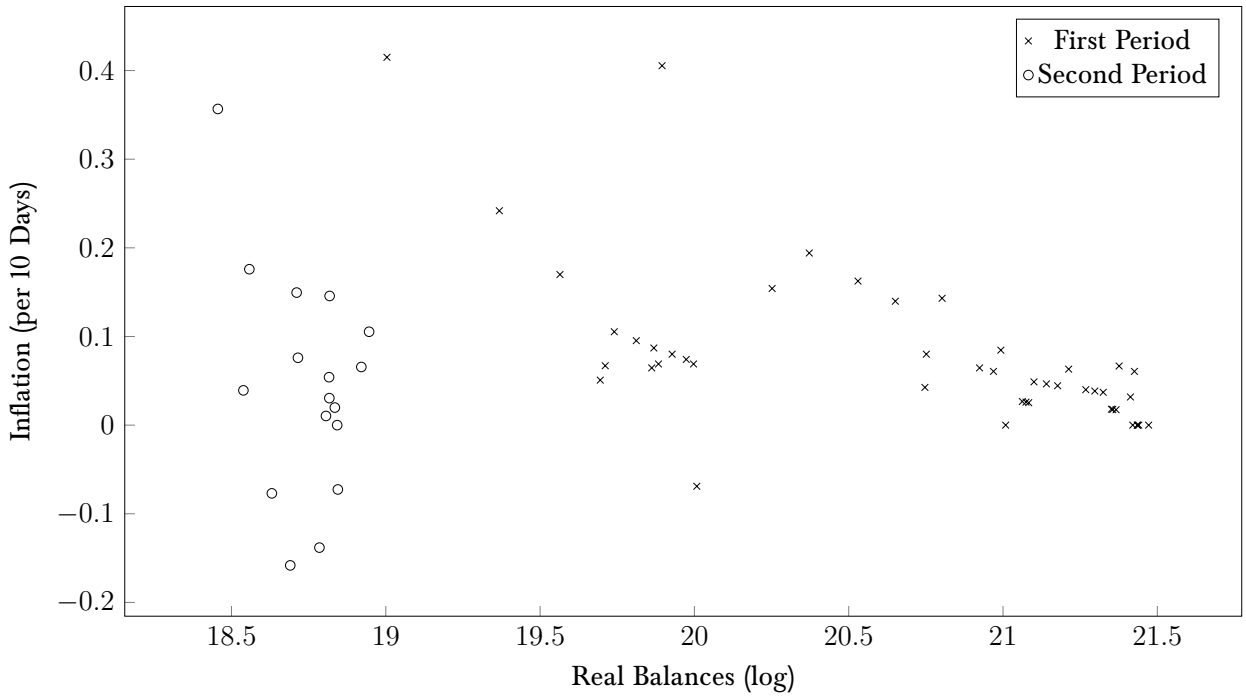
Wald Test for a Structural Break		
Sample	May 10, 1794 - May 10, 1796	July 29, 1794 - March 22, 1796
Supremum Wald Statistic	**657.1485*** **	**421.1725*** **
P-value	0.000	0.000
Break Date	November 12, 1795	November 12, 1795
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$		

Once evidence for a structural break was determined, we used the supremum Wald test to look for structural breaks across either side of the November 12th divide. We did find evidence for an additional break around June 9th 1795. Careful inspection of Figure 5 supports this finding. This structural break seems to correspond with the failed Montagnard insurrection at the end of May 1795 (see Appendix 7.2). According the Crouzet (1993, p. 386) the failure of this insurrection and the disarmament of the faubourg Saint-Antoine "could leave the way to a new politics" *vis-á-vis* finances and the *assignats* as the *Jacobins* lost control of the assembly.

Since the argument of this paper is that regime change matters, and not about the quantity of structural breaks, for simplicity, we felt including an additional break on June 9th 1795 was out of scope. Yet qualitative evidence corroborates the impact of the failed Montagnard coup on the *assignats* and therefore gives additional support to our thesis that changes in political equilibrium may impact money demand. After the obliteration of the Montagnard opposition, and much political unrest, the public expected a new constitution to be enacted and thought this would impact inflation. The Parisian police reports that on June 15 1795 people "would still see with the greatest satisfaction [...] the *assignats* take back a credit considerable enough to let go of anxiety. It has also been noted that what mainly occupies the minds, but without agitation,

is the expectation of the new government, whose mode must be soon proposed." (Aulard, 1899, p. 15). Yet one growing worry was that the government would "default" on the *assignats*. On June 17, 1795, we read in a police report: "Dufresnoy says he heard several individuals say they were not surprised at the loss the *assignats* felt, since during the course of next month France was to have a chief, and bankruptcy would be declared" (Aulard, 1899, p. 20). Similarly, On June 13 1795, a police agent reports that he heard in a coffee shop that "the project of the Convention was to demonetize the *assignats* of ten thousands and five hundred pounds and that people added that several members of parliament did not hesitate to say in their societies that there was no other ways to bring in seven or eight billion of *assignats* on the fifteen which are circulating." (Aulard, 1899, p. 12).

Figure 5: Scatterplot of Real Balances and Inflation

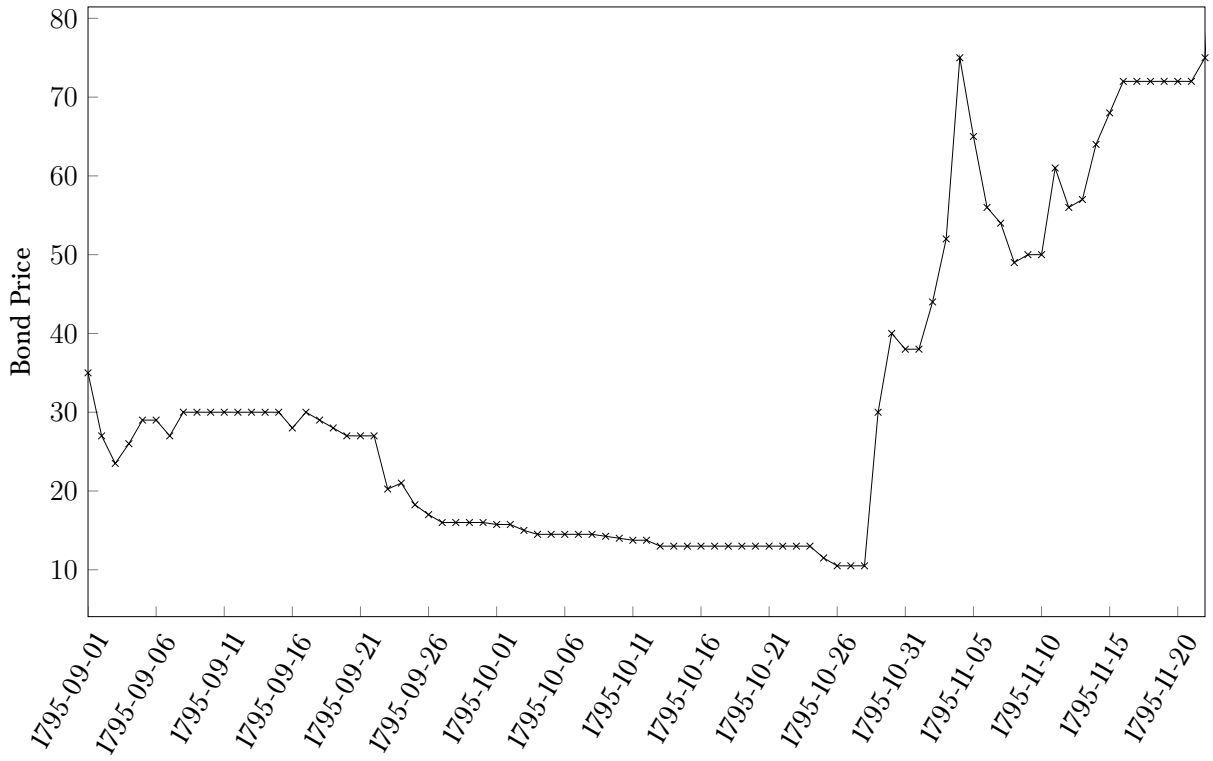


The new Directorial Congress met for the first time on October 30th 1795 and the first Director was nominated on November 1st. The identified structural break in the relationship between money balances (Table 3) happened around November 12. Since our data was collected over 10 day periods, and since this structural break does not correspond to either changes in

economic regulations or major military events (Appendix 7.2), we are confident that the fall in the demand for money was the result of the change in political regime.

The structural break we identified also correspond to a sudden and sharp increase in bond prices. Figure 6 shows the market price for a perpetual bond yielding an annuity of 100 pounds. Those *inscriptions* refer to the consolidation of the public debt in 1792 which led all the contracts of the creditors of the state into an inscription in a great book, which was called the "Great Book of the Public Debt." This reform transformed different claims into perpetual annuities yielding the same interest rate (Thiers, 1845, p. 320).

Figure 6: Perpetual Bond Prices During the Regime Change



Lines (1), (2) and (3) in Figure 6 represent respectively the official start of the Directorial regime (October 26), the beginning of the first session of the new Congress (October 30) and the formation of the executive branch with nomination of the first Director (November 1). The establishment of the new Constitution matches with a more than 7 fold increase in the price of perpetual bonds between October 28 and November 4. This suggest that the structural break in

the demand for money we identified corresponds with a radical change in people's expectations vis-à-vis fiscal and monetary policy.

Why did the enactment of the Directorial regime have such a dramatic negative effect on the demand for *assignats*? Mostly because: (1) the change of institutions was accompanied with a weakening of the Jacobin left which strongly opposed the demonetization of the *assignats* (Lefebvre, 1977, p. 104) and (2) because a constitutional change in a period of exacerbated political instability is an extremely uncertain endeavor. As long as the *jacobins* remained a major political force, demonetization was out of question. The Convention had avoided to engage in monetary reform during the entire summer of 1795. The Directorial regime, on the other hand, was eager to come back to metallic currency, even if it was at the expense of the owners of *assignats*. The new lower chamber, the *Conseil des Cinq-Cents* was not as committed to avoid a *de facto* default on the *assignats* (Levasseur, 1903, p. 126).

The successful establishment of the Directory, on the other hand, was far from certain even in the first week of its existence. On October 3rd 1795, 7 Parisian sections declared to be in a state of insurrection. On October 5th, the monarchists attempted a coup which failed. With both the *Jacobins* and the monarchists crushed, the Directory was now able to emerge. The faith of the new Constitution, however, remained uncertain until the very end. As Director de La Révelliére-Lépeaux (1895, pp. 257-263) explains in his memoirs, the attempted coup by the monarchists gave some Thermidorians an excuse to stop the establishment of the Constitution of Year III and to reestablish the Revolutionary government. A secret agent reports that on October 24th, two days before the official start of the Directorial regime, some people in Paris "manifested the fear that the work of the Convention would continue beyond the 5th of this month [Brumaire], which would further delay the organization of the constitutional government." (Aulard, 1899, p. 335). Even after the official start of the regime, the threat of a *jacobin* coup remained acute (Lefebvre, 1977) and Director de La Révelliére-Lépeaux (1895) remembered being seized with "mortal anguish" during the first few days of the Directory.

The remaining *jacobins* in the Directorial Congress such as Dubois-Crancé or Lindet fiercely

defended the interests of the bearers of *assignats* by opposing their demonetization (Crouzet, 1993; Lefebvre, 1977). Yet their influence was now too limited to determine the course of monetary policy and the Directors "were decided to abandon the assignats" (Crouzet, 1993, p. 399).

One day after the directorial Congress was constituted, on October 31st 1795, the *Conseil des Cinq-Cents* immediately ordered a report to be written on how to reform the monetary constitution. By monetary constitution, we mean the constraints placed on the money creation process. The report, directed by Eschassériaux was represented in front of the parliament on November 13 1795.

Eschassériaux' project was to limit the ability of the government to inflate the currency. He asked for the quantity of *assignats* to be made public (T1, art.1), to to limit the total supply of *assignats* permanently to 30 billion pounds (T1, art. 3), to break the printing press on January 5th 1796 (T.1, art.2) and to convert *assignats* into what would have been devalued bonds (T.2, art.1). Eschassériaux also complained that the depreciation of the *assignats* "made tax revenue almost null." Hence Eschassériaux' commission proposed to fix taxes in gold and accept either gold or *assignats* at its market price to pay them.[16]

Eschassériaux' plan to go back to metallic currency was tantamount to a *de facto* default on the *assignats* which would have lost their legal tender status. The left of the political spectrum fought back. Dubois-Crancé argued the choice was between "assignats or death" while Lindet argued that demonetization was no different from bankrupcy. Although Eschassériaux' plan was voted against by the *Conseil des Anciens* on December 5th, the worry that the *assignats* would soon be demonetized became pervasive. On November 13th 1795, a secret agent reports people "fear that the assignats will be demonetized" (Aulard, 1899, p. 382). Similarly on November 15th 1795, another police report claims that some people "pretend that assignats of less than 100 pounds are going to be demonetized" (Aulard, 1899, p. 388) and another, the same day, warns that the public sees the *assignats* "annihilation as proximate" (Aulard, 1899, p. 389).

[16] *Le Moniteur Universel*, November 24 1795, n6, p.51

Paradoxically, given that the government could not easily raise more revenue through taxes or loans, limiting the government's ability to collect revenue through seigniorage increased the probability of demonetization.[17]

5.2 Constitutional change and the demand for money

The presence of a structural break on November 12th 1795 suggests that the successful establishment of the Directorial regime did affect the demand for *assignats*. To determine how it did so, we now turn to estimating the demand for *assignats* on either side of the break, treating each period as its own sample. To do so, we use the following Cagan-style money-demand function:

$$(m - p)_t = -\alpha \Delta p^e_{t+1} + \psi_t \tag{5}$$

where, m and p denote the natural logarithms of the money supply and price level, respectively, Δ denotes the difference operator, e denotes the public's expectations formed at time t, and ψ_t denotes factors - such as real income and interest rates - whose effect on the demand for money are assumed to be relatively small compared to the those of expected inflation when prices are rapidly increasing (Cagan, 1956, p. 25). The primary variable of interest in equation 5 is α - the semi-elasticity of money demand with respect to expected inflation. Once we obtain an estimate for α, we can determine whether French officials were maximizing the revenue from seigniorage, which, as we noted in our theoretical discussion of inflationary finance, occurs where the demand for money is unit elastic. In the case of equation 5, unit elasticity occurs where $\Delta p^e_{t+1} = 1/\alpha$.

We adopt the approach first introduced by Taylor (1991) to estimate the demand for *assignats* that produces an estimate of α that does not require us to make restrictive assumptions about how the public form their expectations of inflation.[18] Instead, this approach allows us to estimate

[17] This point is similar to that made in (Sargent & Wallace, 1981).

[18] See Salemi & Sargent (1979) and Sargent (1977), for discussions of how the assumptions regarding expectations affect Cagan's approach to hyperinflation. See Phylaktis & Taylor (1993) for an application of the approach we use in this paper to episodes of money mischief in Latin America.

α using ordinary least squares, provided the real-balances and inflation series possess certain qualities. To see what those qualities are, we begin by substituting expected inflation in equation 5 with actual inflation:

$$(m-p)_t = -\alpha \Delta p_{t+1} + \mu_{t+1} \tag{6}$$

where $\mu_{t+1} = \psi_t + \alpha(\Delta p_{t+1} - \Delta p^e_{t+1})$.[19]

Suppose that the growth rates of both real balances and inflation are first-difference stationary, and that μ_{t+1} is stationary, i.e., both ψ_t and the public's forecast errors of inflation are $I(0)$. Adding $\alpha \Delta p_t$ to both sides of equation 6 yields:

$$(m-p)_t + \alpha \Delta p_t = -\alpha \Delta^2 p_{t+1} + \mu_{t+1} \tag{7}$$

If both terms on the right-hand side of equation 7 are stationary, the linear combination of real balances and inflation must also be stationary, despite the fact that each series individually is not.[20] That is, the two series are co-integrated with a co-integrating parameter, after normalizing on real balances, equal to Cagan's α. Thus, a sufficient condition for the applicability of Cagan's model of hyperinflation is for real balances and inflation to be co-integrated. If satisfied, this condition allows us to estimate equation 6 using ordinary least squares.

Table 4: Augmented Dickey-Fuller Tests

Note: This table represents results on the sample from May 10th 1794 through May 10th 1796. The results from our contrasting sample, from July 29th 1794 through March 22th 1796, has similar results and can be furnished by the authors.

Variable	t-Statistic	1% Critical Value	p-Value for Z(t)
1st Difference in Change in Money Demand	-6.668	-3.551	0.0000
1st Difference in Change in Prices	-14.305	-3.551	0.0000

Table 4 reports the results of our unit-root tests for stationarity. Using the Augmented Dickey-Fuller Test, where the null hypothesis supposes a unit root and the alternative suggests

[19] Note that the second term is simply the public's forecast errors of inflation.

[20] Note that the first term on the right-hand side of is the first difference of the inflation series, or equivalently, the second difference of the price series.

that the variable was generated by a stationary process, we can test to see if real balances and inflation are stationary. That is, if we can reject the null, the two series can be said to have tendency toward a constant mean, allowing for asymptotic modelling. As the results indicate[21], at a 99.9% confidence level, we can reject the null.

Table 5 reports the results of our co-integration tests. Our findings indicate that, from May 10th 1794 to May 10th 1796, or as we've defined the whole period, real balances and inflation co-integrated. However, the statistical strength of the co-integrating parameter increases when we test the periods individually. That is, period 1 and period 2 have at least one co-integrating equation, with greater statistical power, than the two periods combined. This suggests that estimating Cagan's α across the whole period introduces bias.

Table 5: Johansen Tests for Co-integration Across Periods

Note:The table represents results on the sample from May 10, 1794 through May 10, 1796. The results from our contrasting sample, from July 29, 1794 through March 22, 1796, has similar results, with one exception. That is, despite having co-integration for both the first period and the whole sample, the second period is not co-integrated across the whole period at the 5% level. This is to be expected, as there are fewer observations to swamp the effects of the structural break.

Period	# of Obs.	Max Rank	Eigenvalue	Trace Statistic	1% Critical Value
1	52	0	.	26.4951	20.04
		1	0.34174	4.7513*	6.65
		2	0.08732		
2	19	0	.	56.4976	20.04
		1	0.93324	5.0719*	6.65
		2	0.23428		
Period	# of Obs.	Max Rank	Eigenvalue	Trace Statistic	5% Critical Value
1-2	70	0	.	16.6470	15.41
		1	0.21164	0.0012*	3.76
		2	0.00002		

There are several reasons that may explain why the co-integrating relationship dissipates across the periods individually and that of the whole period. The first is that the establishment of the directorial regime ultimately led to the abandonment of the *assignat*. Recall that our

[21]The results in this table represent those for the whole sample. We re-tested the sample using each break period, finding similar results

model of inflationary finance indicated that cooperation between the monetary authorities and the public would break down once the time horizon becomes finite. Once people expected the demonetization of the *assignats*, they started worrying that the government would try to deceive the public to raise additional seigniorage revenue. The Directory suffered from extreme credible commitment problems.[22] On December 3 1795, a policeman reports the discontent of the Parisian public which complained that "the Legislature made a law ordering that the printing press be broken in Nivose, and today, it proposes to create more *assignats*" (Aulard, 1899, p. 458). Another police report on December 4th claims that the public was critical of the parliament's secret sessions (called general committees) and that Parisians saw them as partly responsible for "the rise of gold, the rise of commodities and the daily discredit of the *assignats*" (Aulard, 1899, p. 462). Secrecy during periods of high inflation is likely to be interpreted as the government trying the "cheat" their citizen through even higher rates of inflation. If the public expects the government to cheat, they will reduce their holdings of real money balances regardless of the current inflation rate. While our evidence is only suggestive, we suspect that the decrease in the relationship between real balances and inflation in the second period was caused by the decision to abandon the *assignats*.

Another reason for the weakening cointegrating relationship, which is really just an econometric byproduct of the first, is explained by Gregory et al. (1996), who suggests that power falls with the high cost of adjustment. In this case the costs are defined as a dramatic change in the stable root, or mean over time, which leads to a loss in explanatory power.

We now turn to estimating the demand for *assignats* using equation 7. The first two columns in Table 6 report our results for periods 1 and 2, from May 1794 to May 1796, respectively. Both period's estimates of α are significant. The first period has a seigniorage-maximizing rate of inflation of 19.5%, per 10 day period. It's a plausible estimate –the average inflation rate during that period was equal to 6.9%– and offers a sharp contrast to that of the second

[22]For instance On December 10 1795, some people in Paris argued that the forced loans was set to bring 60 billions of *assignats* out of circulation (twice as much as the total money supply) as "a political trick from the part of the government to furtively issue 30 billion of new assignats" (Aulard, 1899, p. 492).

period. According to an F-test, there is no overlap in the two estimates of α. Moreover, the second period suggests a relatively astronomical seigniorage-maximizing rate. One, well above the inflation rate, which we will explain and visualize in Figure 7.

Table 6: Estimating Money Demand Using Change in Inflation

Note: This table displays the results of the OLS regressions of the log of real money balances on the first difference of the log of prices (Prices=1 in December 1790). The first three columns use the data of de Nogaret (1800) from May 10 1794 to May 10 1796 which is the last observation before the announcement that the *assignats* would loose their legal tender status. Columns 4 to 6 restrict the sample by deleting the observations before the death of Robespierre (July 28 1794) and the observations after the end of March 1796, for which the money supply is shrinking. In all cases, the separation between the first and second period occurs on November 12 1795 –i.e. the date of the structural break identified in Table 3.

	May 10 1794 to May 10 1796			*July 29 1794 to March 22 1796*		
	(1)	(2)	(3)	(4)	(5)	(6)
	1st Period	2nd Period	Entire Period	1st Period	2nd Period	Entire Period
Inflation	-5.1329***	-0.5215*	-2.7998**	-4.6019***	-0.3512	-2.2419
	(0.9461)	(0.2492)	(1.3746)	(0.9551)	(0.3057)	(1.4421)
Intercept	21.1259***	18.7633***	20.4265***	21.0198***	18.7535***	20.3727***
	(0.1001)	(0.0320)	(0.1799)	(0.1202)	(0.0339)	(0.1983)
Seigniorage Maximizing Rate	19.5%	191.7%	35.7%	21.7%	284.8%	44.6%
N	54	19	73	46	14	60
R-Squared	0.4097	0.2095	0.0642	.3575	.1022	.0494

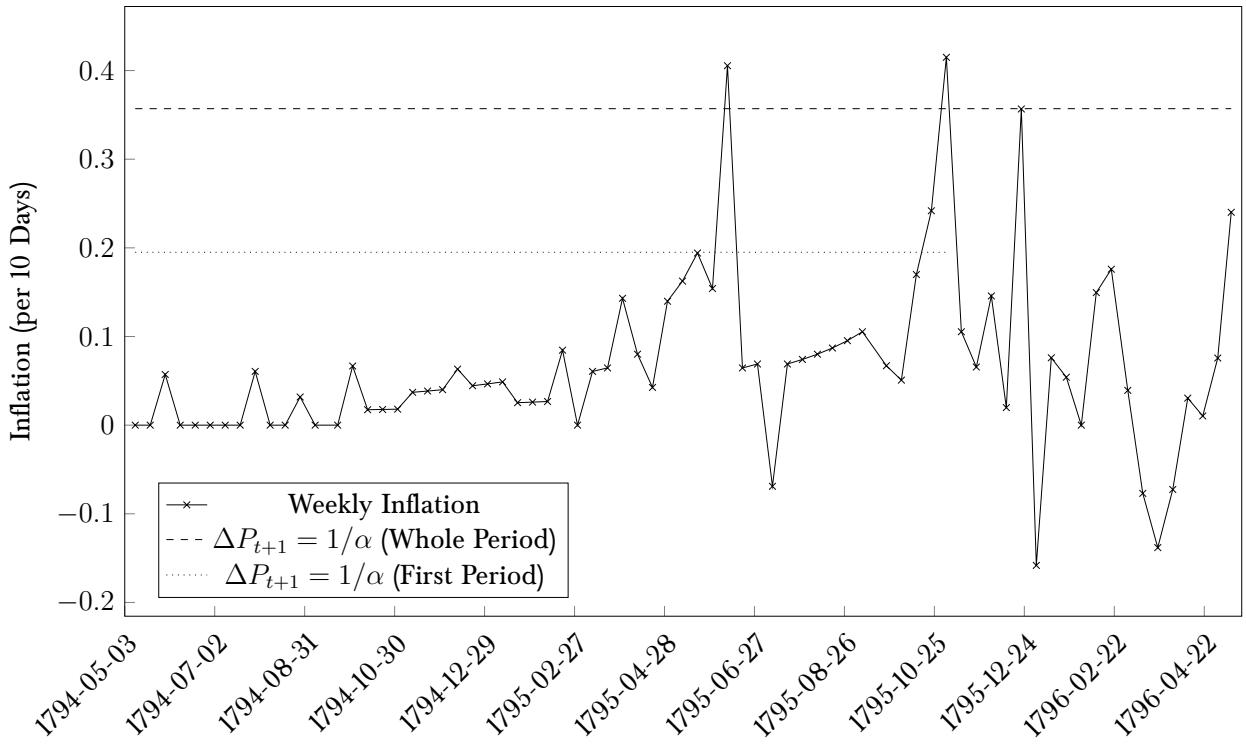
Robust Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

This sample represents our most extensive sample, given the data. We were worried we may have introduced bias in the estimates with data prior to that of the inflationary period, which is one of Cagan's requirements. However, if we restrict the sample, as a robustness check, little changes. Columns 4 to 6 in table 6 restrict the sample by deleting the observations before the death of Robespierre (July 28 1794) and the observations after the end of March 1796. Again, in the period before the structural break, our estimate of α is statistically significant and of a plausible magnitude. It implies that the seigniorage-maximizing rate of approximately 22 percent per 10 days, or roughly 80 percent per month.

Figure 7 plots actual inflation during this period against our estimate of the seigniorage-maximizing rate. Inflation during this period was clearly well below that which would have

maximized seigniorage revenue, although near the end of the period there were a few weeks where actual inflation surged past the seigniorage-maximizing rate.

Figure 7: Inflation and the seigniorage maximizing inflation rate



Contrasting the results of Table 6's two samples, an interesting result emerges. We would expect that as we move from the larger sample on the left (columns 1, 2, and 3) to the restricted sample on the right (columns 4, 5,and 6), that we would pick up explanatory power. This is because the restricted sample focuses on the period of high inflation. Under Cagan, where in such periods the variation in prices swamps all other predictors of money demand, our r-squared values should increase. In other words, we would expect our modelling error to diminish as inflation is increasing rapidly. This is not the case. Thus, it appears that the regime change is a conflating factor.

We began this section by noting that failure to account for regime changes could confound efforts to estimate the demand for money. To illustrate this point, we applied the same tests to

the whole period. Table 6's third and sixth columns lists our results.[23] As before, the estimate of α is statistically significant and of plausible magnitude. Note, however, that the seigniorage-maximizing rate of inflation implied by this estimate - nearly 36 percent and 45 percent, per 10 days respectively - is nearly double that implied by our analysis of the first period, regardless of the sample. This difference illustrates the importance of accounting for regime changes in the analysis money demand during periods of hyperinflation.

5.3 Estimating The Variation in Inflation Uncertainty

Finally, we consider the likelihood that inflation expectations would become more or less uncertain under a new constitution. Specifically, we do not make the case that uncertainty in inflation expectations increases or decreases. There are arguments for both. On the one hand, we could argue that under some regimes, we would expect additional uncertainty, as the price of holding money undergoes a new discovery process. Conversely, it is possible that a particular regime change is met with such credibility, that the price of holding money becomes more stable. Instead of supporting one or the other, we simply argue that changes in the demand for money, due to regime change, likely changes the ability for demanders to predict inflation. Thus, in this section we use a GARCH model[24] to test the hypothesis that a regime change would lead a to changes in the uncertainty of inflation expectations.

There is a substantial literature that models the variation in prices, which they term as Relative Price Dispersion (RPD), according the part of inflation that is expected and that which is unexpected. According to Grier & Perry (1998), their application focuses "on separating the effects of trend inflation from inflation uncertainty. Other examples include Vining & Elwertowski (1976) and Parks (1978). All are extensions of the work done by Bollerslev (1986) and Engel

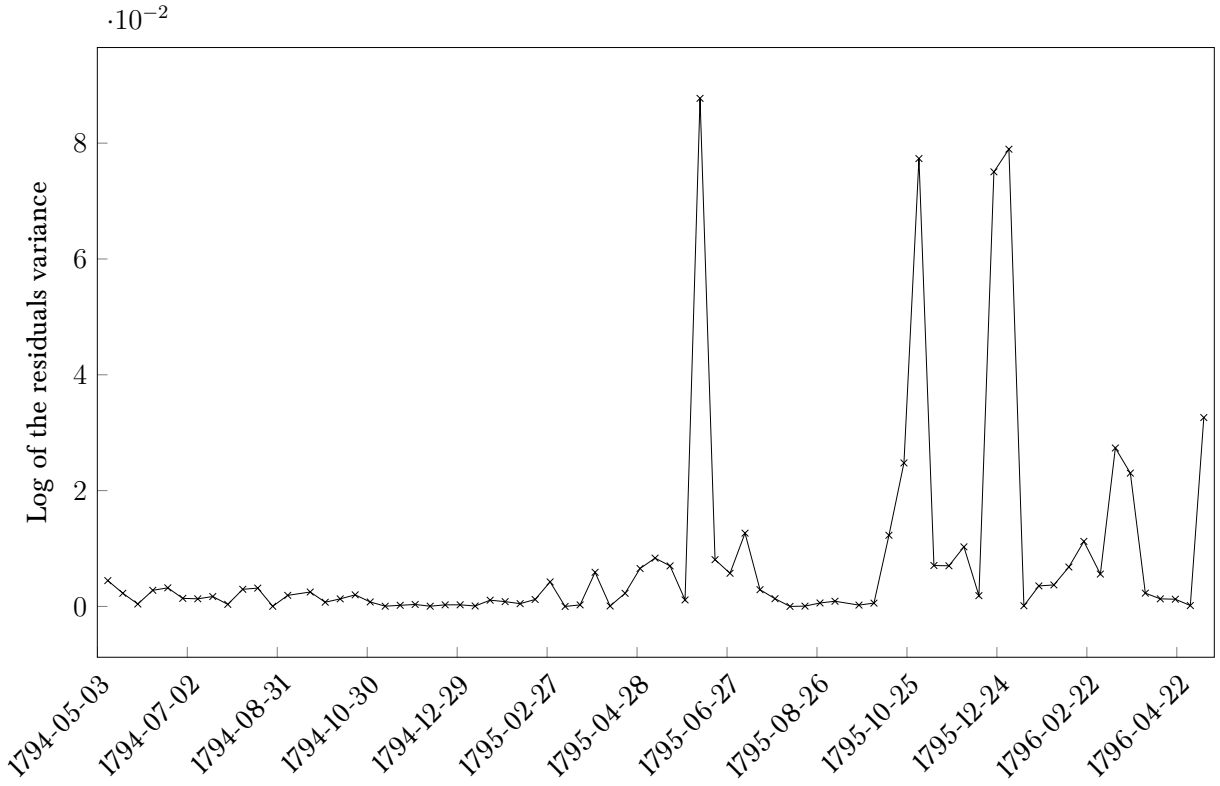
[23] We applied F-tests that suggest that each intercept, that of the individual periods and of the entire sample, is statistically different. This suggests that the regime change, at the very least represents a shock to demand. Moreover, we see a similar result when we compare to the first period's coefficient with those of the other columns of Table 6, despite the lack of statistical confidence in those estimates.

[24] GARCH stands for generalized, autoregressive conditional heteroskedasticity. Based on the work of Engle (1982) these models assume that the conditional error variance can be described by a time- series model. Moreover, the GARCH estimate of the conditional variance of inflation, allows us to capture uncertainty, as opposed to variability.

(1982). We consider the aspect of those models that are relevant for our hypothesis. That is, we borrow the technique used in modelling unexpected inflation, controlling for the periods of regime change.

Before examining the model, it is worth visualizing the data. In Figure 8, we see see volatility in expected inflation, one peak in June of 1795, but then consistently more volatile alongside our statistical structural break[25]. Note, the figure depicts the variance in the predicted inflation error.

Figure 8: Residual Variance



To model these graphical representations, we use two stages of modeling. In the first, we use an ARMA process to estimate the conditional variance of inflation and a residual component, which signifies the aspect of inflation unexplained by prior inflation knowledge. Then we use a GARCH model to estimate the variance of inflation uncertainty.

[25]The early blip is consistent with the testing of additional structural breaks. We describe that process and their omission in an earlier footnote.

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + \beta_2 \epsilon_{t-2} \tag{8}$$

$$\sigma^2_{\epsilon t} = \alpha_0 + \alpha_1 {\epsilon_{t-2}}^2 + \alpha_2 \sigma^2_{\epsilon_{t-1}} + \alpha_3 RegimeChange \tag{9}$$

Equation 8 describes the inflation rate as a function of the first lag of inflation and a second-order moving average term. This specification was determined using auto-correlation and partial auto-correlation tests. ϵ_t represents the part of inflation unexplained, or unexpected, by prior inflation. The intercept and autoregressive component is statistically significant at the 99% level. [26] [27]

$$\pi_t = \underset{(.0220)}{.0668} + \underset{(.0917)}{.2325}\pi_{t-1} + \underset{(.1388)}{.2647}\epsilon_{t-2}$$

Equation 9 is a GARCH model of the conditional variance of the of inflation uncertainty. The GARCH (2) specification implies that the conditional variance of inflation at time t depends on the prior period's conditional variance and the squared residual, or unexpected inflation from Equation 8. In accord with the literature, we use this estimated conditional variance as our time series measure of inflation uncertainty. Table 7 contains our results.

The results suggest that there are autoregressive and moving average components. In other words, inflation uncertainty is a function of both expected and unexpected priors. More importantly, we see that th regime change[28] increased the variation in inflation, or inflation uncertainty. This increased uncertainty after the establishment of the Directorial regime is corroborated by qualitative evidence. Parisians in the last months of 1795 and early months of 1796 constantly complained about the uncertainty relative to the fate of the *assignats*. For instance, on November 12 1795, a report to the minister of the Interior indicates that: "The waiting of the

[26] The second-order moving average corresponds with a p-value of .056. While just below the 95th percentile threshold, its inclusion is substantiated with autocorrelation, Chi-squared, and AIC tests. Moreover, its usage becomes statistically significant in the forthcoming GARCH model. That is, slight unexplained persistence in inflation uncertainty contributes to relevant persistence in the conditional variance of inflation uncertainty.

[27] Standard Errors are in parenthesis. Robust variance estimates are not generally robust to ARMA components. See Hamilton (1994)

[28] Here regime represents a binary variable, 1 if the period is after the structural break and 0 otherwise.

Table 7: Estimating Inflation Uncertainty

	GARCH Model Conditional Variance of Inflation Uncertainty
Inflation Uncertainty Regime	0.0501*** (0.0203)
Intercept	0.0405*** (0.0043)
1st-Order ARCH i.e., Lagged Inflation Uncertainty	.9698*** (.2810)
2nd-Order GARCH i.e., 2nd Lag - Residual Inflation Variation	0.3538*** (0.1021)
Intercept	0.00009 (.0002)
N	73
AIC	-165.1

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

general committee relatively to finances put speculators in a state of uncertainty which has a terrible influence on foodstuffs. We expect a partial demonetization of the assignats."[29] (**?**, 376).

6 Conclusion

We found that the establishment of the Directory had an important effect on the demand for money, namely a breakdown of the relationship between real balances and inflation. Our results indicate that prior to the Directory, the monetary authorities were generally inflating at a rate below the seigniorage-maximizing rate, and that failing to account for the effects of the new regime biased our estimates of the demand for the *assignat*. Moreover, we found that inflation volatility was higher before the Directory came into being, which highlights the important role that constitutional factors play in shaping monetary phenomena.

[29]The "general committee" was the name given to the secret sessions of the *Corps Législatif*.

As we see the matter, future research on inflationary finance should incorporate the insights from constitutional political economy. Episodes of severe inflation that have already been examined should be revisited, and those that haven't should be analyzed from a constitutional perspective. Not only will doing so likely result in more accurate estimates of the relevant parameters, but it may also go along way towards resolving Cagan's paradox and thus providing a much richer understanding of hyperinflation.

Long ago, Philip Cagan (1956, p. 25) motivated his seminal work on hyperinflation by noting that episodes like the *assignat* provide a unique opportunity to examine monetary phenomena. We agree with this sentiment, but think it can be extended to include constitutional factors as well. Hyperinflation often occurs in unstable political environments, which are the product of weak institutions. Weak institutions make regime change more likely, thus periods of severe inflation provide a unique opportunity to apply constitutional political economy to inflationary finance - an insight that we have endeavored to illustrate in this paper.

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7 Appendix

7.1 Price of gold relative to commodity prices

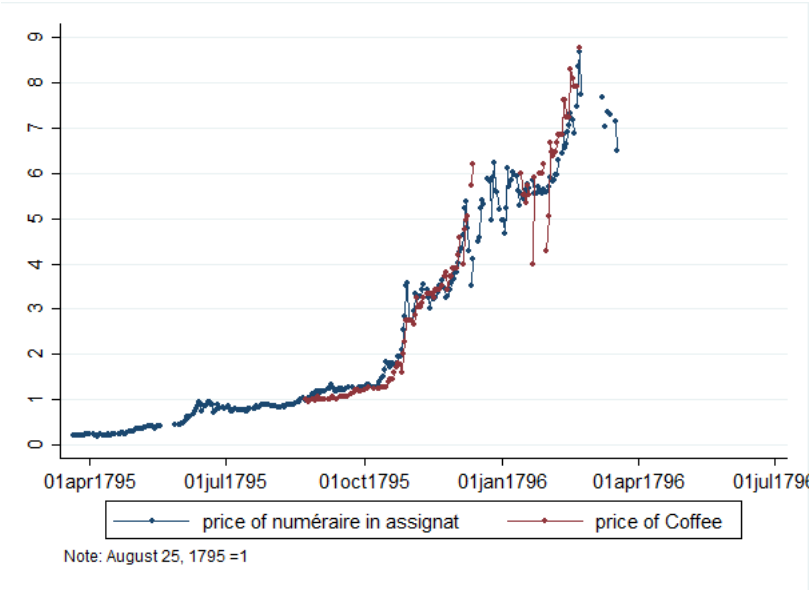

Figure 9: Price of coffee and prive of gold during the hyperinflation period.

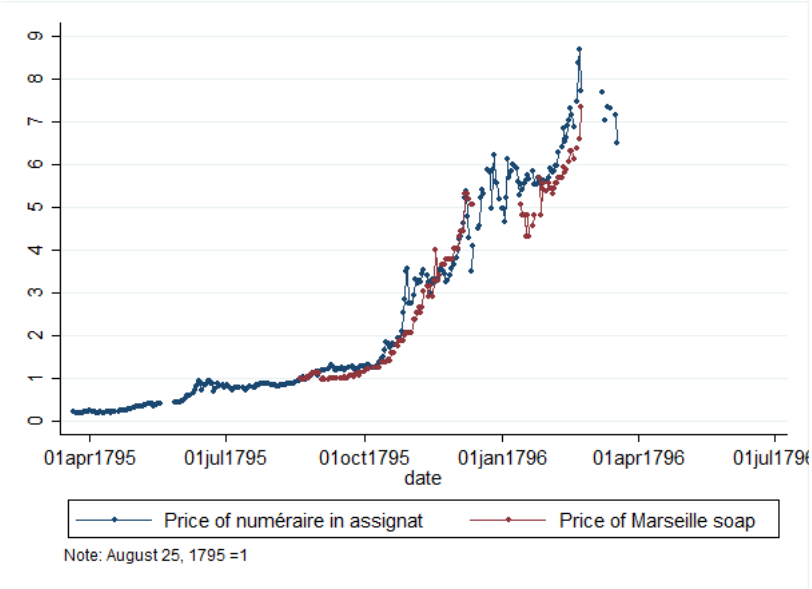

Figure 10: Price of Marseilles soap and price of gold during the hyperinflation period.

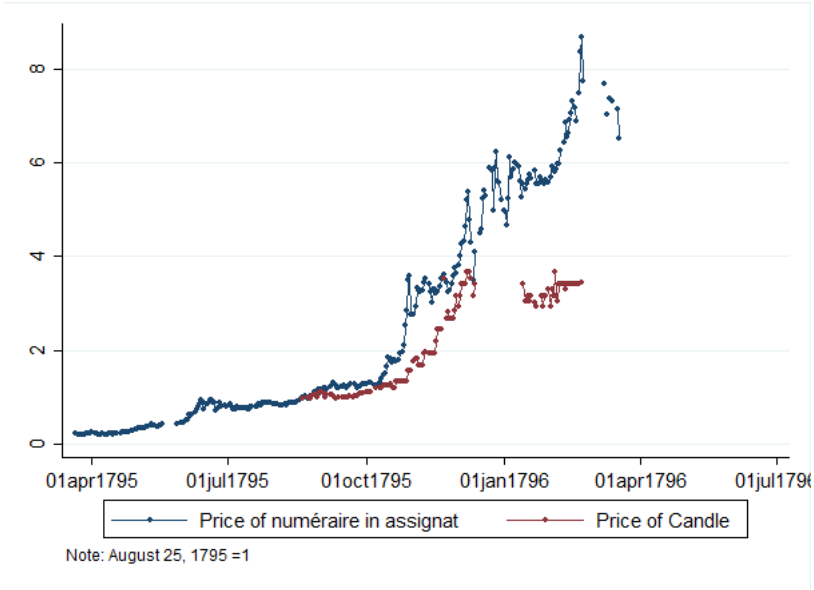

Figure 11: Price of candles and price of gold during the hyperinflation period.

7.2 Timeline

Date	Date index	Distance from nearest break	Economic regulations	Military events	Constitutional and political changes
June 10, 1794	5	-36	"Laws of Prairial" reinforcing the Terror.		
July 28, 1794	9	-32			Fall of Robespierre.
October 7, 1794	16	-25			Proproposition in front of the Assembly for the return of 73 *Girondins*.
November 9, 1794	20	-21	The Maximum for grain is increased to 2/3 the 1790 prices. The use of forced sales of grain (Réquisitions) are restricted.		
December 24, 1794	24	-17	Abolition of the Maximum.		
January 2, 1795	25	-16	The Convention abolishes the interdiction to export metallic currency.		
April 23, 1795	36	-5			The Convention creates a commission composed of 11 parliamentarians to discuss Constitutional reform.
April 25, 1795	36	-5	Selling and buying metalic currency is legalized and stock exchanges are re-opened.		
May 16, 1795	38	-3	Demonetization of the Royal Assignats.		
May 21, 1795	39	-2	Mettalic currency is once again forbidden (decree of April 5 is repealed).		

May 20 to 24, 1795	39	-2			Major montagnard insurection which lasted 4 days and ended up with the defeat of the insurgents.
June 9, 1795	41	0	**POTENTIAL STRUCTURAL BREAK**		
June 14, 1795	41	0			Parlamentarians who were involved in the attempted coup of Prairial (May 20 to 24) are executed.
June 17, 1795	41	0	Reubell in the name of the Comittee of public safety proposes to index tax payments to the amount of *assignats* issued.		
June 21, 1795	42	1	Taxes and payments are indexed on the amount of *assignats* issued.		
June 23, 1795	42	1		Landing of royalist forces in Quiberon leading to their resounding defeat.	Boissy d'Anglas proposes to the assembly the preliminary project fo the Constitution of Year III.
July 1, 1795	43	2		Annexation of Belgium to France.	
July 20, 1795	45	4	The *Contribution foncière* must be paid half in grain.		
July 22, 1795	45	4		Paix de Bale - Peace with Spain.	
August 30, 1795	49	-6	Selling and buying mettalic currency is legalized definitely.		
September 6, 1795	49	-6			The new Constitution is adopted by plebiscite.
October 5, 1795	52	-3			Royalist insurection in Paris.

October 26, 1795	54	-1			The Directorial regime is officially instituted.
October 30, 1795	54	-1			The two chambers of the new regime's parliament are in session for the first time.
November 1, 1795	54	-1			The first Director (i.e. the first member of the executive branch) is nominated.
November 12, 1795	55	0		**STRUCTURAL BREAK**	
December 10, 1795	58	3	The parliament votes in favor of a 600 million forced loan. The loan is a total failure.		
December 23, 1795	60	5	The *Conseil des 500* decides that the printing press will be destroyed once the total value of the *assignats* printed reaches 40 billion pounds.		
February 19, 1796	65	10	The printing press is publically destroyed.		
March 19, 1796	68	13	Creation of a new paper money, The *Mandats*.		
May 23, 1796	75	20	Assignats above 100 pounds stop to be legal tender after the end of June.		