Inflation and the Size of Government*

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Abstract

It is commonly supposed in public and academic discourse that inflation and big government are related. We show that economic theory delivers such a prediction only in special cases. As an empirical matter, inflation is significantly positively related to the size of government mainly when periods of war and peace are compared. We find a weak positive peacetime time series correlation between inflation and the size of government and a negative cross-country correlation of inflation with non-defense spending.

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I. Introduction

It has been increasingly appreciated that economic reasoning can explain the behavior of governments in addition to the reactions of consumers and firms to their policies. Can economic reasoning explain which countries inflate and when? Alesina and Summers (1993), Cukierman (1994), and many others have recently begun to try to make such predictions.

Although we have relatively little to add to the literature on positive theories of inflation, we believe that one correlation in particular is especially relevant for such theories: the correlation between inflation and the size of government. With much being said on the theory of inflation in the literature, it is important to see how the theoretical predictions match the empirical evidence. Such evidence is provided in this paper. We study, from the public finance perspective, how inflation varies across countries and over time in response to the changes in the size of government.

In particular, we first discuss how the quantity of government spending fits into the normative theories of inflation and public finance both in static models and in the "steady states" of dynamic models. These normative theories – following Barro (1979), Judd (1989), and others – might also be used as positive theories of long run inflation. The lessons we learn there are: On the one hand, the conventional optimal tax considerations have suggested that the optimal inflation tax should increase with government spending (e.g., Mankiw 1987, Vegh 1989, Poterba and Rotemberg 1990). On the other hand, it has also been shown that, when money is a certain type of "intermediate good," it is not necessarily optimal for bigger governments to inflate more (e.g., Kimbrough 1986, Woodford 1990).

We also review the dynamic stochastic theories of public finance in which governments optimally inflate and deflate in response to surprises about government spending and economic

conditions. These models emphasize the unanticipated portion of government spending, and seem particularly applicable to wartimes (e.g., Barro and Gordon 1983a, Lucas and Stokey 1983).

Our empirical analysis makes three contributions to the literature. First, we study how inflation responds to government spending in three dimensions: cross-country, time-series, and wartime, while the previous studies mainly looked at cross-country evidence (e.g., Campillo and Miron 1997, Click 1998). The cross-country analysis is most suitable to study the long run relation between inflation and the size of government, or in other words, how inflation responds to permanent changes in the size of government. To study how inflation responds to temporary changes in the size of government, time-series analysis is more appropriate. The wartime analysis provides evidence when the temporary changes in government spending are large. In particular, we study the behavior of inflation during suspensions of convertibility in the classical gold standard periods and in the paper standard periods.

Second, we study how inflation responds to the changes in not only total government spending but also its components, defense and non-defense spending. Distinguishing between defense and non-defense spending is necessary because most of the large temporary changes in the size of government are due to changes in defense spending in wars, while other increases in the size of government are mainly due to the secular increases in non-defense spending. Also, changes in defense spending are more likely to be exogenous than changes in non-defense spending (Becker and Mulligan 1997). Hence the impacts of defense spending on inflation may be different from those of non-defense spending. The previous studies, such as Campillo and Miron (1997) and Click (1998), did not study how inflation is related to the components of government spending.

Third, we use an instrumental variable method to correct the potential bias caused by the

endogeneity of government size and non-defense spending in the ordinary least squared (OLS) regressions.[2] The instrumental variable we use is the ratio of social security spending to output, because, while the ratio of social security spending to output is correlated with the ratio of non-social-security non-defense government spending to output, it is unlikely to be correlated with inflation directly. This independence arises because most of countries rely exclusively on payroll taxes to finance social security spending.[3] We will discuss more about the appropriateness of the instrument in Section III. Previous studies did not attempt to correct the possible endogeneity problems in their OLS regressions.

Section II reviews the existing theories of inflation. Section III presents evidence from 80 countries, showing that there is little, negative if any, cross-country correlation between inflation and the size of government. Defense spending is slightly positively correlated and non-defense spending slightly negatively correlated with inflation. Thus, although we explicitly recognize that seigniorage enters the government budget constraint, we suggest that the emphasis of Sargent (1982) and others on "inflation as a fiscal phenomenon" is not very useful for predicting inflation across countries. These results are also contrary to previous studies, such as those by Grilli, Masciandaro, and Tabellini (1991) and Campillo and Miron (1997), that found a positive correlation between inflation

[2]There are several possibilities of why government spending may be endogenous. For example, governments may want to reduce spending or deficit to reduce inflation. Cukierman (1994) and Becker and Mulligan (1997) also suggest that government spending may respond to inflation and not the other way around (see discussions in Section IID). Finally, governments with limited means for taxing their citizens cannot spend very much and must rely relatively heavily on seigniorage for the little revenue that they do spend.

[3]In some countries such as U.S., social security payments are indexed to the changes in the cost of living. However, the *ratio* of social security spending to output may not necessarily changes with the cost of living because of the high correlation between the changes in the cost of living and the changes in the GDP price deflator.

and the size of government.

Section IV studies time series data on inflation and government spending of the United States and the United Kingdom. We show that inflation and the size of government have both trended upward while the temporary increases in government spending at wartimes have also been positively correlated with inflation. Section V takes a closer look at the wartime inflation during suspensions of convertibility in the classical gold standard periods and in the paper standard periods. We show that inflation rises above normal at the beginning of wars, while inflation falls below normal at the conclusion of wars except in countries that are defeated. Section VI concludes the paper.

II. Theory

In this section, we review the normal theories of inflation in public finance that relate inflation to the size of government. The review also provides a guide to our empirical specifications.

II.A. Inflation in the Static Theory of Public Finance

It has been argued by Barro (1979), Judd (1989), and others that the normative theory of public finance can also serve as a positive theory of government policy. Although a literal application of the normative theory absurdly suggests that economies are run by "benevolent social planners," Becker (1983, 1985), Wittman (1997), and others have shown that in more realistic political models of government decision-making, policies reflect efficiency considerations in the long run. For example, Becker's (1983) Proposition 4 (page 386) states that "Competition among pressure groups favors efficient methods of taxation." Thus we first turn to the normative theory of public finance to obtain a prediction for the relationship between inflation and the size of

government.

Following Ramsey (1927), Phelps (1973) argues that, since seigniorage is a source of government revenue, the marginal deadweight loss of inflation should be equated to the marginal deadweight loss of other taxes. Presumably the marginal deadweight loss of other taxes is greater when the government must raise more revenue. So, assuming the relevant portion of the seigniorage Laffer curve is upward sloping, larger governments should have higher inflation rates, more seigniorage, and a greater marginal deadweight loss from inflation.

However, it has been argued by Kimbrough (1986), Woodford (1990), and others that Ramsey's (1927) formulation does not directly apply to the inflation tax because the inflation tax affects the marginal deadweight loss of other taxes. With some configurations of tastes and technologies, the marginal deadweight loss of inflation and other taxes can never be equated because a higher inflation rate sufficiently increases the marginal deadweight loss of other taxes, so the Ramsey – optimal "inflation tax rate" is zero.[4] In many setups, an optimal inflation tax rate of zero-often referred to as the "Friedman Rule" due to Milton Friedman's (1969) advocacy of such a policy – corresponds to a zero nominal interest rate and an inflation rate equal to zero minus the real interest rate.

Since inflation and nominal interest rates in nearly every country and every year since 1945 have been positive, the Friedman Rule can hardly serve as a positive theory of inflation. But can the basic logic of the models of Kimbrough (1986), Woodford (1990), and others deliver a prediction for the relationship between inflation and the size of government? If the reason for deviating from

[4]See Mulligan and Sala-i-Martin (1997) for a review of the related literate and further discussion of the economics of these results.

the Friedman Rule has to do with political or equity reasons, then these models are not up to the task. But, as Woodford (1990), Faig (1988), and others have pointed out, the Ramsey-optimal inflation tax rate is positive for some of these models. Unfortunately, these models are still pretty ambiguous about the relationship between inflation and the size of government. To see this, consider the setup of Mulligan and Sala-i-Martin (1997) (which they show to be a generalized version of many of the models which have appeared in the literature). In the spirit of the inventory models of demand for money, money reduces the transaction costs or "shopping time" of purchasing consumption goods rather than entering the consumer's utility function. Utility is therefore defined only over consumption and leisure $u(c,l)$, a function which is assumed to have the usual properties. Shopping time v is a function of two variables: the amount of transactions and the real money stock held by the consumer. The quantity of transactions is assumed to be equal to c plus a fraction λ of consumption tax revenues τc (this allows for the possibility that not all taxes have to be paid with money or that the "velocity" of money used to pay taxes is greater than the velocity of other money). Mulligan and Sala-i-Martin define the indirect utility function $V(\tau,R)$ according to:

$$V(\tau,R) \equiv \max_{c,l,m} u(c,l)$$

$$\text{subject to:} \quad R\,m + (1+\tau)\,c \le T - l - v([1+\lambda\,\tau]\,c,\ m)$$

where R is the nominal interest rate and T is the time endowment. The Ramsey problem is:

$$\max_{\tau,R} V(\tau,R) \qquad s.t. \qquad \tau\,c(\tau,R) + R\,m(\tau,R) \ge g$$

where g is government expenditure (taken as given in the Ramsey problem) and $c(\tau,R)$ and $m(\tau,R)$ are "demand functions" from the consumer's optimization program.

Within the above framework, Mulligan and Sala-i-Martin showed that how R and g are related depends crucially on the functional forms of the indirect utility function V and the transaction function v. In particular, their Proposition 10 states:

> "If the shopping time function $v(x,m)$ is homogeneous of degree one and the Laffer conditions hold,[5] then the Ramsey optimal inflation tax depends only on the monetary parameters (the fraction of taxes paid with money, λ, and the shape of the shopping time function $v(\cdot)$)" (page 704).

That is, although the Ramsey-optimal inflation tax is not necessarily zero, it is independent of the size of government in the special case described by the proposition. Thus we cannot say for sure whether static optimal tax considerations predict a positive relationship between inflation and the size of government. However, Mulligan and Sala-i-Martin's (1997) calibration of the monetary parameters from micro and macro empirical studies of consumer behavior suggest that, when the Laffer conditions hold, the Ramsey-optimal inflation tax is quite small and quantitatively insensitive to the size of government.

The Laffer conditions may not hold in some countries. If the maximum amount of revenue that can be raised from the non-inflation taxes (the top of the "non-inflation tax Laffer curve") is less than the required revenue g, then inflation tax revenue must increase in response to increases in g. Assuming that the top of the inflation Laffer curve has not yet been reached, then more g means higher inflation. One empirically relevant example may be countries without effective personal income tax systems. These may be the best cases for Sargent's (1982) and others' emphasis on inflation as a fiscal phenomenon.

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[5]That is, the relevant portion of the seigniorage Laffer curve is upward sloping.

II.B. Inflation as State-Contingent Debt Manager

Lucas and Stokey (1983), Judd (1989), and others have argued that an optimal tax policy involves the use of "state-contingent debt." Citizens buy contingent claims on the government which pay off extraordinarily well when government revenues (expenditures) are above (below) expectations and poorly when government revenues (expenditures) are below (above) expectations. Judd (1989) argues that nominal government liabilities and nominal provisions in the tax code serve this state-contingent debt function, with monetary policy adjusting the price level appropriately to achieve the right pattern of payoffs for the "state contingent debt." Thus, inflation is above normal upon the receipt of "bad news" about the government's fiscal situation and below normal upon receipt of "good news." One empirical counterpart to good and bad news is the beginning and end of wars - inflation should be high during the war and prices should jump down at the conclusion of the war.[6]

II.C. Inflation as Evidence of a Commitment Problem

Alesina and Tabellini (1987), Barro and Gordon (1983a,b), and others have argued that inflation is evidence of a government that cannot make credible promises. Such governments optimally inflate to enjoy the short-run benefits of price level surprises. Depending on which types of agents are best represented in the government (e.g., creditors or debtors), either surprise inflation or surprise deflation can provide short-run gains for the government but it is commonly assumed in

[6]The exact timing of the wartime inflation depends on expectations about the duration and cost of the war and how those expectations change over time. The end of a war is of course "bad news" to the defeated country, especially, when large reparations are expected.

the literature that surprise inflation is desirable. In this case, governments inflate more in the absence of commitment. Barro and Gordon derived a formula for the inflation rate chosen by the discretionary government: it is an increasing function of the "full commitment" inflation rate and an increasing function of the benefits of surprise inflation.[7] In particular, they pointed out that the benefits of surprise inflation include temporary increases in output and decreases in real values of government debts.

If the size of government is uncorrelated with a government's ability to make commitments and with the benefits of surprise inflation, then, because the discretionary inflation rate is an increasing function of the "full commitment" inflation rate, the Barro and Gordon model inherits the predictions of the static public finance model for the relationship between inflation and the size of government. Relatively little is known about a government's ability to make commitments or the benefits of surprise inflation, so we can say little about the correlation between inflation and the size of government in the general case. However, Alesina and Summers (1993) have suggested that governments make commitments by creating an independent central bank. Inflation should therefore be negatively related to central bank independence and, holding constant independence and the benefits of surprise inflation, inflation should vary with the size of government and other variables as suggested by the static theory of inflation and public finance.

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[7]The Barro-Gordon discretionary government minimizes $a(\pi-\pi^*)^2/2 - b(\pi-\pi^e)$, taking π^e as given. π is actual inflation (chosen by the government), π^e is expected inflation, and π^* is the "static" or "full commitment" optimal inflation. Since expectations are formed with full knowledge of the government's objective, the equilibrium inflation rate under discretionary government is $\pi^e = \pi = b/a + \pi^*$. Thus, given b/a, π varies directly with π^*. Also, π is increasing in the benefits of surprise inflation, b.

II.D. The Size of Government as a Response to Efficient Taxes

Cukierman (1994) and Becker and Mulligan (1997) argue that the size of the government responds to the efficiency of taxes. A country without access to efficient taxes (perhaps for technological reasons or because those harmed by efficient taxes are politically powerful), will have a smaller government and rely relatively heavily on inefficient taxes (such as inflation) for revenue. Thus inflation and the size of government can be negatively correlated.

If we further accept the auxiliary hypothesis of Becker and Mulligan (1997) that defense spending is "exogenous" while non-defense spending is "endogenous" (i.e., more sensitive to the efficiency of taxes), then we also expect defense spending to be positively correlated with inflation and non-defense spending to be negatively correlated with inflation.

Since the theory here suggests that government spending, especially non-defense spending, responds to inflation instead of the other way around, the OLS regressions of inflation on government size may be biased. As discussed below, we will use instrumental variable methods to correct the potential bias.

III. Cross-Country Evidence

The cross-country analysis provides evidence on the long-run or "steady state" relation between inflation and the size of government. Our sample consists of 80 countries during the period 1973-90. Inflation is measured by the average growth rates of Consumer Price Index (CPI) and M1, and the size of government is measured by the average of the ratios of general government

expenditure to GDP.[8] Only countries with at least four consecutive years of observations in the period 1973-90 are included in our sample. Figure 1 shows the scatter diagram displaying the relationship between inflation and the size of government. The vertical axis measures the average growth rate of CPI and the horizontal axis measures the total government spending as a fraction of GDP. Note that although the growth rate of the CPI is measured as the log difference, we display this log difference on a log scale in the figures. We do so because inflation rates for a few countries are an order of magnitude larger than the inflation rates of most countries. Figure 2 shows the scatter diagram with the average annual growth rates of CPI replaced by the average annual growth rates of M1 (again on a log scale).

Contrary to the conventional view, the figures show a negative relationship between inflation and the size of government. This negative correlation is confirmed in our regressions. Table 1 shows the regression results using the growth rate of CPI as the measure of inflation. (The results using the growth rate of M1 are similar, but are not shown). The first four regressions, columns (1)-(4), use the whole sample while the last four, columns (5)-(8), exclude six countries experienced hyperinflation during the sample period.[9] The OLS regressions of inflation on government size,

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[8]Data on general government expenditure, defense spending, and GDP are from the Government Finance Statistics Yearbooks, IMF, supplemented from the National Accounts Statistics: Main Aggregates and Detailed Tables, United Nations. Data on CPI and M1 are from the International Financial Statistics Yearbooks, IMF.

[9]There is no consensus of the definition of hyperinflation. The six countries we exclude are those countries that adopted dramatic policies including changing their currencies to fight against inflation during 1973-90. They are Argentina, Bolivia, Brazil, Chile, Nicaragua, Peru, and Uruguay. The static theory of inflation and public finance suggests one reason for separating the "hyperinflation" countries from the rest - hyperinflation countries may be those who are not on the upward sloping portion of their non-inflation tax Laffer curves. Another reason is that those countries appear to be outliers on Figures 1 and 2.

columns (1) and (5), show significant negative coefficients.

As discussed in the previous section, other variables such as defense spending may affect the relationship between inflation and the size of government. In the next set of OLS regressions, columns (2) and (6), we divide total government expenditure into defense and non-defense spending (all as fractions of GDP). The results indicate that inflation is positively but statistically insignificantly correlated with defense spending, but negatively and statistically significantly correlated with non-defense spending. These coefficients suggest that the observed negative relationship between inflation and government size shown in Figures 1 and 2 is mostly driven by the negative relation between inflation and non-defense spending. The results also suggest that the conventional view on the link between inflation and government size may be true only when defense expenditure represents a very important share of total government expenditure, for example, during wartime. But from cross-country regressions we cannot tell whether the temporary nature of wartime is important for the relationship between inflation and the size of government, as is suggested by the "inflation as a state contingent debt manager" model. This issue is better analyzed with the time series data, as presented in the next section.

The coefficients of the OLS regressions may be biased because, as discussed in the previous section, government spending, especially non-defense spending, may respond to inflation and hence be endogenous. We use the ratio of social security expenditure to GDP as an instrument variable (IV) for government size and non-defense spending. The ratio of social security expenditure to GDP is a reasonable IV because, first, it is correlated with government size and especially non-defense spending other than social security spending. In the cross-country data, the correlation between social security spending and non-social-security non-defense spending (both as a fraction of GDP)

is 0.44. (See also discussions on the correlation by, e.g., Mulligan and Sala-i-Martin 1999). Second, because most countries rely exclusively on payroll taxes to finance social security spending,[10] there is no need for a government to use inflation tax to finance social security spending. We note that in some countries such as U.S., social security payments are indexed to the changes in the cost of living. However, because the changes in the cost of living and the changes in the GDP price deflator are highly correlated, the *ratio* of social security spending to output may not necessarily changes with the cost of living. In other words, inflation is unlikely to be correlated directly with the ratio of social security expenditures to GDP.

The results of the IV estimations using the whole sample are shown in columns (3) and (4). They are similar to those OLS estimates. The results using the sample excluding the countries experienced hyperinflation, columns (7) and (8), are similar to those with the whole sample, except that the magnitudes of the effects of defense spending on inflation are stronger, although still statistically insignificant.

We now include other factors that are correlated with government size in our inflation regressions: central bank independence, deficit and output level. First, it is often believed that, because price stability is a chief goal of central banks, a more independent central bank leads to lower inflation rates (see, e.g., Cukierman 1994). We use two measures of central bank independence taken from Cukierman (1994). The first one is a ranking of central bank legal independence in 1980s, and the second is the turnover rates of central bank governors during the period 1950-89.

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[10]The cross-country correlation between social security spending and payroll taxes is high (about 0.87 in our sample). The high propensity to finance social security out of payroll taxes is itself evidence that inflation tax is not a big revenue source.

Government debt or deficit can also be a potential determinant of inflation tax. Because inflation tax can be used as a direct way to generate seigniorage or reduce the real value of outstanding government debts, governments with larger nominal government debts would like to inflate more (e.g., Barro and Gordon 1983a, Cukierman et al. 1992). To determine inflation in the "steady state" of a dynamic model or the static model, however, only the *initial* debt-GDP ratio matters. This is because given the initial debt level, governments optimally choose the amount of debts and inflation over time (Cukierman et al. 1992). So what we are really interested in is a reduced-form relation with the initial debt-GDP ratio as one of the exogenous variables. Based on this, we add the initial debt-GDP ratios to our regressions.[11] The debt used is defined as total public debts minus those held by monetary authorities. The data used to calculate the ratios are from 1973 or the year closest to 1973 with nonmissing observations.

The third variable we add to our regressions is real GDP per capita (in log). It has been suggested that richness of country is a good indicator of the efficiency of the non-inflation taxes (e.g., Cukierman et al. 1992, Click 1998). Also many have been written on whether there is any relationship between inflation and output in the long run. If inflation is related to output, it may induce spurious effects on the relation between inflation and government size since the latter is defined as the ratio of government spending to GDP. So including real GDP per capita can also reduce these possible effects.

The results of the OLS and IV estimations with the above additional variables are shown in Tables 2 and 3, respectively. As in Table 1, we show two sets of regressions: one using the whole

[11]We also conducted experiments with average deficit-GDP ratio in the sample period, instead of initial debt-GDP ratio. The results on the deficit-GDP ratio are similar to those on initial debt-GDP ratio (not shown here).

sample (columns (1)-(4) in Table 2 and columns (1)-(6) in Table 3) and another excluding countries experienced hyperinflation during the period 1973-90 (columns (5)-(8) in Table 2and columns (7)-(12) in Table 3).[12] Because indexes on central bank independence are only available for about half of the countries, the sample size is reduced substantially. Comparing the OLS regressions, columns (1) and (5) in Table 2 and columns (1) and (7) in Table 3, to columns (2) and (6) in Table 1, it appears that the smaller sample size changes the signs of the estimated relation between inflation and defense spending from positive to negative, although they are still statistically insignificant. But the smaller sample size seems to have no qualitative impacts on the estimated relation between inflation and non-defense spending. For non-defense spending, the coefficients are still negative and significant. The same observation can be made when comparing the IV regressions, columns (3) and (9) in Table 3, to columns (4) and (8) in Table 1. With other variables included in the regressions, both OLS and IV regressions in both samples show that inflation is still negatively related with non-defense spending, but the effects become statistically insignificant. The relation between inflation and defense spending is also negative and statistically insignificant.

Other findings are the following. First, the effects of central bank legal independence on inflation are very weak (in term of t-statistics) and change signs from one regression to another. With the whole sample, both the OLS and IV estimations show that inflation is significantly positively related with central bank governor turnover rate. With the three hyperinflation countries excluded in the regressions, the relation is positive in the OLS regressions and negative in the IV regressions, and none of them is statistically significant. This suggests that first, independence written on paper means little if central bank governors can be easily removed in reality; second, in

[12] The countries excluded are Argentina, Chile, and Uruguay.

determining inflation, central bank independence matters only in countries that have experienced hyperinflation. Those countries are presumably those who are not on the upward sloping portion of their non-inflation tax Laffer curves.

Second, all regressions show that inflation is weakly negatively related with initial debt-GDP ratios. If we think redemption of initial debt as part of total government expenditure, the negative relation seems consistent with the relation between inflation and non-defense spending. We also find that inflation is negatively related to real GDP per capital (in log). The relation is significant except in the IV regressions. It suggests that countries with efficient tax systems tend to rely less on inflation to finance a given amount of government spending.

In summary, the cross country exercises show that first, the correlation between inflation and government size is negative but weak.[13] The negative correlation is mainly driven by the negative relation between inflation and non-defense spending. Second, with the whole sample of 80 countries, inflation is significantly positively related to defense spending. So when defense expenditure is an important fraction of total government expenditure, the conventional view that inflation is positively related to government size holds. Using only countries with available central bank independence index data, inflation is shown weakly negatively related to defense spending. Our analysis strongly suggests that the switch of signs of the estimates are mainly caused by attrition of sample size. Finally, the regressions also suggest that inflation may be indeed negatively related with central bank independence, especially for countries experienced hyperinflation. Also, inflation

[13]Although the inflation tax rate and the size of government do not display a strong positive relationship across countries, other tax rates are correlated with the size of government. For example, regressions with the personal income tax rate show that some tax rates are positively correlated with government size (Results not reported here). See also Click (1998).

is shown to be weakly negatively related to the initial debt-GDP ratio and more strongly negatively related to real GDP per capita.

IV. Time-Series Evidence

The above cross-country analysis is suitable to study the relation between inflation and government size in the steady state of a dynamic model or in a static model, which tells us how inflation responds to long-run or permanent changes in government spending. To find out how governments inflate and deflate in response to temporary changes in government spending, we have to turn to time series data. We study this issue using the time series data for the United States and the United Kingdom.

IV.A. The United States

For the US, government size is defined as the ratio of federal government outlays to national income.[14] We use growth rates of CPI and M2 as measures of inflation tax. The data, plotted in Figure 3, are annual time series from 1870 to 1995.[15]

The figure shows that roughly before 1930, federal government spending as a fraction of output (the thickest line) is small and stable, except the large temporary increase during WWI. Since then, there has been a secular upward trend in government spending, and the trend was mainly

[14]We use national income instead of GNP because we don't have data on GNP for the earlier years. The evidence using GNP (not shown here) is similar to that using national income for the periods when we have data on both variables.

[15]The data are from the Historical Statistics of the United States, 1790-1970 (Dodd 1973) and the Economic Report of the President, various years.

driven by non-defense spending (the second thickest line). The large temporary increases in government spending, however, were mainly driven by defense spending (the thinnest line), as shown by the spikes for the WWII, the Vietnam War, and the Korean War. Defense spending seems to return to its steady state in the late 1970s, although the steady state seems higher than that in the pre-war period. From the figure, it is not clear how inflation (the dash-dotted line) is related to government spending, except that inflation during wartimes is usually higher than the normal levels.

The regression results are shown in Table 4. Regressions in Panel A use growth rate of CPI as dependent variable, while those in Panel B use growth rate of M2. In addition to government spending, we also include the ratio of government debt in year t-1 to national income in year t in our regressions. The first four columns in both panels are OLS regressions using data for the entire sample period 1870-1995. All OLS regressions are estimated by assuming that the error terms follow AR(1) processes. The results show that growth rate of CPI is positively related to non-defense spending but negatively related to defense spending. Because of price control during wartimes (e.g., the World War II), however, growth rate of CPI may not be a good measure of inflation tax. Instead, growth rate of money supply is a more reliable measure to test the public finance theory of inflation in the time-series context. The regressions shown in the first four columns of Panel B indicate that growth rate of M2 is weakly negatively related to non-defense spending and strongly positively related to defense spending and government size.

In the rest of regressions in Table 4, we only use data from 1936 to 1995. The reasons of considering the short sample period are two. First, before 1933, the US was in the classical gold standard period. With the gold standard, governments only have limited ways to generate revenue through inflation tax. Hence, to test the public finance theory of inflation, the appropriate economic

system should be in paper standards. We will discuss this issue further in Section V. Second, as in the cross-country analysis, we would like to use social security expenditure (as a ratio of national income) as an IV for government spending (especially non-defense spending) to correct the potential bias caused by the endogeneity problem. But the social security program only started in 1936.

The IV regressions for the period 1936-95 are shown in the last four columns of Table 4. To show the differences between OLS and IV regressions, we also reproduce the OLS regressions for the period in the middle four columns. The results show that the growth rate of CPI is negatively related to both non-defense and defense spending as well as government size in the OLS regressions. The signs all change to positive in the IV regressions. However, as discussed above, because of price control during the World War II, those coefficients may be downward-biased estimates of the relation between inflation tax and government size. The results in Panel B show that for the period 1936-95, the growth rate of M2 is positively related to both non-defense and defense spending in both OLS and IV regressions. Moreover, the coefficients of defense spending are all statistically significant while those of non-defense spending are not significant.

It is also interesting to note that the growth rate of M2 is shown to be positively related with government size in all OLS regressions in Panel B. But the signs change to negative in the IV regressions. It is important to note that social security expenditure is a better IV for non-defense spending than for government size. The correlation between social security expenditure and non-defense is 0.80, while the correlation between social security expenditure and government size is only 0.15. So the IV results for non-defense spending are more reliable than those for government size.

Finally, the growth rate of M2 is weakly negatively related to the lagged debt-national income

ratios, as we have seen in the cross-country analysis.

In summary, the evidence based on the US time-series data shows that inflation is strongly positively related to government size, and the relation is mainly driven by the strong positive relation between inflation and defense spending. The relation between inflation and non-defense is statistically weak and ambiguous.

IV.B. The United Kingdom

We now turn to the UK's time series for the period of 1721-1990. We measure government size by total central government expenditure as a fraction of GNP. We also compute the ratios of defense and non-defense spending to GNP. Inflation is measured by growth rates of CPI and M1.[16] The time series are plotted in Figure 4. The first noticeable feature of the graph is that the spikes on the size of government (the thickest line) are mainly due to the sharp increases in defense spending (the thinnest line). The United Kingdom fought several wars during the sampling period, resulting

[16]The data on price levels are from McCusker (1992). To calculate the growth rate of money, we use the figures on bank notes of the Bank of England for the period of 1720-1921. The data are from Mitchell (1988, pp. 655-670). For the period since 1922, we use data on M1, which are also from Mitchell (1988, pp. 674 and 1998, 813-823). For the central government expenditure, the data are net public expenditure for the period of 1700-1801 from Mitchell (1988, pp. 578-580); the data are gross public expenditure for the period of 1801-1980 from Mitchell (1988, pp. 587-595); for the period of 1981-1990, the data are from United Nations (1985,1994). The data on defense are from Mitchell (1988, pp. 578-580, 587-595) for the period of 1700-1980. The figures combine the spending on Army, Ordinances, Navy, Air Forces, special expeditions, and votes of credits. For the period after 1980, the data on defense are from United Nations (1985, 1994). Data on GNP from 1830 to 1980 are from Mitchell (1988, pp. 831-836); from 1980 to 1990, data are from United Nations (1985, 1994). For the period of 1700-1830, Deane (1967, pp. 78, 282) has estimates on the growth rate of real GNP over every ten years. To obtain estimates within a decade, we interpolate the series according to the average annual growth rate of GNP in the decade.

in unusually large temporary increases in defense spending (as a fraction of GNP).

As in the US, the United Kingdom's time series show a secular upward trend in government spending (as a fraction of GNP) after the WWII and the trend seems to mainly associate with the increases in the size of non-defense expenditure (the second thickest line). On the other hand, the fractions of defense expenditure are about the same in the entire sample period, except during the wars. Finally, as in the US, it is not clear of how inflation (dash-dotted line) is related to government spending, except that inflation during wartimes is usually higher than the normal levels. This is especially true in the paper standard period (more discussions on this in next section).

The time-series regressions using the growth rates of CPI (Panel A) and M1 (Panel B) as dependent variables are shown in Table 5. As in the analysis of the US time series, we consider regressions using both the entire sample period and the paper standard period 1932-1990. All regressions are OLS by assuming that the error terms are AR(1) processes.

The results are similar to what we obtain using the US time series. First, using the entire sample period, the growth rates of both CPI and M1 are positively related to government size as well as defense and non-defense spending. In particular, the relation is statistically significant for growth rate of M1. Second, for the paper standard period, the growth rates of both CPI and M1 are positively related to defense spending, but ambiguously related to non-defense spending. The relation between the growth rate of CPI and the size of government is also not clear.

We also find that, as in the US time series and cross-country analysis, the growth rates of both CPI and M1 are negatively related to the debt-GNP ratio. The main difference is that the relations are statistically significant in all regressions for the UK time series.

In summary, as in the US time-series analysis, we find that inflation is positively related to

government size, and the relation is mainly driven by the positive relation between inflation and defense spending. The relation between inflation and non-defense is weak and ambiguous.

V. Wartime Inflation and Suspensions of Convertibility

In the previous section, we provided a statistical analysis of the effects of the changes in the size of government on inflation. In this section, we look specifically into the behavior of inflation during the periods when the large and temporary changes in the size of government are induced by wars.

In the British and American history, temporary high levels of government expenditure especially defense spending associated with major wars were often financed by public debts that were nominally denominated in their own currencies. Because of these nominal provisions, the theory of Lucas and Stokey (1983), Judd (1989), and others suggests that inflation serves as a state-contingent manager to adjust the real returns on the public debt. In particular, inflation would rise upon the arrival of "bad" news–the start of a war, and fall upon the arrival of "good" news–the end of a war. This reduces the real returns on the public debt during the war but raises the real returns when a war is over. This high expected real rate of returns after the war induces people to buy government debt at reasonable prices, and generates the necessary revenues for fighting a war. Moreover, the theory also suggests that from the viewpoint of optimal taxation, inflation can be desirable in the event of temporary increases in government expenditure because ex post inflation serves a tax on a stock variable–money holding, a kind of "capital levy." In both arguments, through the adjustment of inflation, government achieves certain a degree of smoothness of total taxes across different states and reduces the distortion of taxation.

The presumptions of the above state-contingent theory are that the government has the ability to adjust inflation contingent on the event of a war and that the government should also show the public that it commits to such a contingent policy. In the classical gold standard system, suspensions of convertibility (and/or lowering conversion ratios) serves as a tool to effectively raise inflation at the start of a war because it allows the government to print paper money to generate more seigniorage. Inflation in turn also reduces the real value of government's debt payments during the war. At the same time, resumption of convertibility shows the government's commitment to the state-contingent policy (Bordo and Kydland 1996). Hence, the state-contingent theory of inflation implies that inflation is high at the beginning and during suspensions of convertibility, and low when resumption of convertibility starts.

There are two episodes of suspensions of convertibility in the UK in the classical gold standard periods (1717-1931). The first one is 1797-1821 because of the War with France (1793-1815). The second is 1914-1925 because of World War I. In the US, there is one episode of suspension of convertibility in the classical gold standard periods (1792-1933). That is 1862-1879 because of the Civil War (1862-1865). Table 6 shows the summary statistics of inflation and money growth rates during those episodes. UK's and US' time series of inflation during those wars are also plotted in Figures 5 and 6, respectively.

Table 6 shows that on average, inflation and money growth rate are higher during wars in the suspension periods than in non-suspension periods. For example, in the UK, the average inflation is essentially 0 and M1 growth rate is 0.01 in the non-suspension periods, while the average inflation ranges from 0.01 to 0.13 and the average M1 growth rate from 0.03 to 0.17 in the wars during the two suspension periods. Same patterns also exist in the US episode. Note that since resumptions

of convertibility in all cases did not start until several years after the wars ended, the inflation and money growth rates must be much lower at the end of each suspension period in order to reach the low inflation in the non-suspension periods.

Indeed, Figures 5 and 6 show that inflation even started to fall just at the end of each war. UK's inflation in the World War I[17] and US' inflation in the Civil War are all high at the beginning of the wars, reach peak during the wars, and are low or becomes negative at the end of wars or immediately after the wars. UK's inflation seems to behave differently in the War with France (1793-1815). But note that the War with France has two phases: the French Revolutionary War (1792-1802) and the Napoleonic War (1803-1815). The first trough of inflation matched the end of the French Revolutionary War, in which Britain was a winner. After a brief truce, the war broke up again in 1803, and inflation rises above normal level again, and fell at the end of war.

In short, the above analysis shows that in the classical gold standard periods, suspension and resumption of convertibility serve as a state-contingent manager to adjust inflation and the real returns on government debts in the temporary need of large revenues. As a result, inflation is high at the beginning of the wars and suspensions of convertibility and low at the end of the wars and the start of resumption of convertibility.

The above observations on wartime inflation in the classical gold standard periods also hold for the paper standard periods. Table 7 shows the summary statistics of inflation during wars since 1933. The time series of inflation during these wartimes are also plotted in Figures 5 and 6 for UK

[17]Inflation did not go down until a couple of years after the end of WWI in both the United Kingdom and the United States. However, although official fighting in WW I ended on November 11, 1918, when the armistice was declared, the peace itself was not established until the Treaty of Versailles was signed on June 28, 1919, and it did not go into effect until January 10, 1920.

and US, respectively. In all cases except the Vietnam War (1965-1973),[18] inflation is high at the beginning, reaches peak in the middle, and is low at the conclusion of a war. These support the prediction of the theory that inflation is above normal upon the receipt of "bad news" of government fiscal situations - starting a war, and below normal upon the receipt of "good news" - ending a war.

For the United States, inflation rose at the end of the Vietnam War. Note that the Vietnam War is one of the few wars since US independence that did not end in an unmistakable American victory. These cases suggest that ending a war alone is not always good news for a government's fiscal situation. For a defeated country, its government has to face tougher challenges, both economically and politically, to raise necessary revenues using only non-inflation tax to meet the needs of postwar reconstructions, debt repayments, and possibly, large war reparations. This provides more incentives for the government to rely on inflation as a revenue source. These episodes and the high inflations in the defeated countries[19] after the two World Wars suggest that inflation responds strongly to the nature of how a war ends and the ability of a government meets its future fiscal obligations.

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[18] For both the United Kingdom and the United States, inflation remained at high levels after World War II. Grossman (1988) argues that the continuing high inflation after the World War II can be explained by the changes in factors increasing the power of debtors relative to that of creditors in the political process and the large demands on national resources for huge postwar reconstruction and maintenance of a nuclear warfare.

[19]During the World War II, the Nazi government in Germany imposed a strict price control to keep inflation low. After its defeat in 1945, a currency reform was carried out. As a result, there was no high inflation in Germany. Other defeated countries such as Japan and Italy experienced high inflation after the war.

VI. Summary

In this paper we review the implications of existing theories on the relationship between inflation and the size of government and study how the theoretical predictions match empirical evidence. We find that the strongest empirical relationship between inflation and the size of government arises from wartime. Inflation was fairly high during several British and American wars and often negative after wars. We also find that permanently high non-defense government spending – as observed across countries – seems to be weakly negatively related to inflation while defense spending is somewhat more strongly positively related. Also there has been a slight secular increase in inflation with the size of government over time, which we cannot account for with defense spending.

The static or steady-state Ramsey theory thus fails to predict the magnitude of the inflation tax. Not only is the theory ambiguous about the sign of the relationship between inflation and the size of government, it also fails to explain why wars are the best predictors of inflation and why the composition of government spending is correlated with inflation.

To the extent that wars are surprises, a dynamic stochastic Ramsey theory (such as Lucas and Stokey 1983) does explain the strong correlation between inflation and temporary wartime government spending, although perhaps not the relationship with more permanent defense spending.

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Table 1: Cross-country inflation regressions, 1973-90 averages.

	dependent variable = log(average annual CPI growth rate)							
	All countries				Excluding countries experienced hyperinflation			
independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
gov spending/GDP	-1.49 (0.61)		-1.84 (0.93)		-1.04 (0.41)		-1.90 (0.63)	
non-defense/GDP		-1.57 (0.63)		-1.82 (0.94)		-1.14 (0.41)		-1.89 (0.62)
defense/GDP		0.99 (3.43)		0.98 (3.43)		1.98 (2.27)		1.96 (2.32)
regression method	OLS	OLS	IV	IV	OLS	OLS	IV	IV
number of countries	80	80	80	80	74	74	74	74
R-squared	0.07	0.08	0.07	0.08	0.08	0.11	0.13	0.14

Note: Figures in the parentheses are standard errors. The instrumental variable in the IV regressions is the average of the ratio of social security spending to GDP in 1973-1990.

Table 2: Cross-country inflation regressions, 1973-90 averages with measures of central bank (CB) independence.

	dependent variable = log(average annual CPI growth rate)							
	All countries				Excluding countries experienced hyperinflation			
independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
gov spending/GDP				0.74 (0.83)				1.02 (0.85)
non-defense/GDP	-1.76 (0.81)	-0.15 (0.74)	0.80 (0.85)		-1.38 (0.62)	-0.82 (0.78)	0.17 (0.86)	
defense/GDP	-2.33 (7.48)	-2.95 (6.07)	-3.48 (6.14)		-2.82 (5.92)	-3.10 (5.97)	-4.05 (5.68)	
CB legal independence in 1980s		-0.06 (0.81)	0.06 (0.78)	0.07 (0.78)		-0.21 (0.81)	-0.09 (0.75)	-0.08 (0.75)
CB governor turnover rate over 1950-89		3.17 (0.67)	3.03 (0.64)	3.01 (0.64)		1.25 (1.05)	0.79 (1.00)	0.75 (0.99)
public debt/GDP (1973)			-0.21 (0.56)	-0.31 (0.53)			-0.19 (0.66)	-0.27 (0.65)
average log (real GDP per capita)			-0.29 (0.13)	-0.28 (0.12)			-0.34 (0.12)	-0.33 (0.12)
number of countries	43	43	43	43	40	40	40	40
R-squared	0.11	0.44	0.51	0.51	0.12	0.21	0.33	0.31

Note: Figures in the parentheses are standard errors. All regressions are OLS.

Table 3: Cross-country inflation IV regressions, 1973-90 averages with measures of central bank (CB) independence.

	dependent variable = log(average annual CPI growth rate)											
	All countries						Excluding countries experienced hyperinflation					
independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
gov spending/GDP						-0.40 (2.18)						-1.41 (2.33)
non-defense/GDP	-2.14 (0.93)	0.80 (1.01)	-2.90 (1.50)	-1.20 (1.59)	-0.40 (2.22)		-1.47 (0.71)	-0.13 (1.04)	-2.61 (1.17)	-2.97 (2.06)	-1.41 (2.36)	
defense/GDP	-3.53 (8.08)	-1.62 (6.89)	-4.36 (8.26)	-2.81 (6.89)	-2.84 (7.32)		-2.43 (6.20)	-2.88 (6.31)	-3.67 (6.53)	-4.16 (7.01)	-4.19 (6.83)	
CB legal independence in 1980s		0.04 (0.88)		-0.08 (0.89)	0.02 (0.90)	0.04 (0.88)		-0.07 (0.83)		-0.32 (0.92)	-0.08 (0.85)	-0.06 (0.83)
CB governor turnover rate over 1950-89		3.15 (0.75)		2.69 (0.99)	2.77 (0.98)	2.79 (0.97)		0.46 (1.19)		-0.67 (1.92)	-0.34 (1.79)	-0.33 (1.77)
public debt/GDP (1973)		-0.25 (0.63)			-0.06 (0.71)	-0.12 (0.68)		-0.43 (0.74)			-0.11 (0.92)	-0.17 (0.89)
average log (real GDP per capita)		-0.22 (0.17)			-0.14 (0.22)	-0.13 (0.22)		-0.33 (0.16)			-0.25 (0.20)	-0.25 (0.19)
regression method	OLS	OLS	IV	IV	IV	IV	OLS	OLS	IV	IV	IV	IV
number of countries	37	37	37	37	37	37	34	34	34	34	34	34
R-squared	0.13	0.51	0.12	0.44	0.48	0.48	0.12	0.52	0.05	0.02	0.23	0.22

Note: Figures in the parentheses are standard errors. The instrumental variable in the IV regressions is the average of the ratios of social security spending to GDP in 1973-1990.

Table 4: Time series regressions of inflation in the US, 1870-1995 and 1936-1995
(Figures in the parentheses are standard errors)

	1870-1995 (OLS)				1936-1995 (OLS)				1936-1995 (IV)			
independent variables	**Panel A. Dependent variable: growth rate of CPI**											
gov spending/GNP	0.06	-0.03			-0.16	-0.16			0.72	0.47		
	(0.05)	(0.07)			(0.07)	(0.07)			(0.70)	(0.34)		
non-defense/GNP			0.25	0.14			-0.19	-0.18			0.21	0.22
			(0.11)	(0.13)			(0.20)	(0.21)			(0.10)	(0.11)
defense/GNP			-0.02	-0.07			-0.16	-0.16			0.04	0.04
			(0.07)	(0.08)			(0.07)	(0.07)			(0.05)	(0.05)
debt[t-1]/GNP[t]		0.06		0.05		0.02		0.02		-0.02		0.00
		(0.03)		(0.03)		(0.03)		(0.03)		(0.02)		(0.02)
R-squared	0.01	0.04	0.04	0.06	0.09	0.10	0.09	0.10	0.02	0.04	0.13	0.10
adjusted DW-statistic	1.77	1.74	1.78	1.74	1.49	1.49	1.49	1.49				
independent variables	**Panel B. Dependent variable: growth rate of M2**											
gov spending/GNP	0.14	0.18			0.32	0.31			-0.36	-0.60		
	(0.06)	(0.06)			(0.07)	(0.06)			(0.67)	(0.57)		
non-defense/GNP			-0.05	-0.00			0.27	0.09			0.13	-0.07
			(0.10)	(0.11)			(0.15)	(0.11)			(0.10)	(0.08)
defense/GNP			0.25	0.28			0.32	0.32			0.29	0.30
			(0.07)	(0.08)			(0.07)	(0.06)			(0.05)	(0.04)
debt[t-1]/GNP[t]		-0.02		-0.02		-0.03		-0.05		-0.02		-0.06
		(0.02)		(0.02)		(0.02)		(0.02)		(0.04)		(0.01)
R-squared	0.05	0.06	0.09	0.10	0.30	0.33	0.31	0.42	0.01	0.04	0.39	0.57
adjusted DW-statistic	1.82	1.83	1.82	1.81	1.91	1.90	1.90	1.80				

Table 5: Time series regressions of inflation in the UK, 1721-1990 and 1932-1990								
	1721-1990				1932-1990			
independent variables	**Panel A. Dependent variable: growth rate of CPI**							
gov spending/GNP	0.10 (0.06)	0.21 (0.06)			-0.10 (0.12)	0.08 (0.10)		
non-defense/GNP			0.18 (0.13)	0.33 (0.12)			0.37 (0.31)	0.38 (0.30)
defense/GNP			0.07 (0.07)	0.17 (0.07)			0.04 (0.10)	0.11 (0.10)
debt[t-1]/GNP[t]		-0.03 (0.01)		-0.03 (0.01)		-0.04 (0.02)		-0.03 (0.02)
R-squared	0.01	0.06	0.01	0.06	0.01	0.07	0.03	0.09
adjusted DW-stat.	1.95	1.94	1.95	1.93	2.38	2.04	2.06	2.12
independent variables	**Panel B. Dependent variable: growth rate of M1**							
gov exp/GNP	0.27 (0.06)	0.39 (0.07)			0.13 (0.18)	0.32 (0.17)		
non-defense /GNP			0.39 (0.13)	0.56 (0.13)			-0.08 (0.60)	-0.12 (0.49)
defense/GNP			0.22 (0.07)	0.34 (0.08)			0.10 (0.19)	0.29 (0.16)
debt[t-1]/GNP[t]		-0.04 (0.01)		-0.04 (0.01)		-0.09 (0.03)		-0.09 (0.03)
R-squared	0.06	0.11	0.07	0.12	0.01	0.14	0.01	0.16
adjusted DW-statistic	1.97	2.10	1.98	2.11	2.08	1.99	2.08	1.98

Note: All regressions are OLS. Figures in the parentheses are standard errors.

Table 6. Inflation and money growth rates during suspensions of convertibility in the classical gold standard periods in UK and US

Episodes	Num of periods	Inflation			Money growth rate*		
		Mean (std dev.)	Minimum	Peak	Mean (std dev.)	Minimum	Peak
United Kingdom: 1717-1931							
1797-1821 (Paper Pound)	25	0.00 (0.12)	-0.26	0.31	0.03 (0.08)	-0.08	0.20
1797-1802 (French Revolutionary War)	6	0.02 (0.20)	-0.26	0.31	0.08 (0.09)	-0.04	0.20
1803-1815 (Napoleonic War)	13	0.01 (0.09)	-0.14	0.15	0.04 (0.07)	-0.06	0.18
1914-1925	12	0.04 (0.16)	-0.23	0.24	0.10 (0.14)	-0.06	0.35
1914-1919 (World War I)	6	0.13 (0.12)	-0.10	0.24	0.17 (0.13)	0.05	0.35
Non-suspension periods	178	0.00 (0.06)	-0.17	0.20	0.01 (0.10)	-0.41	0.41
United States: 1792-1933							
1862-1879	18	0.01 (0.09)	-0.07	0.22	0.04 (0.05)	-0.05	0.12
1862-1865 (American Civil War)	4	0.15 (0.09)	0.04	0.22	N/A	N/A	N/A
Non-suspension periods	124	0.00 (0.06)	-0.17	0.18	0.05 (0.06)	-0.12	0.17

* For UK, money growth rate is growth rate of M1. Data are only available from 1721. For US, it is growth rate of M2. Data are only available from 1868.

Table 7. Inflation and money growth rates during wars in the post-classical gold standard periods in UK and US

Episodes	Num of periods	Inflation			Money growth rate*		
		Mean (std dev.)	Minimum	Peak	Mean (std dev.)	Minimum	Peak
United Kingdom: 1932-1990							
1941-1945 (World War II)	5	0.07 (0.07)	0.00	0.17	0.15 (0.03)	0.12	0.21
Non-war periods	54	0.06 (0.06)	-0.07	0.26	0.08 (0.11)	-0.06	0.80
United States: 1934-1995							
1941-1945 (World War II)	5	0.05 (0.03)	0.01	0.10	0.15 (0.04)	0.10	0.21
1950-1953 (Korean War)	4	0.03 (0.03)	0.01	0.07	0.05 (0.01)	0.03	0.06
1965-1973 (Vietnam War)	9	0.04 (0.01)	0.02	0.06	0.08 (0.03)	0.04	0.13
Non-war periods	44	0.04 (0.04)	-0.02	0.14	0.06 (0.03)	-0.00	0.13

* For UK, money growth rate is growth rate of M1. For US, it is growth rate of M2.

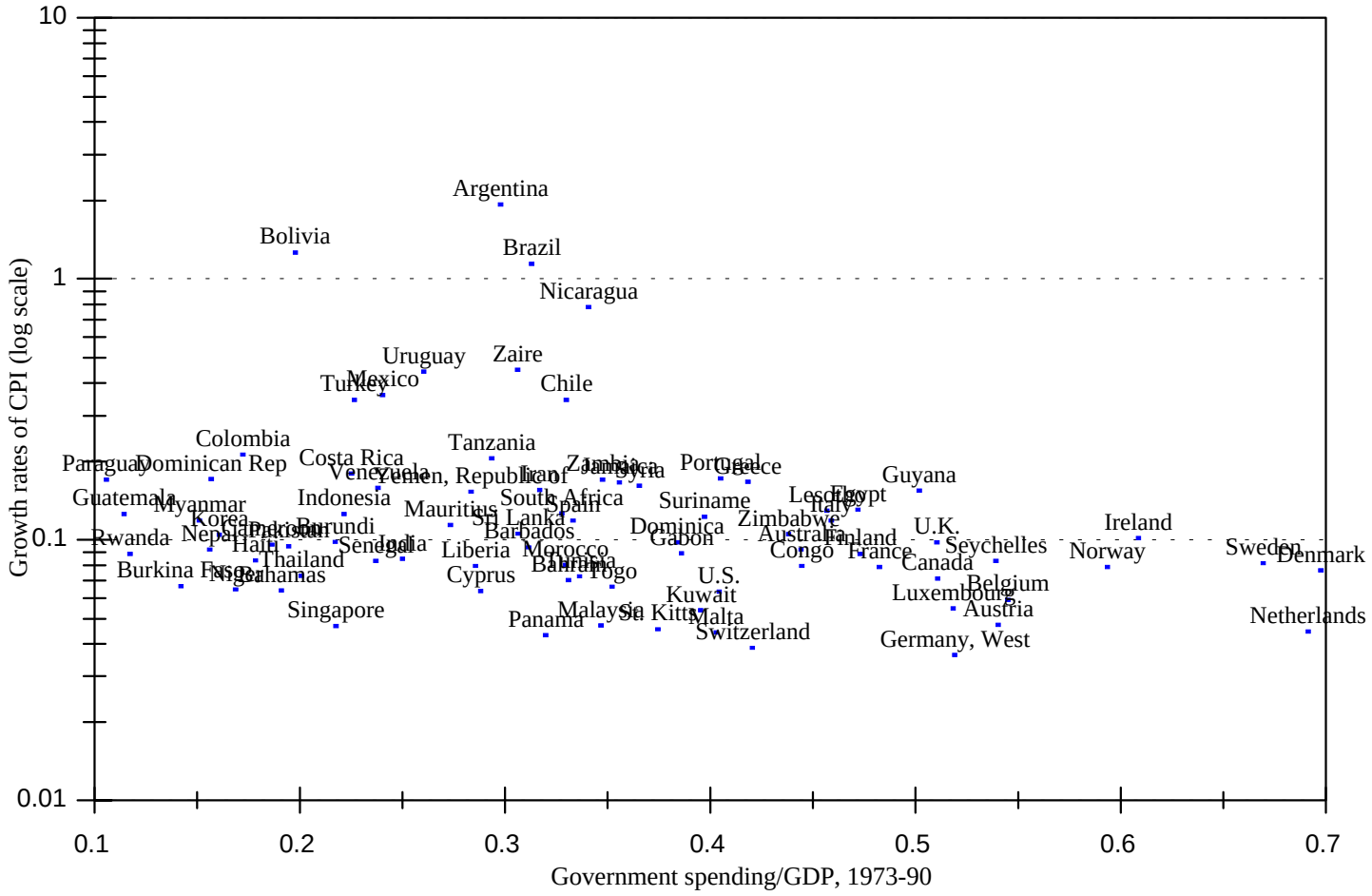


Figure 1: Inflation and government size: 1973-1990

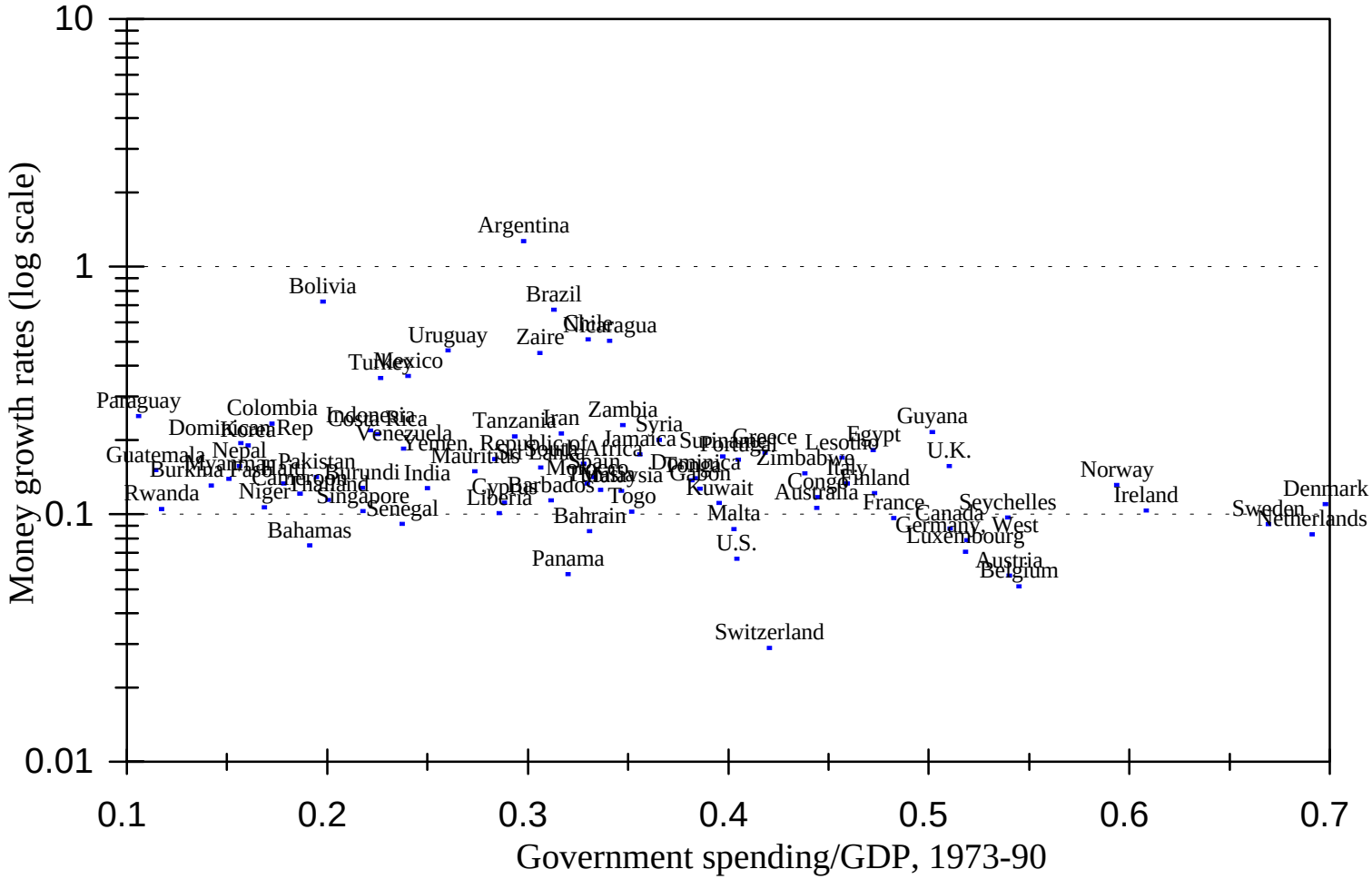


Figure 2: Growth rate of M1 and government size: 1973-1990

Figure 3. Inflation and government size and its components: US 1870−1995

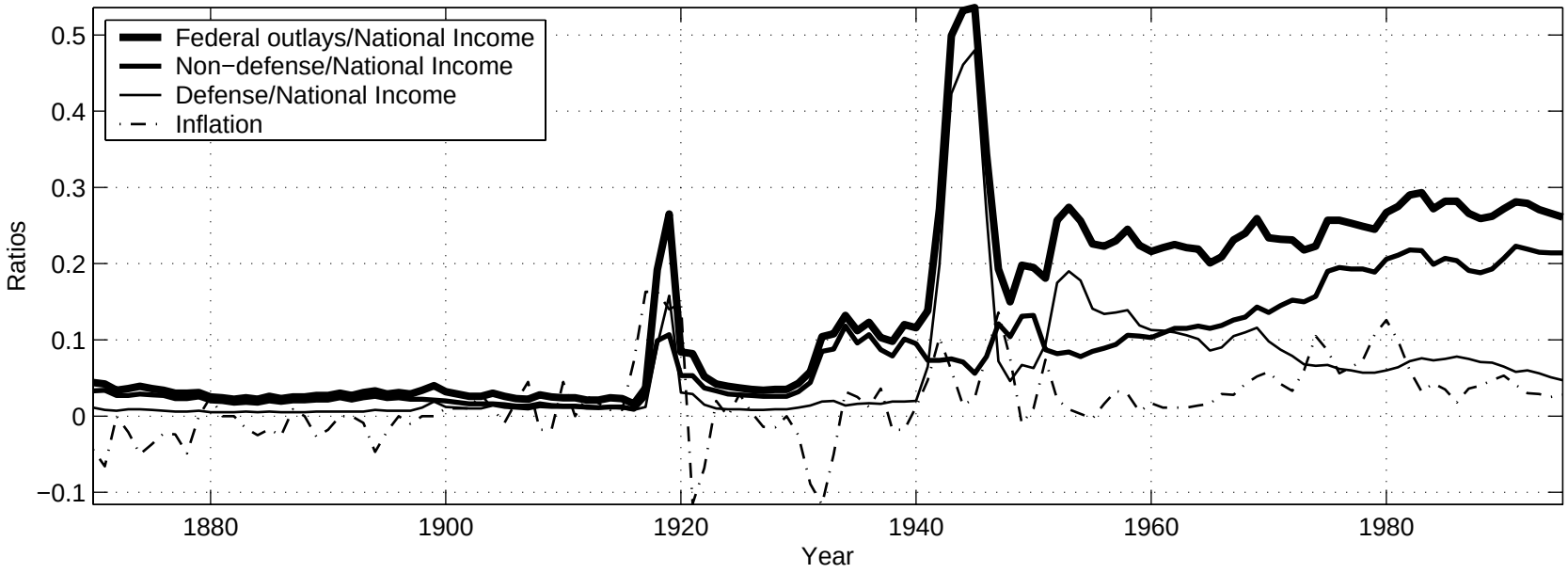
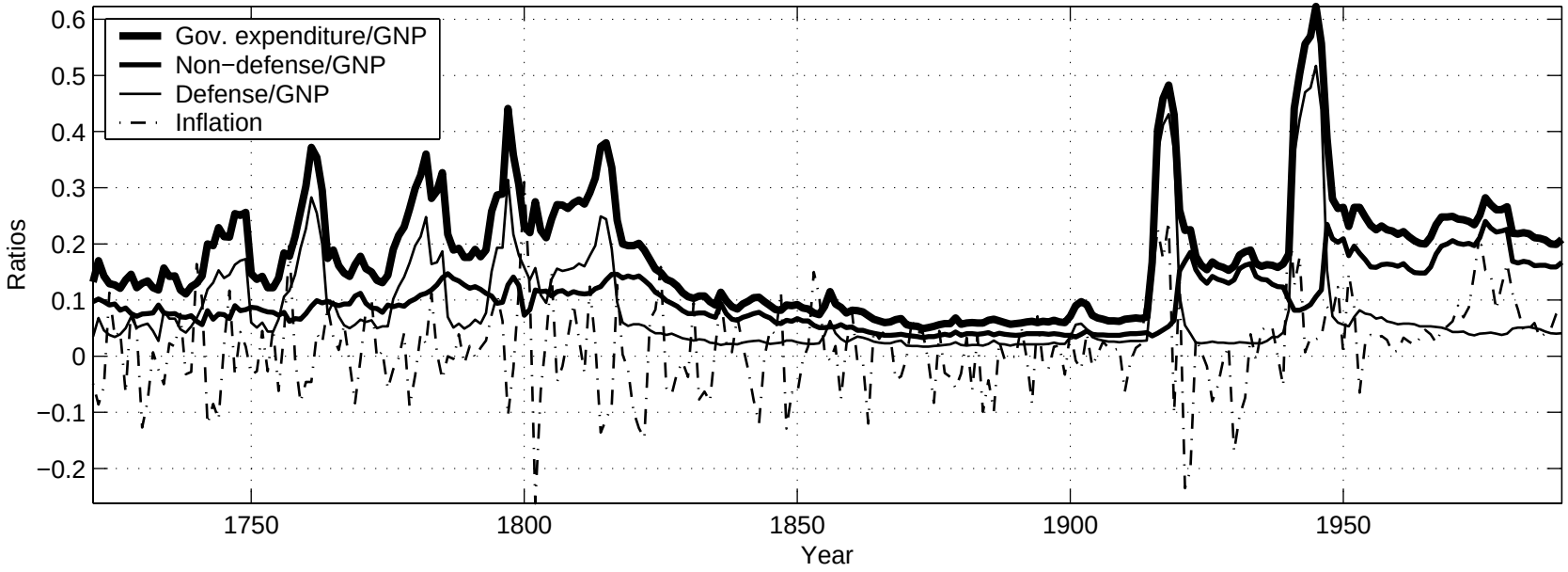


Figure 4. Inflation and government size and its components: UK 1721−1990



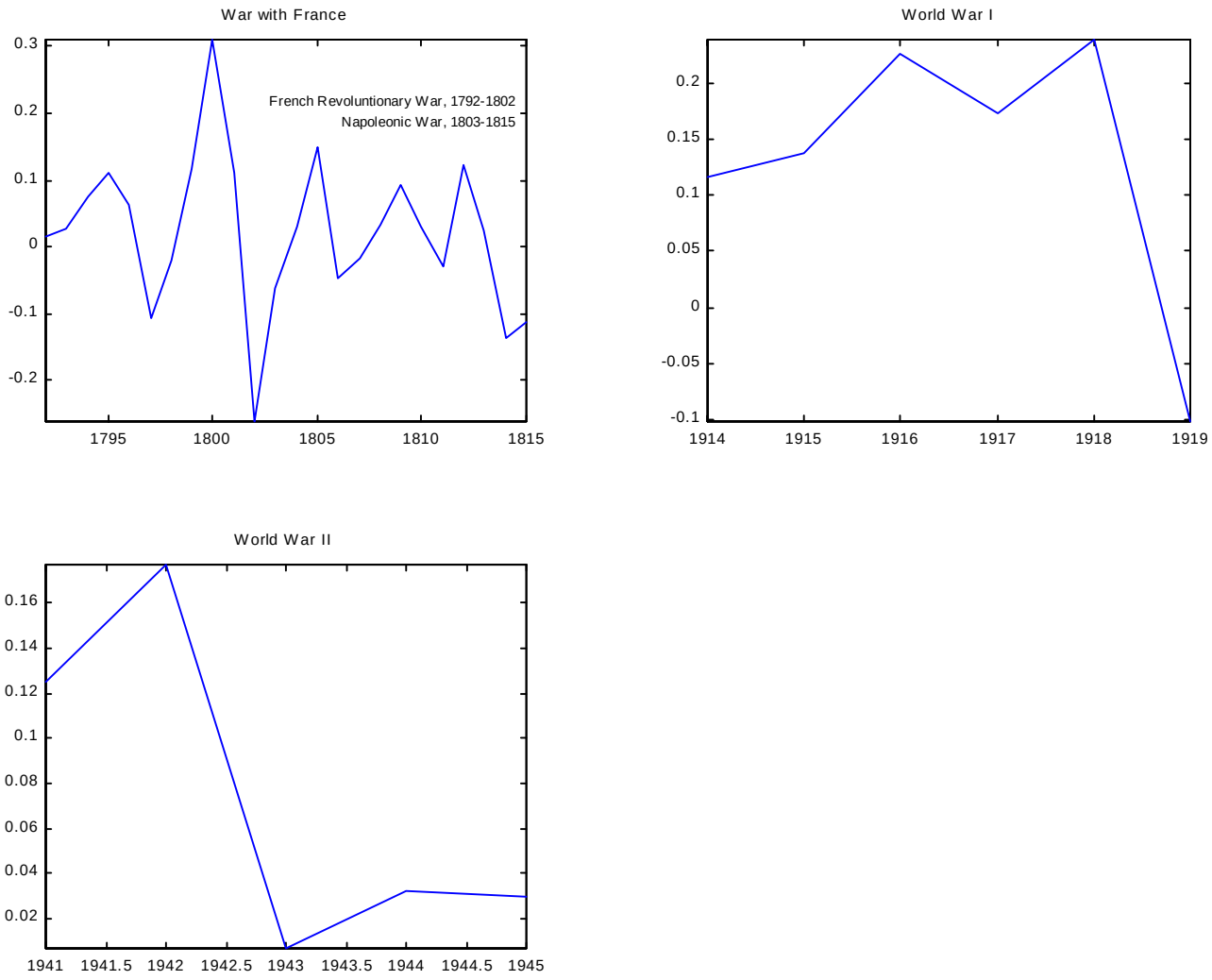


Figure 5: Wartime inflation during suspensions of convertibility in the classical gold standard period and in the paper standard period: UK 1721-1990

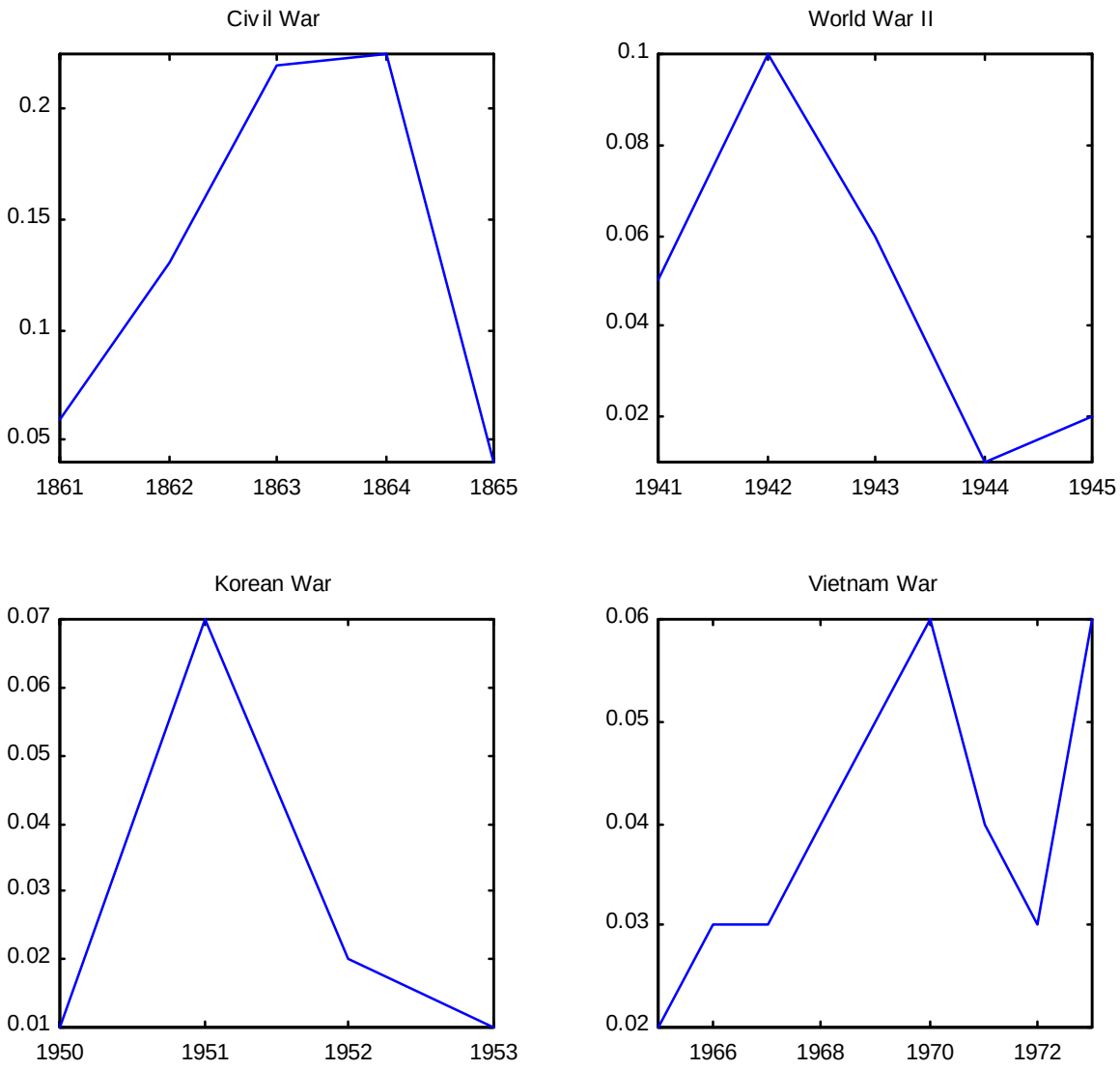


Figure 6: Wartime inflation during suspensions of convertibility in the classical gold standard period and in the paper standard period: US 1792-1995