Cagan's paradox and money demand in hyperinflation: Revisited at daily frequency

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ABSTRACT

Using daily data the Cagan money demand is estimated and accepted for the most severe portion of Serbia's 1992–1993 hyperinflation, i.e. its last 6 months. An implication is that the public adjusted daily throughout this extreme period. Moreover, the obtained semi-elasticity estimates are by far lower than those previously found using monthly data sets. Consequently, the daily estimates reject the longstanding Cagan's paradox, based on monthly studies, by showing that the economy has been on the correct, increasing side of the Laffer curve almost through the end of hyperinflation. This strongly supports the view that hyperinflation is triggered and driven all way through its end by the government's hunt for non-decreasing seigniorage. Daily adjustments of public in hyperinflation can account for the difference between the results obtained at daily and monthly frequencies, calling into question the latter. Some evidence is offered that the findings of this paper may hold for other hyperinflations.

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1. Introduction

There has been a longstanding interest, initiated by Cagan (1956) in exploring money demand in hyperinflation, and most relevant studies have been done using monthly data. However, hyperinflations are extreme events with daily inflation rates comparable to quarterly or annual rates in moderate inflation economies. Thus a conjecture is that in hyperinflation the public adjusts at daily frequency and hence that monthly observations could offer a misleading picture of the public's behavior (Taylor,

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2001). In addition, hyperinflations are short-lived episodes characteristically lasting around 20 months. Obviously this is very small sample for sound estimation, and the problem has typically been moderated by extending it to include the lower inflation period preceding hyperinflation. The latter practice leads us to another problem with monthly estimates which is that they encompass a non-homogenous period. The issue is further complicated by some evidence that even hyperinflations themselves are non-homogenous events, each with its own distinct severe portion (Michael et al., 1994). Again the latter proposition cannot be demonstrated and taken care of with monthly observations. All of the above suggest that previous monthly studies of money demand could be misleading, and that daily data is required to bring to light agents' behavior in periods of hyperinflation.

This paper examines the money demand schedule at daily frequency in an advanced stage of hyperinflation, and contrasts it with monthly studies. In particular we ask whether money demand estimates at daily frequency can resolve the longstanding Cagan's paradox derived from monthly studies.

Cagan's (1956) paradox states that in hyperinflation authorities tend to expand money supply at a rate well beyond that which would maximize their inflation tax revenue. As early as the early 1970s Barro (1972) reported widely different estimates of revenue-maximizing rates: Friedman (1971) came out with the maximizing inflation rate below 20% per year, Cagan (1956) with around 20% per month, and Barro (1972) with 140% per month.

Mainstream research has followed Cagan's model, generating estimates that uniformly reinforce the paradox of non-optimal seigniorage from excessive money creation (Michael et al., 1994). Specifically, highly efficient estimates of the Cagan money demand that hold for a wide set of expectation formation processes supported Cagan's results (Taylor, 1991; Engsted, 1994). The estimated semi-elasticity varies in ranges similar to those found in Cagan (1956), i.e. from 3 to 6, and their inverse values provide revenue-maximizing inflation rates in the range of 17–33% per month. Statistical tests confirm that average inflation rates across hyperinflations significantly exceed the seigniorage maximizing ones. This suggests that for a substantial portion of each hyperinflation, economies were placed on the wrong, decreasing side of the inflation tax Laffer curve.

Some alternative research however has suggested that in the extreme portion of hyperinflation semi-elasticity might decrease, placing an economy on the correct side of the Laffer curve for a large part of hyperinflation. Thus Michael et al. (1994) focused on the most extreme period of the German hyperinflation, including the final months that have been previously considered as outliers, and obtained a seven times smaller semi-elasticity than reported above, which goes a long way to resolving Cagan's paradox. The result also suggests that the considered extreme period represents a distinct portion of the German hyperinflation. However, a serious shortcoming of the Michael et al. (1994) result is its reliance on a brutally small monthly sample of only 14–16 observations, which severely limits its robustness.

Another strand of research abandons Cagan's framework and opts for money demand schedules that allow for money substitutes, where semi-elasticity decreases (elasticity increases) as inflation accelerates. Advancing that line, Barro (1970, 1972) obtained estimates for the five classical hyperinflations showing that in three cases governments were on the increasing segment of the Laffer curve through to the end of hyperinflation. However, in the most extreme episodes of Germany and Hungary II (1945–1946) the economies were on the wrong side of the curve for the last 3 and 4 months of hyperinflation, respectively.

This paper explores the most severe portion of the Serbian hyperinflation of 1992–1993, at daily frequency. As opposed to previous monthly studies, including Michael et al. (1994), we are able to rely on a large sample of daily data covering the last 6–7 months of extreme hyperinflation. The Serbian hyperinflation itself is an extreme event, second only (in the 20th century) to Hungary II in extremity and to 1920s Russian in duration (Petrović et al., 1999). The severe portion that we shall examine is characterized by an average monthly currency depreciation rate of 10,700% which is 33 times higher than the average inflation rate (322%) in the German hyperinflation. Our motivation for choosing this period is a conjecture that the public adjusts daily in these extreme conditions.

The paper proceeds as follows. Section 2 gives a background of the Serbian hyperinflation while demonstrating its severe nature in the period to be explored and describes the evolution of the series, particularly inflation tax and real money balances. It also explains the data set that is used. Section 3