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Finite-time singularity signature of hyperinflation

D. Sornette^{a,b,c,*}, H. Takayasu^d, W.-X. Zhou^a

^a*Institute of Geophysics and Planetary Physics, University of California,
Los Angeles, CA 90095, USA*

^b*Department of Earth and Space Sciences, University of California, Los Angeles, CA 90095, USA*

^c*Laboratoire de Physique de la Matière Condensée,
CNRS UMR 6622 and Université de Nice-Sophia Antipolis, 06108 Nice Cedex 2, France*

^d*Sony Computer Science Laboratories, 3-14-13 Higashigotanda, Shinagawa-ku,
Tokyo 141-0022, Japan*

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Abstract

We present a novel analysis extending the recent work of Mizuno et al. (Physica A 308 (2002) 411) on the hyperinflations of Germany (1920/1/1–1923/11/1), Hungary (1945/4/30–1946/7/15), Brazil (1969–1994), Israel (1969–1985), Nicaragua (1969–1991), Peru (1969–1990) and Bolivia (1969–1985). On the basis of a generalization of Cagan’s model of inflation based on the mechanism of “inflationary expectation” of positive feedbacks between realized growth rate and people’s expected growth rate, we find that hyperinflations can be characterized by a power law singularity culminating at a critical time t_c . Mizuno et al.’s double-exponential function can be seen as a discrete time-step approximation of our more general non-linear ODE formulation of the price dynamics which exhibits a finite-time singular behavior. This extension of Cagan’s model, which makes natural the appearance of a critical time t_c , has the advantage of providing a well-defined end of the clearly unsustainable hyperinflation regime. We find an excellent and reliable agreement between theory and data for Germany, Hungary, Peru and Bolivia. For Brazil, Israel and Nicaragua, the super-exponential growth seems to be already contaminated significantly by the existence of a cross-over to a stationary regime.

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Keywords: Finite time singularity; Double-exponential growth; Hyperinflation; Econophysics; Price index; Critical time; Expectation; Positive feedback

* Corresponding author. Institute of Geophysics and Planetary Physics, University of California, Los Angeles, CA 90095, USA.

E-mail addresses: sornette@moho.ess.ucla.edu (D. Sornette), takayasu@csl.sony.co.jp (H. Takayasu), wxyzhou@moho.ess.ucla.edu (W.-X. Zhou).

1. Introduction

Inflation is the economic situation in which prices apparently move monotonically upward and the value of money decreases. To classical economics, inflation is the undue increase in the supply of credit above the level that is supported by current savings. High inflation is always associated with high rates of money supply growth while the relationship is weak for countries with low inflation [1]. Thus, fighting high inflation requires reducing the growth rate of the money supply.

Inflation is one of the few big issues in macroeconomics, together with unemployment, monetary policy, fiscal policy, import–export deficits, productivity, government spending and the business cycle, and has been at the forefront of public battles over the past half-century. A good economic policy should strive to achieve a balance between often contradictory requirements: for instance, many economists assume that unemployment tends toward a natural rate below which it cannot go without creating inflation. Samuelson and Solow had brought to the US the empirical evidence, first compiled by the British economist A.W. Phillips, that there seems to be a tradeoff between inflation and unemployment—that is, higher inflation meant lower unemployment. There is thus a long tradition among economists to adopt monetary policy as a way to keep the economy running on high-employment overdrive. Allowing prices to rise seemed the only humane thing to do. Friedman argued however that the unemployment/inflation tradeoff was temporary, and he also pointed out that using fiscal and monetary policy to avert recessions was a lot harder than it looked. The difficulties stem from the fact that policies designed to restrain inflation by lowering the level of aggregate demand will tend to depress investment and harm capacity. Improved industrial performance requires a climate conducive to investment and research and development, which in turn depends on, *inter alia*, high and stable levels of aggregate demand. Business and inflation cycles often result from the combination of endogenous interactions (that can lead to incoherence) and of the effects of institutions to contain these tendencies in the economy. The corresponding economic time series can exhibit smooth growth and well-behaved cycles as possible transitory results of the economic processes, but can also allow for intermittent conditions conducive to the emergence of incoherence or turbulence. Institutional factors attempt to act as circuit breakers on the economy. Whenever institutionally determined values dominate endogenously determined values, the path of the economy is broken and an interactive process, which starts with new initial conditions, generates future values. Specifically, whenever the economy threatens to behave incoherently, these stabilizers, whether built-in or activated by government authority, prevent the economy from continuing on the prior determined path, with the corresponding added complication and possible elements of destabilization. These are important elements in the path evolution of inflation.

In standard economic theory, inflation is associated with money supply growth. At equilibrium, money determines price level and implies equilibrium in markets for other assets. At equilibrium, money demand depends primarily on income and interest rates. But there are several factors keeping money demand unstable, such as financial innovations as well expectations. Indeed, one of the major causes of the complexity in stabilizing inflation together with other macroeconomic variables is that expectations

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