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On the dynamics of sovereign debt in China: Sustainability and structural change

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ABSTRACT

The dynamics of public debt are an important determinant of the macroeconomic environment of an economy and of the investment climate in the private sector. There have been concerns recently about the sustainability of debt in China, given the surge in the fiscal deficit in the last few years that has aided economic activity. This paper aims to shine some light on the dynamics of public debt in the Chinese economy given the risk of a debt crisis, taking nonlinearities and structural breaks into account. Our results show that caution needs to be exercised as there was a clear trend in 2014 towards an unsustainable path in the debt-to-GDP ratio.

1. Introduction

After the collapse of Lehman Brothers in 2008 and the end of the Great Moderation, the sovereign debt of a number of countries started to pile up at high speed (see Paret, 2007, among many others). In the European Union this was a consequence of the introduction of expansionary fiscal policies to reverse the effects of the downturn (EC, 2009).

China meanwhile makes an interesting case study for its ability to sustain high levels of economic growth and controlled levels of unemployment and public debt even after 2008. However, concerns about the Chinese miracle have recently appeared as China's economic growth slowed down sharply from 2014 and the level of sovereign debt escalated, after it had dropped and then recovered between 2008 and 2010. Excessive borrowing by the public sector in China may be traced back to the huge stimulus package introduced during the 2008–2009 global financial crisis. On top of this, the government subsidised the development of several important industries (Chen and Liu, 2017), and an RMB 4 trillion investment plan focusing on infrastructure was rolled out, creating the biggest fiscal stimulus in the world (Zheng and Chen, 2009). The initial plan was for the stimulus package to be funded from three sources: central government, local governments and borrowing from banks. However, local governments had limited fiscal capacity so they turned to banks, many of which felt unable to decline loan requests because of their government ownership. For some time, growth remained fast and China was able to face the increase in debt. However, when growth started to slow down in 2012, the authorities responded with further expenditure on infrastructure projects to revive the economy. Stimulus packages have blotted China's consolidated deficits every year since 2008. China's public debt in 2015 was above 40% of GDP,[1] which may look small by the standards of advanced economies, but the rate of debt growth is unmatched elsewhere.

One of the biggest problems with an uncontrolled escalation of sovereign debt is how credible it is that the government will be able to repay the debt. This may increase the cost of borrowing, and this may then increase the fear of default, which is what happened to the Asian Tigers during their 1997–1998 crisis. As a result, efforts to analyse the sustainability of China's debt have gathered momentum. Debt sustainability has been a very popular topic recently in Europe, with for instance Cuestas and Staehr (2013) and Cuestas et al. (2014) analysing the stability of the sovereign debt in EU countries, given that there may be endogenously determined breaks. Their results show how the year 2008 changed the dynamics of debt.[2]

This paper aims to shed some light on the sustainability of China's sovereign debt, paying particular attention to changes in its dynamics, and to provide clear policy recommendations. Such recommendations are of increasing importance, as it would be helpful to link changes in debt dynamics with particular events so that conclusions with policy relevance could be provided. To the best of our knowledge this is the first attempt to analyse changes in the dynamics of the public debt in

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[1] https://fred.stlouisfed.org/series/GGGDTACNA188N.
[2] See also Cunado et al. (2004), amongst others, for the US case.

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China in more recent times. Li and Zhang (2017) express some concerns about debt sustainability since their calculations suggests an overall debt-to-GDP ratio of 249% in 2015 from all sectors,[3] but most of this debt is in the private sector while the public sector debt is 41% of GDP.

The remainder of the paper is organised as follows. The next section provides a brief summary of the economic underpinning of this paper and the econometric methodology applied in it. Section 3 presents the results, and then Section 4 provides some concluding remarks and policy recommendations.

2. Economic and econometric background

In this paper we focus on the dynamics of debt and potential sustainability problems amid increasing concerns about China's expansionary fiscal policy.

In a seminal contribution, Bohn (2007) established that the concept of debt sustainability, which implies that the transversality condition of the intertemporal budget constraint is met, as can be analysed by cointegration and unit root tests over the deficit, had lost its economic meaning. The transversality condition is defined as

$$\lim_{n\to\infty} \delta^n E_t(D_{t+n}) = 0 \tag{1}$$

where δ is the rate of discount and $E_t(.)$ is the expectations operator; therefore the intertemporal budget constraint is the expected present value condition D_t

$$D_t = \sum_{i=0}^{\infty} \delta^i E_t(G_{t+i} - T_{t+i}) \tag{2}$$

where $G_t - T_t$ is the fiscal deficit at moment t. The intertemporal budget constraint would be satisfied if the transversality condition (1) is also satisfied.

Bohn's (2007) conclusion arises because Eq. (1) and (2) will be satisfied for a sufficiently large value of the discount rate, regardless of the order of integration $I(d)$ of D_t. This is because the discount rate is $0<\delta<1$.

Bohn (2007) then proposes comparing the autoregressive parameter δ in

$$D_t = \delta D_{t-1} + \varepsilon_{1t} \tag{3}$$

with the interest rate of debt. Eq. (3) relates directly to the econometric analysis of unit roots and autoregressive parameters, so $\delta = 1$. This reaction function, and in particular the parameter δ, can give us information about the way debt is accumulating.

In this paper we not only test for unit roots in D_t, but also look for structural breaks in δ endogenously determined, and in the way the order of integration moves from I(1) to I(0) and back again.

As preliminary analysis we apply the Ng and Perron (2001) unit root tests to assess the order of integration of the variable for the full sample. These tests are linear, but the authors have proposed a series of modifications that can improve their size and power in short samples (see Ng and Perron, 2001, for more details).

Even with the modifications of Ng and Perron (2001), it is well known in the literature that assuming a linear model when the data generation process is nonlinear may reduce the power of the tests, meaning that the null might not be rejected in cases where it is false.[4] This has made it now customary when considering analysis of the order of integration of macrovariables to consider nonlinear models so as to account for asymmetric adjustments (see Sollis, 2009 and the references therein).

It could be argued for debt mean reversion that the speed of adjustment towards the equilibrium may actually depend on the size of the shock, implying that the speed of mean reversion is not constant. This means the authorities may choose not to act upon small deviations from the equilibrium, implying that up to a certain threshold the variable behaves as a random walk. When deviations from the equilibrium are larger though, the authorities may apply policies to restrain them, and the variable may return to its equilibrium faster. We can then see a process with a central regime where the variable's speed of mean reversion is very slow at yielding to an I(1) process, and an outer regime where the variable behaves as a stationary process, with a faster speed of mean reversion.[5]

To test the hypothesis of a unit root in a nonlinear model we apply the Kapetanios et al. (2003) (KSS) test. These authors find that the auxiliary regression to test for unit root in the nonlinear framework is based on an exponential smooth transition autoregressive (ESTAR) model such as:

$$\Delta D_t = \alpha D_{t-1} + \phi D_{t-1}(1 - \exp(-\theta D_{t-1}^2)) + \varepsilon_{2t} \tag{4}$$

where the first term of the right-hand side of the equations represents the order of integration in the central regime and the second corresponds to the outer regime. KSS assume that $\alpha = 0$ in a globally stationary process. To test for unit roots in the outer regime the null hypothesis is H_0: $\theta = 0$ against the alternative H_1: $\theta > 0$. Since some of the parameters in Eq. (4) cannot be identified, KSS propose the following first order Taylor approximation:

$$\Delta D_t = \beta D_{t-1}^3 + \varepsilon_{3t} \tag{5}$$

meaning that the test becomes H_0: $\beta = 0$ against H_1: $\beta < 0$. Eq. (5) may contain lags of the dependent variable to control for autocorrelated residuals.

By applying the Ng and Perron (2001) and KSS tests we can have an idea of the overall order of integration of the debt-to-GDP ratio. However, we are interested in analysing how China's debt accumulation may have changed over time, and for this purpose we propose the use of the Leybourne et al. (2007) (LKT) test. LKT developed a unit root test that allows us to find changes endogenously in the order of integration from I(1) to I(0) and from I(0) to I(1). The test is based on the following statistic

$$M = \inf_{\lambda\in(0,1)} \inf_{\tau\in(\lambda,1)} \mathrm{DF}_G(\lambda, \tau) \tag{6}$$

with $\lambda \in (0,1)$, $\tau \in (\lambda,1)$ and DF the Dickey-Fuller test for a generalised least square detrended series, so $\Delta D_{t-1}^d = \hat{\rho} D_{t-1}^d + \hat{\varepsilon}_t$. The results from this analysis can be very insightful since they can endogenously give the periods when the debt-to-GDP ratio behaves as a mean reverting variable and periods when it behaves as a random walk, with shocks having permanent effects.

To complement this analysis, and to gain more insights into the changes of the δ parameter showing how the Chinese government is piling up debt, we also apply the Bai and Perron (2003) method, which allows us to estimate

$$\begin{aligned} D_t = {} & \gamma_1 I(t < T_b) + \gamma_2 I(t \geq T_b) + \alpha_1 t I(t < T_b) + \alpha_2 t I(t \geq T_b) \\ & + \delta_1 I(t < T_b) D_{t-1} + \delta_2 I(t \geq T_b) D_{t-1} + \varepsilon_{4t} \end{aligned} \tag{7}$$

where I(.) is an indicator function which equals 1 when the condition in the bracket is fulfilled and 0 in other cases. This is a truncated equation that can be used to estimate the different parameters conditional on different subsamples. This allows us to assess changes in the dynamics of debt and, as Bai and Perron (2003) showed, to find the dates for the breaks endogenously. Bai and Perron (2003) propose a method for determining the number of breaks from a maximum set by the user. It is a sequential test based on an F-test for the null of no breaks against the alternative of more than zero, and so on.

Like in LKT the dates for the subsamples can be obtained endogenously, with some confidence intervals.

[3] Several news reports have quoted this research. See: http://www.china.org.cn/china/2016-06/16/content_38681734.htm

[4] We are grateful to an anonymous referee for pointing this out.

[5] See Cuestas and Mourelle (2011) and Cuestas and Regis (2013) amongst others.