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Evaluating the sovereign and household credit risk in Singapore: A contingent claims approach

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ABSTRACT

This study evaluates the credit risk of the household and government (sovereign) sectors in Singapore using the contingent claims approach (CCA). The CCA model estimates the default probability of both sectors based on the market value of the assets and liabilities of the sectors. Compared to the traditional credit rating system, this model is able to provide numerical estimates of the exposures and default probabilities. We find that from the year 2000 to 2013, variations in the credit risk measures correspond to the economic growth of Singapore. In addition, we suggest that the main factor affecting the credit risks in the government and household sectors in Singapore is the volatility of the assets held by both sectors, given that the asset-to-distress barrier ratios are relatively stable over the past 14 years for both sectors.

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1. Introduction

This study evaluates the credit risk of the household and government sectors in Singapore. Departing from the popular methodologies employed by credit rating agencies and banks, we examine the credit risk of these two sectors using the contingent claims approach (CCA) of Merton (1974). This model estimates the default probability of the sector based on the market value of the collective liabilities and assets of the sector. The advantage of this CCA model lies in its objectivity and its ability to present numerical estimates of the exposures and default probabilities, as compared to the standard letter grading system.

Singapore is a highly modernized city-state situated in South-East Asia. Currently, it is the only country in Asia to receive AAA credit rating by all three credit rating agencies (Standard and Poor's, Moody's and Fitch) owing to its strong economy and large foreign reserves. Fig. 1 shows the GDP per capita in US$ of Singapore compared with the United States and OECD member states from 2000 to 2013. We can see that the GDP per capita of Singapore has been growing at a steady pace since 2000, it has also surpassed the GDP per capita of both the US and the OECD states since 2011.

As the Singapore economy is highly dependent on trade (with a trade to GDP ratio of 383%[2]) and interlinked with the global financial industry, one can expect that the credit risk of Singapore is sensitive to the global economy, especially in times of global and regional crises. However, its credit rating has remained AAA from the major rating agencies since 2003. To examine the evolution of the country's credit risk in detail, we employ the CCA approach to provide detailed quantitative estimates about its credit risks.

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[2] Trade to GDP ratio in 2013 provided by the World Bank.

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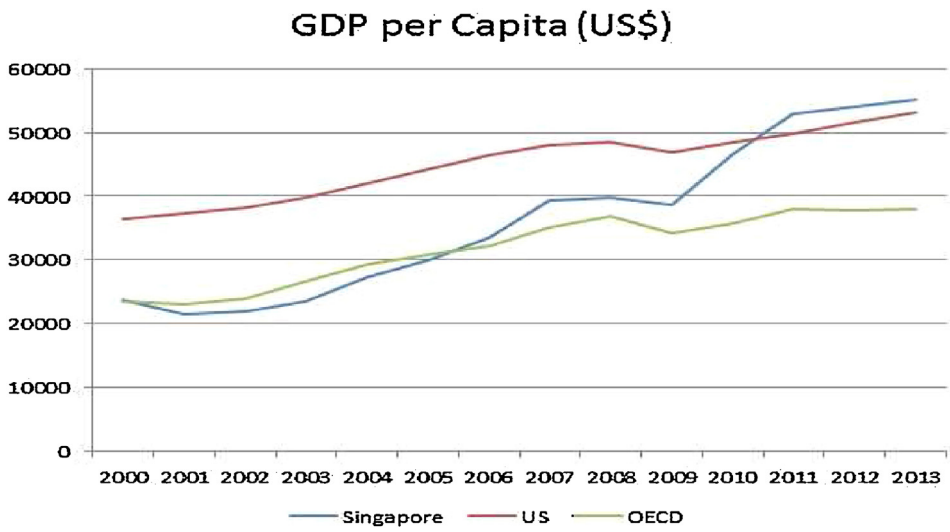

Fig. 1. GDP per capita (US$) of Singapore, United States and OECD Member States.

Source: World Bank.

Apart from the lack of quantitive details, the recent financial crisis (2007–2009) has also evoked massive criticisms on the existing way to assess credit risk.[3] In fact, similar questions have already been raised during the East Asian crisis (1997–2000)[4] and also the more recent Greek debt crisis (2010).[5] As we have learnt from these crises, a partial and judicious system to analyse credit risk is crucial not only for the borrowing entity, but also to the overall financial stability of an economy.

To date, the standard practice to assess credit risk relies heavily on the rating systems of the major credit rating agencies (Standard and Poor's, Moody's and Fitch). While this system to use credit ratings provided by these agencies are well established and widely accepted, it is also a stylized fact that the system is flawed. Reflecting on the origins of the 2007–2008 liquidity and credit crunch, Brunnermeier (2009) noted that the credit rating agencies relied on complex methodologies that are overly optimistic on projecting the default mortgage rate and delinquency rate, contributing to the subsequent subprime crisis. In addition, there is also a potential conflict of interest since the issuers, rather than users pay for the rating services. At the onset of the subprime crisis, ratings of mortgage based securities may have received better ratings because the rating agencies charged higher fees for rating these products, according to Baily et al. (2008). Lack of transparency and conflict of interest aside, the inherent subjectivity that belies the methodology used in the credit rating agencies is another source of concern in this approach.

The inherent subjectivity embedded in the usual rating methodology comes from the way credit risk is typically evaluated: using a mixture of qualitative and quantitative methods. Hence the typical approach to assess credit risk often threads the line between "art" and science. Credit risk valuation is an established notion in the corporate sector. It assesses the ability of a corporation to honour its debt obligations in order to determine the price of borrowing for the corporation. Likewise, the same notion can be extended to the non-corporate sectors, for example, the credit risks of households/consumers and sovereigns.

The common approach to assessing sovereign credit risk is akin to valuing the credit risks of corporations; sovereign credit risk is typically assessed by the three major credit rating agencies: Standard and Poor's, Moody's and Fitch. Consequently, the credit risk of the country is published as a rating, where the scale is universal to companies and countries alike. To date, credit ratings provided by the major rating companies remain the most popular way of assessing sovereign credit risk (Bhatia, 2002). The proprietary methodologies of these rating companies are typically built on a two tier approach: information drawn from the national accounts (e.g. GDP, inflation, national debt, etc.) and macroeconomic projections are first gathered and analysed. Based on the analysis, a credit rating committee will assign scores to each analytical category (e.g. political stability, economic prospects, etc). Drawing on the scores, the committee will discuss and eventually agree on the final credit rating of the country. The dependance on a credit rating committee renders this approach subjective and

[3] See Baily et al. (2008) and Brunnermeier (2009) for detailed accounts that explains the cause of the financial crisis, and the role of credit rating agencies in the origins of the crisis.

[4] Ferri et al. (1999) suggest that mis-reaction of the credit rating agencies unduly increased the borrowing costs of East Asian countries in crisis. Kaminsky and Schmukler (2002) support this view and find that credit rating agencies contribute to the financial instability in East Asia during the crisis.

[5] In their recent consultation paper, European-Commission (2010) expressed their concerns on the over-reliance on credit rating agencies and is seeking to address this issue.

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