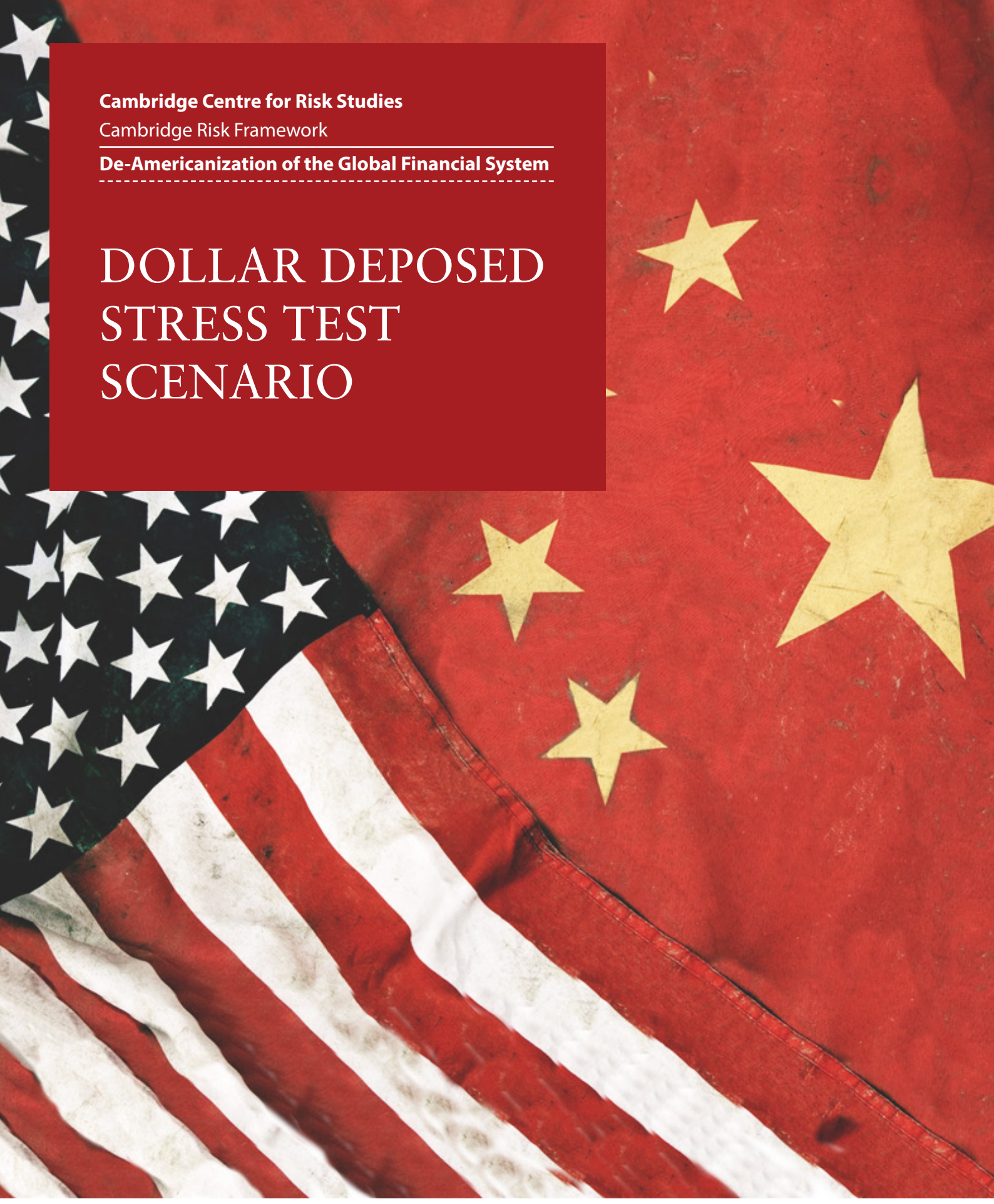

**Cambridge Centre for Risk Studies**

Cambridge Risk Framework

**De-Americanization of the Global Financial System**

# DOLLAR DEPOSED STRESS TEST SCENARIO


Centre for
**Risk Studies**

UNIVERSITY OF CAMBRIDGE
Judge Business School

**Cambridge Centre for Risk Studies**
University of Cambridge Judge Business School
Trumpington Street
Cambridge, CB2 1AG
United Kingdom
enquiries.risk@jbs.cam.ac.uk
http://www.risk.jbs.cam.ac.uk

September 2015, Review copy

In collaboration with:


## Report citation:

Ralph, D.; Coburn, A. W.; Copic, J.; Evan, T.; Kelly, S.; Nedev, E.; Ruffle, S. J.; Skelton, A.; Yeo, Z. Y.; 2015. ***Stress Test Scenario: Dollar Deposed***; Cambridge Risk Framework series; Centre for Risk Studies, University of Cambridge.

## Research Project Team

**Dollar Deposed Project Lead**
Professor Daniel Ralph, *Academic Director*

**Dollar Deposed Project Contributers**
Dr Andrew Coburn, *Director of Advisory Board*
Simon Ruffle, *Director of Technology Research and Innovation*
Dr Scott Kelly, *Senior Research Associate*
Dr Andrew Skelton, *Research Associate*
Dr Eugene Nedev, *Risk Researcher*
Jennifer Copic, *Research Assistant*
Tamara Evan, *Research Assistant and Coordinating Editor*
Jaclyn Zhiyi Yeo, *Research Assistant*

**Cambridge Centre for Risk Studies Research Team**
Dr Michelle Tuveson, *Executive Director*
Dr Olaf Bochmann, *Research Associate*
Eireann Leverett, *Senior Risk Researcher*
Dr Louise Pryor, *Senior Risk Researcher*
Dr Andrew Chaptin, *Risk Researcher*
Edward Oughton, *Risk Researcher*
Dr Ali Shaghaghi, *Risk Researcher*
Dr Duncan Needham, *Risk Affiliate*

**Consultant and Collaborators**

***Oxford Economics Ltd.***, with particular thanks to Nida Ali
***Maris Strategies***, with particular thanks to Joe DiVanna and Jay Jung
***Financial Networks Analytics Ltd.***, with particular thanks to Dr Kimmo Soramaki, *Founder and CEO*; and Dr Samantha Cook, *Chief Scientist*

This report presents a hypothetical stress test scenario developed by the Centre of Risk Studies to explore management processes for dealing with extreme external shocks. It does not predict any catastrophes.

De-Americanization of the Financial System Stress Test Scenario

# Dollar Deposed

## Contents

## De-Americanization of the Financial System Stress Test Scenario

# Dollar Deposed

# 1 Executive Summary

The rise and fall of dominant currencies, associated with trade and linked to financial and political systems, is a recurrent theme in financial history.

We describe a global real estate bubble as one our four Financial Catastrophe scenarios. Scenarios more generally can be used to cover the spectrum of extreme shocks, such as those proposed in the Cambridge Taxonomy of Threats, which encompasses five classes of business risk. A suite of scenarios is a basis for a global enterprise to stress test itself and improve its resilience.

### De-Americanization as a Financial Crisis

The rise and reign of the US dollar, signposted by the end of the Second World War, is the most recent and most complete example of how monetary hegemony functions as a stabilising force in the global economy.[1]

*From "greenback" to "redback"*

This scenario imagines a global financial shift from the US dollar to the Chinese renminbi resulting from continued, rapid and massive development of China on a track towards becoming the world's largest domestic economy.[2]

The overall impact of the changeover in monetary hegemony does not lead to a worldwide recession in any of the scenario variants. The US, however, suffers a year long recession in the first year of the shock, and an ultimate loss of 5.2%, 7.3% and 8.4% of domestic GDP across all variants. In the S1 and S2 scenarios, the overall loss, expressed as lost global Gross Domestic Product during the scenario compared with the project rate of growth ("GDP@Risk"), is between $1.9 and $1.6 trillion, respectively.

In the extreme variant, X1, however, the global GDP makes a return of $1.6 trillion above the projected non-crisis growth.

### What is the life expectancy of a global currency?

*Scenario selection*

"Global" currencies have existed as long as there has been cross-cultural trade, exemplified by the trade empires of historical Rome, Byzantium, Italy, the Netherlands, and Spain. Hegemony stability theory suggests that a dominant reserve currency with a weakening economic base is suggestive of a trade currency or reserve currency shift.[3]

The Dollar Deposed Scenario is analogous to the post-World War II replacement of the British Pound Sterling by the US dollar in that it is underpinned by economic weakness, large debt and large forces that are external to the reserve currency nation.

*Variants of the scenario*

In our 'standard' scenario, identified as S1, the size of the shock is gauged by the depreciation of the US dollar by 10 percent against the Chinese RMB, which supplants it as the new reserve currency. Scenario variant S2 increases the shock to a 25 percent depreciation of the dollar while the most severe variant, X1, considers 50 percent depreciation.

The scale of loss inflicted by the Dollar Deposed Scenario has been very roughly calibrated to correspond to an event that happens about once a century on average, a 1-in-100 year event. Two indicators that may give a sense of the likelihood of a catastrophe scenario occurring are its impact on equity returns and growth rates, which are expected to be negative in the throes of a catastrophe.

US (UK) equities over the last two hundred years have experienced return rates below -24% (-13%) about once in twenty years, with return rates below -36% (-20%) signifying 1-in-100 events.

In our scenario variants, those return rates are similar regarding the US, with return rates of -30% for S1 and -44% for S2, and less dramatic for the UK where the scenario return rates are -9% for S1 and -13% for S2. That is, these suggest that an impact at the scale of the Dollar Deposed Scenario is roughly comparable with

[1] D. Calleo (ed.), *Money and the Coming World Order*, Lehrman Institute, New York University Press, 1976

[2] KPMG, "China's 12th Five-Year Plan: Overview", 2011

[3] A. Walter, *World Power and World Money*, Prentice-Hall, 2003

1-in-100 year event. Near zero economic growth rates are found in our scenarios but these don't compare to the historical drama of US (UK) growth rates below -7% (-3%), which are 1-in-20 year events, or rates below -13% (-5%) which happens every century.

*This is a stress test, not a prediction*

This report is one of a series of stress test scenarios, produced by the Centre for Risk Studies, to explore management processes for dealing with an extreme shock. It does not predict a catastrophe.

## The unfurling scenario

*Dragon rising*

China continues to invest heavily in expanding its industrial base. For the first time, there is massive growth in infrastructure north and west of traditional economic zones exemplified by the coastal Pearl River Delta and central Chongching province.

This is accelerated by growing China's domestic bond markets as well as developing regulation and financial market infrastructure within China and in the pursuit of international markets. Politicians in China and elsewhere identify China as the "sun" around which other economies including the USA are orbiting.

*The dragon makes rain*

As China's internal economy lurches forward, resource and social stressors rise to the fore. The Chinese government responds with a frenzy of combined trade and foreign "partnership" campaigns aimed at locking in decades of foreign commodity supplies.

China's infrastructure and commodities spending spree, funded from its vast store of US treasuries, drives the value of the US dollar down and simultaneously forces the floatation of the Chinese RMB.

Shockingly quickly, the RMB supplants the US dollar as the global reserve currency.

*Coming through the storm*

The USA is hit hard as the dollar sinks and there is a global loss in confidence in the USA as a stable long-term economy. Foreign Direct Investment in the USA falls. Investors engage in a flight to quality by moving out of the US and into China, boosting China's inward Foreign Direct Investment.

Overall, the world economy suffers short term losses due to the hasty transition of global currencies but the longer term macroeconomic view is healthy due to the growth of the dynamic domestic Chinese market.

## Global GDP impact

We estimate the macroeconomic impact of this scenario by shocking the US Dollar, the Chinese RMB and interest rates and foreign direct investment levels in both the USA and China within the Global Economic Model of Oxford Economics. This yields 'GDP@Risk' which estimates the loss to the global gross domestic product over 5 years, i.e., the cumulative effect of this scenario on the global economy.

GPD@Risk, expressed in real terms in US dollars, ranges from $1.9 trillion for S1, a loss, to a global gain in the X1 variant of $1.6 trillion.

The US expectedly takes the largest plunge in GDP output losses, while the other major economies record gains or negligible impacts to their GDP, signalling that growth in the Chinese economy is ultimately beneficial globally.

These impacts are considered insignificant compared to the Great Financial Crisis whose GDP@Risk is around $20 trillion in 2015 dollars.

## Financial market impact

We estimate the portfolio impacts of this scenario by modelling the outputs from Oxford Economics' Global Economic Model into portfolio returns, projecting market changes and cash flows while keep the allocation percentages fixed. We also default all corporate bonds given the 2008 default rates.

Although, the macroeconomic shocks are applied for 5 years, this is the only scenario where we see the portfolio begin generating positive returns after the first year. The maximum downturn experienced for the Conservative portfolio in the S1 variant is -18.94% nominal occurs in Yr1Q4. The worst performing equity are the US stocks (W5000) while the best performing equities are the UK (FTSE 100). The worst performing fixed income bond is the US while German bonds perform the best. The worst performing portfolio structure is Aggressive, with a -20.06% loss for the S1 variant.

For portfolio protection it is recommended that equity and fixed income allocation is shifted away from US towards UK and Germany.

| Summary of Effects of Dollar Deposed Scenario and Variants | | | | | | |
|---|---|---|---|---|---|---|
| **Scenario Variant** | **S1** | | **S2** | | **X1** | |
| **Variant Description** | Standard Scenario | | Scenario Variant | | Extreme Variant | |
| **Bond Market Stress (US)** | 210% | | 280% | | 440% | |
| **Short-term Interest Rates (US)** | 180% | | 250% | | 310% | |
| **Dollar devaluation** | | | | | | |
| **- Against Chinese RMB** | -10% | | -25% | | -50% | |
| **- Against RoW currencies** | -2% | | -5% | | -10% | |
| | | | | | | |
| **Macroeconomic losses** | | | | | | |
| **Global recession severity** (Minimum qtrly growth rate global GDP) | 0.7% | | -0.3% | | 0.8% | |
| **Global recession duration** | No recession | | | | | |
| **GDP@Risk $Tr** (5 year loss of global output) | $1.9 Trillion | | $1.6 Trillion | | -$1.6 Trillion | |
| **GDP@Risk %** (as % of 5-year baseline GDP) | 0.5% | | 0.4% | | -0.4% | |
| | | | | | | |
| **Portfolio Impact** | | | | | | |
| **Performance at period of max downturn** | | | | | | |
| ***High Fixed Income*** | -17% | | -24% | | -31% | |
| ***Conservative*** | -19% | | -27% | | -36% | |
| ***Balanced*** | -20% | | -28% | | -37% | |
| ***Aggressive*** | -20% | | -29% | | -37% | |
| **Asset class performance** | | | | | | |
| | **Yr1Qr4** | **Yr3Qr4** | **Yr1Qr4** | **Yr3Qr4** | **Yr1Qr4** | **Yr3Qr4** |
| **US Equities (W5000), % Change** | -22% | 9% | -36% | 7% | -118% | 3% |
| **UK Equities (FTSE100), % Change** | 1% | 26% | 0% | 29% | 1% | 30% |
| **US Treasuries 2yr Notes, % Change** | -15% | -4% | -23% | -5% | -31% | -10% |
| **US Treasuries 10yr Notes, % Change** | -55% | -26% | -81% | -60% | -108% | -121% |

**Table 1: Summary impacts of the Dollar Deposed scenario**

| | | Trillion US$ GDP@Risk across scenarios | | |
|---|---|---|---|---|
| | | S1 | S2 | X1 |
|  | **Millennial Uprising**<br>Social Unrest Risk | 1.6 | 4.6 | 8.1 |
|  | **Dollar Deposed**<br>De-Americanization of the Financial System Risk | 1.9 | 1.6 | -1.6 |
|  | **Sybil Logic Bomb**<br>Cyber Catastrophe Risk | 4.5 | 7.4 | 15 |
|  | **High Inflation World**<br>Food and Oil Price Spiral Risk | 4.9 | 8 | 10.9 |
|  | **Sao Paolo Influenza Virus**<br>Pandemic Risk | 7 | 10 | 23 |
|  | **Eurozone Meltdown**<br>Sovereign Default Risk | 11.2 | 16.3 | 23.2 |
|  | **Global Property Crash**<br>Asset Bubble Collapse Risk | 13.2 | 19.6 | |
|  | **China-Japan Conflict**<br>Geopolitical War Risk | 17 | 27 | 32 |
| | **2007-12 Great Financial Crisis** | 18 | | |
| | **Great Financial Crisis at 2014** | 20 | | |

**Table 2: GDP@Risk impact of the High Inflation World scenario compared with previous Centre for Risk Studies stress test scenarios**

# 2 Financial Catastrophe Stress Test Scenarios

This scenario is an illustration of the risks posed by a plausible but extreme financial market based catastrophe. It represents just one example of such a catastrophe and is not a prediction. It is a "what-if" exercise, designed to provide a stress test for risk management purposes by institutions and investors wishing to assess how their systems would fair under extreme circumstances.

This scenario is one of a series of stress test scenarios that have been developed by the Centre for Risk Studies to explore the management processes for dealing with an extreme shock event. It is one of four financial market catastrophe scenarios being modelled under this work package and includes the following:

- Global Property Crash: Asset Bubble Collapse;
- Dollar Deposed: De-Americanisation of the Global Financial System;
- High Inflation World: Food and Oil Price Spiral;
- Eurozone Meltdown: Sovereign Default Crisis.

The scenarios present a framework for understanding how global economic and financial collapse will impact regions, sectors and businesses throughout the networked economy. These financial stress tests aim to improve organisations' operational risk management plans to form contingencies and strategies for surviving and minimising the impacts from market-based financial catastrophe. In particular, the stress tests allow institutions to manage and build resilience to different forms of risk during periods of financial stress.

These risks include:

- financial and investment risk stemming from a collapse in asset prices across different sectors and regions;
- supply chain risk and the ability of an institution to effectively manage its input requirements through its supply chain, to meet internal production and operational requirements;
- customer demand risk and knowledge for how demand might shift for goods and services during periods of low investment and consumer spending;
- market or segmentation risk and an understanding of how other firms within the same sector will react and perform during periods of financial stress and how this may impact on the business;
- reputational risk and the protection of brand image for reacting appropriately and confidently under crisis conditions;

Each individual scenario may reveal some aspects of potential vulnerability for an organisation, but they are intended to be explored as a suite in order to identify ways of improving overall resilience to surprise shocks that are complex and have multi-faceted impacts.

## Market catastrophe risk and financial contagion

The Great Financial Crisis of 2007-8 not only revealed the extent to which the global financial system is interconnected but how interrelationships between commercial banks, investment banks, central banks, corporations, governments, and households can ultimately lead to systemic instability. As global financial systems become increasingly interconnected, a shock to one part of the system has the potential to send a cascade of defaults throughout the entire network.

In 2008, it was only through government intervention in the form of extensive bailout packages that a widespread collapse of the global financial system was potentially avoided. New models of the global financial system are an essential tool for identifying and assessing potential risks and vulnerabilities that may lead to a systemic financial crisis.

The literature identifies three types of systemic risk: (i) build-up of wide-spread imbalances, (ii) exogenous aggregate shocks and (iii) contagion (Sarlin, 2013). Similarly we work with three analytical methods that help deal with decision support: (i) early-warning systems, (ii) macro stress-testing, and (iii) contagion models. All three methods are actively under research in the Centre for Risk Studies and utilised in the development of these stress test scenarios.

## Understanding financial catastrophe threats

This scenario explores the consequences of a financial market catastrophe by examining the notional 1-in-100 severity for a Dollar Deposed scenario and examining how the shock would play out.

For a process that truly assesses resilience to market catastrophe, we need to consider how different market-based catastrophes occur and then propagate these shocks through global financial and economic systems. This exercise would ideally include a thorough analysis for each different

type of market catastrophe in addition to the four financial catastrophes included in this suite of stress tests. Such an analysis would also include a range of different severities and characteristics for these scenarios would occur as a result of these different financial and economic crises.

IThe Cambridge Risk Framework attempts to categorize all potential causes of future shocks into a "universal threat taxonomy." We have reviewed more than a thousand years of history in order to identify the different causes of disruptive events, collating other disaster catalogues and categorization structures, and researching scientific conjecture and counterfactual hypotheses, combined with a final review process. The resulting Cambridge taxonomy catalogues those macro-catastrophe threats with the potential to cause damage and disruption to a modern globalised world. The report *Cambridge System Shock Risk Framework: A taxonomy of threats for macro-catastrophe risk management* (CCRS, 2014) provides a full description of the methodology and taxonomy content.

Within this universal threat framework we have developed a specified taxonomy for financial catastrophes. This can be seen in Figure 1 and includes a list of seven unique financial, market and economic catastrophes. A large economic or financial catastrophe seldom affects just one part of the system. The historical record shows that multiple market catastrophes tend to occur at the same time and impacts cascade from one crisis to the next. The recent Great Financial Crisis (GFC) is one example of this. The financial crisis started in the US as a sub-prime asset bubble but quickly spread to the banking sector where many major banks were left holding assets worth much less than had originally been estimated. The complicated nature of the various financial derivatives that were being sold made it difficult for traders to understand the true underlying value of the asset that was being purchased. This result was a systemic banking collapse that had worldwide implications that is still being played out across the globe. Throughout history there have been many other examples where multiple forms of financial catastrophe have cascaded from one form of crisis to the next, examples include the 1720 South Sea Bubble; 1825 Latin American Banking Crisis; 1873 Long Depression; 1893 Bearing Bank Crisis; 1929 Wall Street Crash and Depression; 1997 Asian Crisis and the 2008 Global Financial Crisis.

## Scenario design

Each scenario is selected as a plausible, but not probable, extreme event that is driven by a number of factors and would cause significant disruption to normal lifestyles and business activities. They are illustrative of the type of disruption that would occur within a particular category of "threat" or "peril" – i.e. a cause of disruption.

In this scenario, we explore the consequences of a "Dollar Deposed" scenario, wherein the US Dollar loses its place as the world's number one reserve currency to the Chinese renminbi. It is equally as likely that this global phenomenon could occur in a completely different fashion, or not occur at all.

The analysis is presented in two parts. The first includes estimates based on a contagion model of the banking sector and estimates aggregate loss to the stock of financial capital within the banking system. The second part assesses losses to the real economy using the OEM to estimate losses in GDP output. We have also estimated how the event would impact investment asset values, using standardized investment portfolios to show the effect on indicative aggregate returns. Investment managers could apply these asset value changes to their own portfolio structures to see how the scenario would potentially affect their holdings. The impacts of the different variants of this scenario are applied to four financial portfolios: high fixed income, conservative, balanced and aggressive.


**Figure 1: Financial catastrophe "FinCat" taxonomy**

## Developing a coherent scenario

It is a challenge to develop a scenario that is useful for a wide range of risk management applications. Fully understanding the consequences of a scenario of this type is difficult because of the complexity of the interactions and systems that it will affect. The economic, financial, and business systems that we are trying to understand in this process are likely to behave in non-intuitive ways, and exhibit surprising characteristics. During this process we try to obtain

insights into the interlinkages through using an extreme scenario.

To develop a coherent stress test we have devised a methodology for understanding the consequences of a scenario, as summarised in Figure 2. This involves sequential processing of the scenario through several stages and sub-modelling exercises, with iteration processes to align and correct assumptions.

We believe it is important to create a robust and transparent estimation process, and have tried to achieve this through a detailed process of the recorded assumptions made, and by making use of sensitivity tests regarding the relative importance of one input into another. In the macroeconomic stages of the modelling, we are conscious that we are attempting to push macroeconomic models, calibrated from normal economic behaviour, outside their comfort zone, and to use them in modelling extreme events. We have worked closely with economists to understand the useful limits of these models and to identify the boundaries of the models functionality.

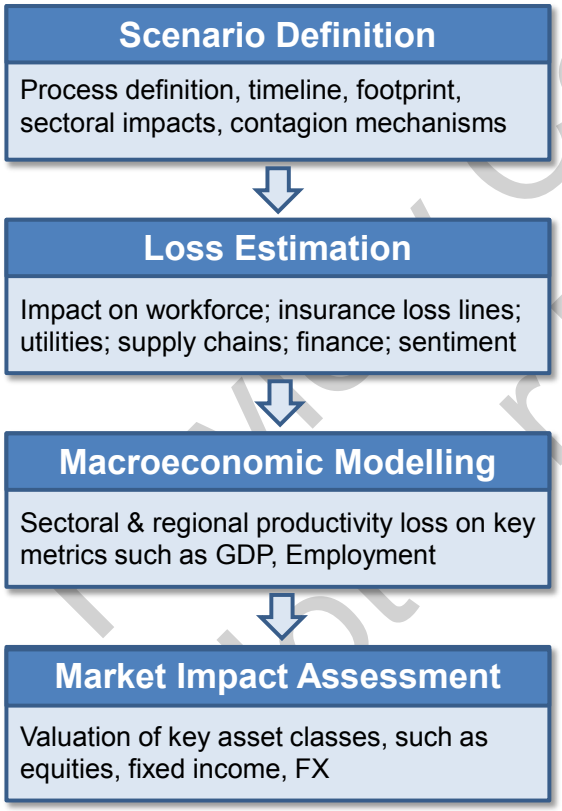


**Figure 2: Structural modelling methodology to develop a coherent stress test scenario**

## Uncertainty and precision

Overall the scenario consequence estimation process is steeped in uncertainty. The process entails making a number of assumptions to assess losses and direct impacts. These are then used as inputs within a macroeconomic model, with additional assumptions and the introduction of considerable uncertainties and variation. The outputs then feed the assessment of portfolio performance, with further assumptions and uncertainties. Linking all the components into a coherent scenario is difficult to achieve and the process described in this report is one approach that has attempted to do this. It is flawed in that the process is imprecise and one of compounded uncertainty from one stage to the next and the credibility of multiple aspects of any particular scenario can be challenged.

The point, however, of producing the scenario is to understand the consequences in terms of their holistic effects, their relative severities and the patterns of outcome that occur. In fact, the scenario is deterministic and is not designed to provide exceedance probability data points. It is very approximately selected on the basis of expert elicitation, to be in the range of the 1-in-100 annual probability of occurrence worldwide, but not rigorously determined.

The scenario production process, limited as it is, does provide interesting insights, and many of the applications of the scenario are achieved through this imperfect approach. The scenario is offered as a stress test, to challenge assumptions of continuing status quo and to enable practitioners to benchmark their risk management procedures.

## Use of the scenario by investment managers

The scenario provides a timeline and an estimation of the change of fundamental value in assets in an investment portfolio. These are segmented into broad asset classes and geographical markets to provide indicative directional movements.

These provide insights for investment managers into likely market movements that would occur if an event of this type started to play out. In real events, market movements are chaotic and difficult to analyse. This analysis suggests how the underlying fundamentals are likely to change over time, due to the macroeconomic influences.

The spread of asset class and geographical distributions enable investors to consider how different portfolio structures would perform under these conditions and how to develop strategies for portfolio management that will minimize the losses that might occur.

Where there are obvious winners and losers by economic sector, these have been highlighted to provide inputs into optimal hedging strategies and portfolio diversification structures.

This report provides performance projections for a standardized high-quality, fixed income portfolio, under passive management. This is to enable comparisons over time and between scenarios. We also estimate returns for individual asset classes to help investment managers consider how this scenario might impact their particular portfolio and to consider the intervention strategies over time that would mitigate the impact of this financial catastrophe.

## Use of the scenario by policy makers

International agencies like The World Bank, The International Monetary Fund (IMF), The Organisation for Economic Co-operation and Development (OECD) and G7-G8 Group Meetings recognise the serious global implications of market-based catastrophe. Scenario stress testing is a sensible and appropriate tool to improve the awareness and decision-making ability of policy advisors. This scenario is proposed as an addition to the existing frameworks and procedures that are already being used to understand risk and contagion in the global financial and economic systems.

National governments, central banks and other regulatory authorities like the Prudential Regulation Authority (PRA) in the UK use stress tests to determine whether banks have sufficient capital to withstand the impact of adverse economic developments. Many banks also carry out stress tests as part of their own risk management processes. Such tests are designed as an early detection system to find weak spots in the banking sector so that corrective action can be taken by regulators. These stress tests focus on a few key risks such as credit risk, market risk and liquidity risk. In many cases, banks are subject to performance reviews against classified versions of these scenarios and they are a mandatory requirement for many national regulatory authorities.

This scenario is a contribution to the design of future versions of these policy-maker scenarios. It offers a view of the economic environment and broader financial disruption that will be caused. It provides inputs into the decision making and resource planning of these authorities, and is offered as context for policy-makers concerned with stemming the impacts of market catastrophe.

## Complex risks and macroeconomic impacts

Financial and economic systems are inextricably linked. Thus, financial market catastrophes are of interest because they represent complex risks – they impact the networks of activities that underpin the global economy, disrupting the interrelationships that drive business, and cause losses in unexpected ways and places. They have multiple consequences, causing severe direct losses, as well as operational challenges to business continuity, cascading effects on the macroeconomy through trading relationships, and on the capital markets and investment portfolios that underpin the financial system.

The stress test is aimed at providing an illustration of the effects of an extreme event, to help a general audience understand the potential for events of this type to cause disruption and economic loss. It is aimed at informing risk management decisions for a number of different communities.

# 3 De-Americanization of the Global Financial System as a Financial Catastrophe

Certain currencies are held in reserve quantities by central banks and governments in order to influence domestic exchange rates and ease the payment of international loans. The practice of stockpiling reserve currencies is a by-product of an ever growing international trade economy.

An international system of monetary hegemony provides a basic "foundation of order" in the greater world economy.[4] Historical precedents indicate that functional, international economic cooperation is difficult both to achieve and sustain when there is no dominant liberal power that establishes a hierarchy of currency values. Global currencies have existed as long as cross-cultural trade. After the collapse of Rome and loss of its centralised currency, the monetary systems of the medieval and early modern period were drawn from the largest centres of trade – Byzantium, Italy, the Netherlands, and Spain. The dominant reserve currencies amongst these cities ebb and flow with a lifespan of roughly a century for many historical global currencies. Hegemony stability theory suggests that the erosion of economic health is indicative of a dominant reserve currency which can no longer uphold the system.

The global economy as it exists today is a product of the long period of fiscal continuity shared between United Kingdom and the United States and stemming from the latter years of the 19th century. Economic globalisation is, arguably, a product of reserve currency use, permitting unrelated nations to trade in fluid and convertible terms.

## Pax Americana, 1945-present

The rise and reign of the US dollar is both the most recent and most complete example of how monetary hegemony functions as a stabilising force in the global economy. American dominance in the financial system was vital to the re-establishment of international economic order following the Second World War.

Throughout the war, the United States was the industrial centre of the allied West and aggregate demand and output production remained strong during the conflict. Ultimately, the US was the only economy to benefit from the war. It emerged in 1945 with an unrivalled merchant fleet, having captured new markets and territories in the Pacific and South America and accumulated more than two-thirds of the world's gold reserves. Britain, in comparison, suffered a 25% reduction in its national wealth during the war and emerged with its shipping industry and foreign investments heavily damaged.

The central banks of recovering nations were glad to stock their vaults with US treasuries.

In his book *Money and the Coming World Order*, economist David P. Calleo states, "it is widely accepted that the United States has acted since World War Two as a kind of world central bank." The Bretton Woods system, begun in 1944, sought to establish a method of stabilising international exchange rates by basing monetary management scheme around a central, dominant US dollar.

The worldwide reliance on the gold-backed dollar led to the financial "disequilibrium" of the 1960s and 70s, revealing the currency's weaknesses and the vulnerabilities inherent in an interdependent global economy. Despite this and Richard Nixon's 1971 decision to close the gold window the US dollar remains the international global reserve currency.

## Weakness of the greenback

The monetary dominance of the United States stems from the diversity of its markets, its role as a major exporting and importing nation, and the size of its economy. As newly industrialised and diversifying rival markets emerge onto the world stage, the dollar's position is becoming contentious.

As of 2014, around 60% of the world's central bank reserves are made up of dollars. The majority of foreign trade is conducted in dollars: "dollar diplomacy" props up both legal and illegal markets in Latin America and East Asia; since the 1970s, petrodollars have been the standard currency for oil markets across the world. China, in particular, is a central player in the dollar standard's supremacy as it owns such a high proportion of US debt – in 2015, around 8% in all.

Some economic commentators feel that the global reliance upon the dollar actively puts undue burdens on the US financial system. At the risk of losing its international monetary supremacy, the US suppresses domestic demand in favour of maintaining cheap foreign trade incentives.[5]

[4] A. Walter, *World Power and World Money*, 1993, 3

[5] J. Bernstein, "Dethrone 'King Dollar'", *The New York Times*, Aug 27, 2014

*Historical Case Study*
**Pax Britannica, 1821-1914**

During the peacetime which followed the Napoleonic Wars in Europe, the convertible gold standard reigned supreme as the premiere reserve currency for most of the developed world.

From 1821 onwards until the Great War, the gold standard system grew out from British imperial territories and directed the flow of international finance directly through London for nearly a century. The outbreak of war in 1914, however, limited the movement of gold supply and belligerent nations suspended the gold standard in order to fund the conflict. The First World War shook the political foundations of the international gold standard and it never fully recovered.

After the war, gold supplies remained low as nations drained their stockpiled reserves to pay reparations and the standard failed to support economies struggling to rebuild. Many countries pegged their local currencies to the dominant Pound sterling and US Dollar, deemed stronger economic units than the fixed price of gold.

However, as the Fed keeps US interest rates down in an effort to bolster inflationary growth, the incentive for foreign banks to purchase dollars with no practical promise of return diminishes. Further weakness in the dollar and US economy aggravates shocks to oil and energy systems in international markets and ennui in the system grows. BRICs economies must buy up dollars in order to meet exchange rate objectives but, in light of the US's current zero-interest rate policy, the currency is becoming less and less of a viable investment.

## Continuation or change?

In the wake of the 2007 financial crisis, a 2009 statement from the People's Bank of China called for the replacement of the dollar with "an international reserve currency that is disconnected from individual nations and is able to remain stable in the long run."[6]

[6] Z. Xiaochuan, *Reform the International Monetary System*, statement by The People's Bank of China; 23 March 2009, 2

Ten years before, in 1999, the size, strength and stability of the European Union strongly suggested that the newly introduced Euro would ultimately overtake the US Dollar as the world's number-one reserve currency. The 2010 Greek debt crisis, however, has cast aspersions on the Euro's long-term prospects as a robust monetary system, leaving the field open for the continuation of dollar supremacy or a changeover to an entirely different, more attractive currency.

Today, it is the emerging industrialised BRICs markets pose the greatest threat to dollar hegemony. Despite its claims for a more selfless international currency scheme in 2009, it is China that is making the policy changes necessary to step into the dollar's role.

If money and power are intrinsically linked, then it seems clear that as China's economy usurps the US as the world's largest market, the RMB/yuan will gradually depose the dollar as the dominant global currency. It is not a matter of "if," but a question of "when."

Regardless, the dollar maintains its international position as a "safe haven," even in times of financial crisis. It has weathered catastrophes in the 1970s, 1980s and 2000s and yet remains robust. As of 2014, the US Dollar Index was back at a four-year high after a period of poor performance following the Great Recession. Confidence is the basis of the dollar's reign and as confidence returns with the US economic recovery, the dollar retains its position as the first mover in global finance.

While monetary hegemonies come and go, the "King Dollar" is not likely to go anywhere fast. Despite the Fed's low interest rates, at this stage, only a "cataclysmic" event would depose the dollar as the world's first currency.

# 4 Defining the scenario

The practice of using stress tests to check the health of banks and economic institutions in the wake of the Great Financial Crisis is currently a point of some contention in financial circles. While stress tests have restored confidence in some instances, they have also failed to accurately capture the risk limits of the institutions whose health they seek to diagnose. Recently, the changing economic climate makes so that the results of such stress tests have little longevity and are quickly rendered meaningless. In this period of general economic recovery there are concerns that current stress tests are either too predictable or too poorly applied and require closer re-examination.

In light of this issue, the University of Cambridge Centre for Risk Studies devised a new suite of coherent stress tests designed to reflect four potential, though improbable, global financial crises with an insight into longevity. The following scenario examines the impacts of a hypothetical transfer of the global reserve currency from the US Dollar to the Chinese renminbi over an extremely short period.

## Rise of the redback

China's 12th 5 year plan, running from 2011 to 2015, is critical to the development of China and promises to have a large impact on the global economy through trade and finance.

The plan is summarised as internal economic development underpinned by industrial development and facilitated by marked progress in China's financial markets and their regulation.[7]

One goal of the 5 year plan is for China's economy to be driven by domestic consumption rather than by exports. The plan therefore includes specific industrial development priorities, one of which is further investment in China's underdeveloped western regions. Its broader industrial priorities follow the themes of sustainable growth, particularly with reference to green energy, biotech, new materials, IT innovation and high tech manufacturing.

The internal transition of China's domestic economy will rely on ongoing progress in financial mechanisms and markets.

The stages of the RMB as an international currency are its growing strength across three dimensions: trade, investment, and reserve holdings.[8] Only the last of these is currently minor, hence the road to the RMB becoming a global reserve currency invites continual speculation. Taking its domestic economic and international financial agendas together, two of China's longer term goals are to reduce its dependence on the US economy, hence on the dollar, and simultaneously increase its global political influence.

Given that the shift away from the US dollar to the Chinese RMB would represent a global cataclysm as suggested in the previous section, this eventuality could be regarded as a trend, i.e., the domination of the RMB will emerge gradually over the next decade or three.

In the scenario to follow we suggest that there nevertheless may be a shorter term shock, i.e., in the next decade, representing a loss of confidence in the US dollar by investors as their collective consciousness registers the long-term shift.

Global investors' views on dollar-denominated instruments could be dampened or accelerated in the negative direction by China's actions as it works on the nuts and bolts of its 5 year plan, specifically[9] its development of the stock market and more ambitious plans to develop markets for bonds, monetary instruments, foreign exchange, gold, insurance, and futures and financial derivatives.

Note that the latter developments, including access to significant volumes of Chinese bonds, are expected to play an important role as reserve instruments in foreign banks.

Thus, China could take a deliberate stance to spark or speed up a sentiment-driven shift away from the US dollar, and hence toward the RMB.

## What's the likelihood?

The scenario we describe is unlikely to occur. We stress that, for a counterfactual event that has never occurred, estimating how its severity corresponds to its return period is problematic. Historical changes in dominant reserve currency have happened naturally and as a by-product of changing international and economic fortunes. There has never been a planned

[7] KPMG, "China's 12th Five-Year Plan: Overview", KPMG Advisory (China) Ltd, March 2011

[8] HSBC, "RMB Internationalisation: RMB going global", August 2013

[9] The 12th Five-year Plan for the Development and Reform of the Financial Industry, Peoples Bank of China

or purposeful changeover in the order of monetary hegemony as is reflected in this scenario.

In the past five years, China has repeatedly confirmed that it views US Treasury bonds as a key component of its national reserves and a useful tool in the making of its financial policies.[10] With the increased globalisation of the international economy, the two countries have grown more interdependent in their plans for ongoing expansion.

## Scenario variants

We have introduced a set of variants to the scenario to provide sensitivity analysis and so as to gain a better understanding of the greater effects of the dollar deposed scenario.

**Standard scenario S1** represents a best estimate of what a dollar deposed scenario might mean to the United States and the global economy. The dollar depreciates two percent with respect to the rest of the world, and depreciates 10 percent against the Chinese RMB, which supplants it as the new reserve currency. **Scenario variant S2** increases the shock to the dollar depreciation to five and 25 percent respectively, while **extreme variant X1**, which is the most severe variant considered in this impact analysis, further depreciating the dollar by 10 and 50 percent respectively.



[10] "China is seeking more exposure for the renminbi", *The Economist*, Global Forecasting Service, May 18 2011

# 5 The Scenario

## Phase one: Trouble brewing for the US dollar

The general economic weakness in the US is exacerbated by the one bright spot in the US domestic economy, namely the emergence of abundant and cheap natural gas via fracking. This energy production boom effectively relaxes the link between US manufacturing and the global oil economy, pushing the US balance of trade in a positive direction and reducing the global liquidity of the dollar.

Simultaneously China has continued to grow in international trade, inward and outward investment, and the governance and market prerequisites for floating the RMB.

Continuing the growth trend set in the last 5 years we now have:[1]

- 200+ countries doing RMB business in a typical month
- 100 countries with RMB capabilities
- 50 territories with swap / settlement agreements
- 6 offshore RMB centres

With an aim to make good on its promises for increased internal consumption, China begins a domestic industrial investment plan starting with developments in the northern and western parts of the country. These endeavours tap into China's unused economic potential by engaging its rural, traditionally farm-based, citizens in the massive development of infrastructure, funded partly by developing domestic bond markets; business development there is predicted to follow. Politicians in China and elsewhere, egged on by some economic historians, identify China as the "centre of the economic solar system", the "sun" around which other economies including the USA are orbiting "planets".

## Phase two: trigger for dumping the dollar

As China's internal economy grows, resource and social stressors rise to the fore. The Chinese government responds with a frenzy of combined trade and foreign "partnership" campaigns aimed at locking in decades of foreign commodity supplies. China's infrastructure and commodities spending spree, funded from its vast store of US treasuries, drives the value of the US dollar down and simultaneously forces the floatation of the Chinese RMB, causing a de facto "dump" of US bonds.

[1] C. Ho, "Overview of RMB Internationalisation", HSBC, 8 May 2013, Slide 6

Very quickly, the RMB gains credibility as a global reserve currency, greater pressure is put on the US dollar, fueling perceptions of unsustainability of US long-term debt as a stable investment and leading to questions over the sovereign-risk rating of the US.

Private ratings agencies such as Egan-Jones Rating Co. have been questioning for some months whether a ratings "correction" for the USA is on the horizon. A virtual stampede is kicked off when Moody's reduces the country's rating from AA+ to AA- in what becomes known as its US Double Whammy following its 2011 downgrading of the USA from AAA (outstanding) to AA+. This is also a double downgrade in that it skips the AA rating that lies between AA+ and AA-.

This downgrading signals what some smaller ratings agencies and fund managers and financial pundits have been forecasting: the dollar is taking a plunge. Panic ensues as private and institutional investors dump the $US denominated assets, with the exchange rate of the dollar dropping markedly against most currencies and taking a violent hammering relative to the RMB.

## Phase three: the rise and rise of the RMB

The global economic effects of the downgrading of the USA develop predictably and increasingly quickly. Although the dollar is cheaper than ever and the RMB is correspondingly at a historical high, the smart money favour growth prospects in China. US interest rate rises as the world loses faith in the dollar and Foreign Direct Investment in the USA drops relative to China, in spite of US manufacturing continuing to improve in its competitiveness, due to the loss in confidence in the USA as a stable long-term economy and the evident growth prospects in China.

The US quickly falls into a recession which lasts four fiscal quarters as the dollar exchange rate plummets relative to the RMB. Investors engage in a flight to quality by moving out of the US and into China, boosting the inward Foreign Direct Investment and China's domestic interest rates fall as the RMB becomes more expensive globally.

Overall, the global economy suffers short term losses due to the rapid transition between reserve currencies. Long-term outlook, however, is positive, due to the dynamic growth of China's central markets.

# 6 Macroeconomic Analysis

## Economic impacts of dollar deposed

The dollar deposed scenario occurs when the dollar value declines to the extent where its reputation collapses and no longer serves as the dominant reserve currency. When the dollar's standing collapses, the value falls at such a rate that bond holders panic and rush to sell at any cost.

There is no historical example of a changeover in monetary hegemony which mirrors the situation proposed in the dollar deposed scenario exactly but a study of the rise of the dollar over the pound sterling in the early 20th century bears some key similarities. With reference to this historical precedent, we identified several conditions that must be in place for a reserve currency to be replaced.[1]

First, there must be an underlying economic weakness in the host country of the reserve currency, such as the two World Wars which savaged the British economy from 1914-1945. Next, there must be a viable and reliable alternative currency to substitute the weakening reserve stocks which, after a final trigger, begins to attract wider global attention.

During the first and second World Wars, when the British borrowed heavily in order to subsidise the war effort, the United States transited from a net debtor to net creditor of the United Kingdom. Further, the US economy had surpassed the British economy in size by the early 1900s (Chinn and Frankel, 2008). At the time, the dollar was the only currency which retained its convertibility into gold under the Bretton Woods Systems, which allowed it to become the accepted international currency for trade and finance.

During the 1900s "Pound Dethrone" scenario, the trigger was the outbreak of war. Though the pound retained its dominance in the years that followed the war, this was largely due to economic inertia coming off the back of victory. The replacement of the dominant reserve currency has always been a massive and gradual process, requiring the shared resolution of the global economy.

As seen with sterling, the fall from a position of dominance in the world financial system is not to fall into disuse, but the place of Britain's currency has followed a similar trajectory to the country itself. The historical pattern suggests that new reserve currencies rise on the backs of strong economies, just as incumbent reserves decline with the loss of economic and military dominance of its related nation.

[1] Amadeo, Kimberley, "US Dollar Collapse: Causes, Impact, and When It Would Happen," 14 January 2014

## Macroeconomic consequences of dollar deposed

In the dollar deposed scenario high interest rates and weak investment sentiments could dampen domestic economic growth and worsen unemployment rates in the US. Although US exports will be relatively cheaper and this may provide a brief boost to its economy, import prices will be driven up and lower the purchasing power of the general public. On the global stage, any political or economic influence that the American policy-makers currently enjoy will diminish significantly. Moreover, the initial triggering shock might send the entire global economy into turmoil due to the high uncertainties regarding the future outlook. Nonetheless, these economic shocks and impacts may be transitional; the market could stabilize or even outperform its original growth projection as soon as the new currency gains trust and confidence in the global economy.

## Oxford Economics Global Economic Model

We use the Oxford Economics Global Economic Model (GEM), a quarterly-linked international econometric model, to examine how the global economy reacts to the various dollar deposed variants. The model contains a detailed database with historical values of many economic variables and equations that describe the systemic interactions among the most important 47 economies of the world. Forecasts are updated monthly for the 5-year, 10-year and 25-year projections. These models are suitable to analyse the impacts of future policy changes, especially in our case of catastrophe modelling, shocks to the respective major economies from an exogenous source.

### *Assumptions and uncertainty*

The economic estimates presented in this analysis are subject to the assumptions imposed during the narrative development and how the scenario unfolds over time. The modelling and analysis completed are also subject to several sources of uncertainty. A best attempt has been made to ensure the macroeconomic interpretation of the narrative is justified on historical grounds and follows sound macroeconomic theory and principles. However, the unusual and unprecedented nature of this particular catastrophe introduces several layers of uncertainty in final model outputs that cannot be completely ruled out.

## Macroeconomic modelling of the scenario

To model the effects of a dollar deposed scenario, we shock the global economic model through an assumption where the dollar depreciates substantially against the rest of the currencies. The greatest devaluation is assumed against the Chinese renminbi (RMB) as the latter becomes the preferred and default reserve currency for major trading partners. This collapse of the dollar is triggered by a widespread sell off of US-assets by irrational investors at a loss, when the dollar declines at a rate faster than expected.

This sudden trigger directly impacts stresses in the US bond markets and increases the US short-term lending rates, amidst the depreciation of the dollar especially against the RMB, as well as other currencies around the world.

## Variable Descriptions

The scenario includes three independent variants, modelled using the Oxford Economic GEM, to provide sensitivity analysis around the assumptions made. The following table summarises the key input variables applied to the respective scenario variants (Table 1).

| S/N | Input Variable | Scenario Variants | | | Max. Shock duration applied |
|---|---|---|---|---|---|
| | | S1 | S2 | X1 | |
| 1 | Bond Market Stress | | | | |
| | United States | 5% | 8% | 12% | 4 Qtrs |
| 2 | Short-term Interest Rate | | | | |
| | United States | 4% | 6% | 8% | 4 Qtrs |
| 3 | Currency Exchange Rate^ | | | | |
| | China | 10% | 25% | 50% | 5 yrs |
| | Other countries# | 2% | 5% | 10% | 5 yrs |

^ *Exchange rates against the dollar*

# *Other countries include: The Eurozone, the United Kingdom, Japan, Australia, Indonesia, South Africa, Argentina, Brazil, Malaysia, Thailand, Philippines, Singapore, South Korea, Taiwan, Hong Kong, Canada, Chile, Russia, and India.*

**Table 3: Overview of key input variables to the respective scenario variants**

## Results

### *Impact on regional inflation rates*

Figure 3 compares the mean inflation rates across the variants for the selected countries, with the baseline depicting the corresponding inflation without the Dollar Deposed scenario. Healthy inflation (at 2%) is observed in most parts of the world except for China, where the rate of inflation falls incrementally across all scenario variants. One major contribution to this sharp deflation is primarily due to the sharp appreciation of the currency: the RMB appreciates between 10 and 50% such that it impacts international trades significantly.

The dollar depreciates drastically against the RMB compared to other currencies as exports become more expensive and imports cheaper. This leads to a decrease in China's domestic Aggregate Demand (AD) and an increase its budget deficit. This is similarly reflected in the lower economic growth data, where China's GDP growth rate shrinks by more than 10%, from 5.3 to -6%, in the extreme X1 variant.

### *Impact on interest rates*

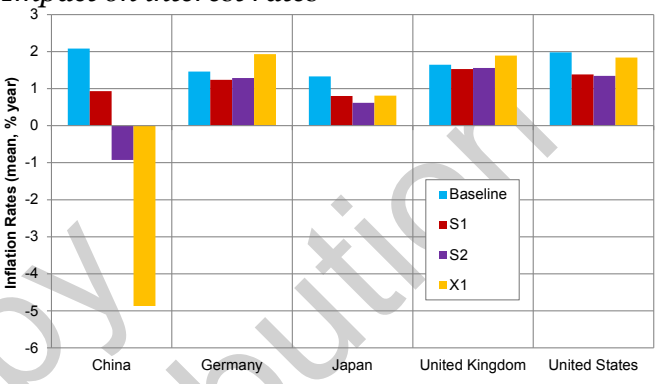


**Figure 3: Average inflation rates (% year) comparison**

Figure 4 compares the short-term interest rates of some observing countries. In the scenario, China's interest rates are consistently lower across all variants, while the remaining countries show an upward trend. This observation is consistent with the inflation rates: China's deflationary outlook pushes its central bank to lower interest rates in order to stimulate its domestic economy, following a sharp appreciation of the Chinese RMB. Furthermore, the depreciated dollar leads to increased US interest rates in attempt by the Federal Bank to attract demand.

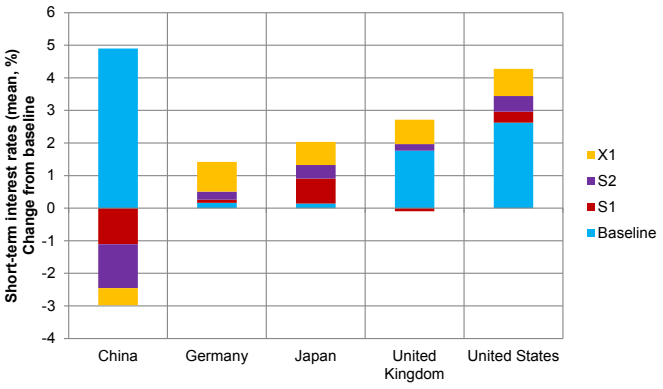


**Figure 4: Average short-term interest rates (%) comparison, change from baseline**

The long-term interest rates, as shown in Figure 5, increase across the variants of the observing countries. The sharpest rise in the long-term US interest rate is primarily due to the long-term uncertainty outlook in

the economy, as the Chinese RMB replaces the dollar as the reserve currency. The long-term rates are higher than their corresponding short-term rates to compensate for the additional risks associated with future outlook. China shows a consistent decrease in long-term interest rates across variants, a reflection of relatively weaker market sentiments toward the shock.

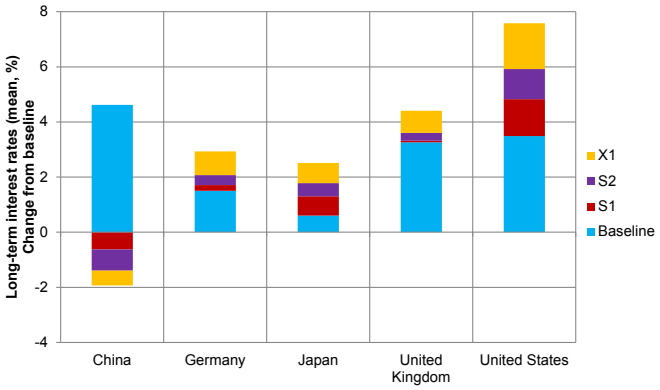


**Figure 5: Average long-term interest rates (%) comparison, change from baseline**

### *Impact on country credit ratings and government debts*

Credit rating is the evaluation of a country's credit worthiness of the foreign currency debt which is often assessed by the country's ability to repay the debt and the likelihood of default. While credit ratings are not based on mathematical equations, they rely heavily on credit rating agencies' judgement and experience, taking reference from market indicators.

Table 4 shows the respective credit ratings of the selected countries affected in various severity of a dollar deposed scenario. All countries maintain their respective credit ratings in the standard variant from the baseline condition, without the Dollar Deposed scenario occurring, indicating credit ratings are inelastic to slight dollar depreciation. In the extreme variant X1, both China and the US decrease their credit ratings, indicating a drop in confidence levels amongst investors.

The incremental government debt, measured as a percent of the country's GDP, is greatest impacted in the US economy (Figure 6). Other countries experience negligible incremental government debt, with Japan measuring slightly more than proportional due to the substantially large baseline debt to begin with.

As the dollar value falls, together with investment confidence and business sentiments, the affected government potentially intervenes through expansionary fiscal policy by increasing government expenditure and cutting tax. One implication of the

| Location | Minimum Credit Rating | | | |
|---|---|---|---|---|
| | Baseline | S1 | S2 | X1 |
| China | AA | AA | AA | BBB |
| Germany | AAA | AAA | AAA | AAA |
| Japan | AA | BBB | BBB | BBB |
| United Kingdom | AAA | AAA | AAA | AAA |
| United States | AAA | AAA | AA | AA |

**Table 4: Credit ratings comparison across affected countries and regions**

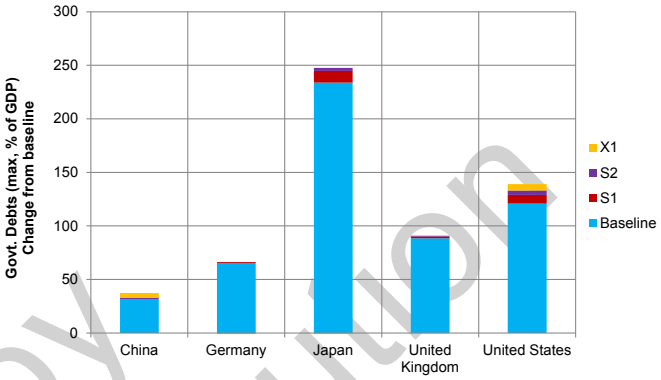


**Figure 6: Maximum government debts (% of GDP) comparison, change from baseline**

higher government debt increases the debt held by public and other intergovernmental holdings. In 2012, approximately half of the US public debt was owned by foreign investors, especially China and Japan. In this scenario, the incremental US debt fuels greater ownership by other countries, and does not present a positive outlook, especially for the future US economy.

### *Impact on GDP growth rates*

Table 5 represents the minimum GDP growth rates (quarter-on-quarter) across the affected regions. As is expected, the US suffers the greatest loss across the scenario variants, while China nosedives into the red in the extreme variant, an effect of its currency appreciation of more than 50%.

In general, with the dollar depose scenario, the US experiences a recession across the scenario variants, while China experiences it only in the extreme variant. Nonetheless, despite falling into a negative growth rate, no global recession is developed under this dollar deposed scenario.

## GDP@Risk

The macroeconomic consequences of this scenario are modelled, using the Oxford GEM. The output from the model is a five-year projection for the world economy. The impacts of the scenario are compared with the baseline projection of the global

| Location | Minimum GDP Growth Rate (% Qtr) | | | | Worst recession duration (Qtr) | Recession scenario variant(s) |
|---|---|---|---|---|---|---|
| | Baseline | S1 | S2 | X1 | | |
| China | 5.3 | 3.5 | 0.5 | -6.0 | 2 Qtrs | X1 |
| Germany | 1.0 | 0.9 | 0.8 | 0.3 | N/A | |
| Japan | -1.2 | -1.4 | -1.4 | -1.2 | 2 Qtrs | S2 |
| UK | 2.2 | 1.5 | 1.3 | 1.0 | N/A | |
| US | 2.7 | -2.5 | -4.6 | -5.7 | 4 Qtrs | S1, S2, X1 |
| World | 2.7 | 0.7 | -0.3 | -0.8 | N/A | |

**Table 5: Impact on GDP growth rates in the course of the Dollar Deposed scenario variants**

| Location | 5-yr GDP (US$ Trillion) | S1 | | S2 | | X1 | |
|---|---|---|---|---|---|---|---|
| | | GDP@Risk (US$ Trillion) | GDP@Risk (%) | GDP@Risk (US$ Trillion) | GDP@Risk (%) | GDP@Risk (US$ Trillion) | GDP@Risk (%) |
| China | 48.4 | -0.4 | -0.8% | -0.9 | -1.8% | -1.5 | -3.1% |
| Germany | 19.1 | 0.0 | 0.1% | 0.0 | -0.2% | -0.2 | -1.1% |
| Japan | 29.3 | 0.2 | 0.8% | 0.2 | 0.6% | -0.2 | -0.8% |
| UK | 14.0 | 0.0 | 0.1% | 0.0 | 0.0% | -0.1 | -0.8% |
| US | 88.9 | 1.5 | 1.7% | 2.1 | 2.4% | 2.3 | 2.6% |
| World | 395.0 | 1.9 | 0.5% | 1.6 | 0.4% | -1.6 | -0.4% |

**Table 6: Country-specific and global GDP@Risk values for the three scenario variants**

economy under the condition of no crisis occurring. The difference in economic output over the five-year period between the baseline and each model variant represents the GDP@Risk.

The primary figure representing the impact of this catastrophe is the GDP@Risk metric, which represents the total difference in GDP between the baseline projections and the scenario-specified projections. The total GDP loss over five years, beginning in the first quarter of Year 1 during which the shock of the dollar deposed is applied and sustained through to the last quarter of Year 5 (Y5Q4), defines the GDP@Risk for this scenario. This is expressed as a percentage of the total GDP projection for the five years without the crisis occurring. Figure 7 illustrates the dip in global GDP that is modelled to occur as a result of the scenario, in all its variants.

Table 6 provides the GDP loss of each of the variants of the scenario, both as the total lost economic output over five years, and as the GDP@Risk.

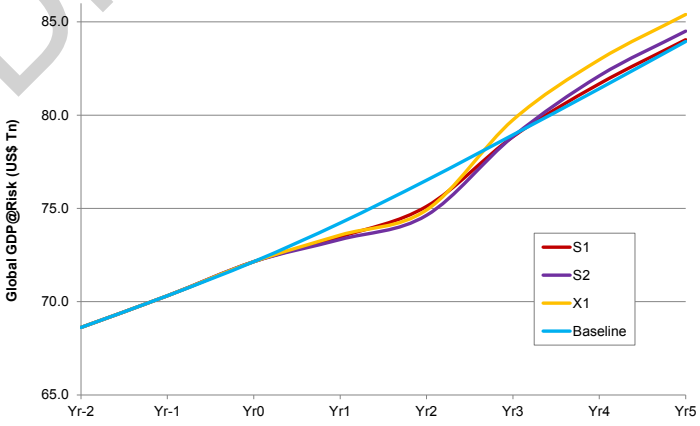


**Figure 7: Estimated loss in global output as a result of the De-Americanization scenario variants**

## Economic conclusions

In this analysis, we have shown that a scenario wherein the dollar is unseated at the global reserve currency of choice does not necessary result in long-term adverse impacts to major countries and the global economy. The sudden trigger of a dollar collapse and a switch to another reserve currency would constitute an intense and widespread shock to confidence levels, which in turn would initially reduce spending or investment at first as people become generally more cautious about the global economic outlook.

While the US expectedly suffers the largest drop in GDP output, other major economies show either a gain or negligible changes to their GDP output. For example, China shows a $1.5 trillion increase in its projected GDP output in the extreme variant, where the dollar depreciates by up to 50% to the RMB.

Further, this scenario does not result in a global recession. In fact, in the extreme variant, the global economy is estimated to grow by almost $2 trillion. After the initial shock applied in the scenario, the global economy begins to recover in the second year. It is observed in the extreme variant X1, GDP recovers fully and beyond where it would have been without the shock occurring within the 5-year model duration, although the total output loss incurred during the transition period is permanently lost.

# 7 Impact on Investment Portfolio

## Introduction

The macroeconomic effects of the Dollar Deposed scenario will have an inevitable effect on the capital markets. This section considers the market impact of the scenario and the consequence for investors in the capital markets.

The performance of bonds, alternatives and equities in different markets are estimated from the macroeconomic outputs, and compared with a baseline projection of their expected performance that would result from the economic projection without the scenario occurring.

## Valuation fundamentals

Note that this is an estimate of how the fundamentals of asset values are likely to change as a result of these market conditions, as directional indication of valuation. This analysis is not a prediction of daily market behaviour and does not take into account the wide variations and volatility that can occur to asset values due to trading fluctuations, sentiment and the mechanisms of the market.

## Passive investor assumption

A fundamental assumption we make in our analysis is that of considering a passive investment strategy. This assumption is unrealistic, as we expect an asset manager to react to changing market conditions in order to reduce losses and large fluctuations in returns. It is however a useful exercise to consider what would happen to a fixed portfolio, in particular because this represents a benchmark against which to compare the performance of dynamic strategies. Understanding what drives the behaviour of the fixed portfolio at different times gives useful insight towards the design of an optimal investment strategy.

## A standardized investment portfolio

We access the performance of four typical high quality investment portfolios under the Dollar Deposed scenario. We built a fictional representative portfolio that mimics features observed in the investment strategies of insurance companies, titled High Fixed Income Portfolio and three others that mimic the investment strategies of pension funds titled Conservative, Balanced and Aggressive. For example the Conservative Portfolio structure has 55% of investments in sovereign and corporate bonds, of which 95% are rated A or higher (investment grade). Residential Mortgage Backed Securities (RMBS) make up 5 % of the Conservative Portfolio structure.

Investments are spread across the US, UK, Germany and Japan. Equities compose 40% of the Conservative Portfolio. We will assume for simplicity that equity investments correspond to investments in stock indexes. The Wilshire 5000 Index (W5000) , FTSE 100 (FTSE), DAX (DAX) and Nikkei 225 (N225) stocks are used to represent equity investments in the US, UK, Eurozone and Japan, respectively. We assume a maturity of 10 years for long-term bonds, while short-term bonds have a maturity of 2 years in each country.

Details of the High Fixed Income Portfolio are shown on the following page in Table 7, Figure 8, Figure 9 and Figure 10.

Details of the Conservative Portfolio are shown on the following page in Table 8, Figure 11, Figure 12 and Figure 13.

Details of the Balanced Portfolio are shown on the following page in Table 9, Figure 14, Figure 15 and Figure 16.

Details of the Aggressive Income Portfolio are shown on the following page in Table 10, Figure 17, Figure 18 and Figure 19.

## High Fixed Income portfolio structure

| | USD | GBP | Euro | Yen | Total |
|---|---|---|---|---|---|
| Government 2 yr | 8% | 6% | 5% | 3% | 22% |
| Government 10 yr | 8% | 7% | 6% | 2% | 23% |
| Corp. Bonds 2yr | 4% | 4% | 4% | 2% | 14% |
| Corp. Bonds 10yr | 6% | 7% | 3% | 2% | 18% |
| RMBS 2 yr | 2% | 1% | 1% | 1% | 5% |
| RMBS 10 yr | 1% | 1% | 1% | 1% | 4% |
| Equities | 2% | 3% | 3% | 2% | 10% |
| Cash | 4% | 0% | 0% | 0% | 4% |
| Total | 35% | 29% | 23% | 13% | 100% |

Table 7: Composition of the High Fixed Income Portfolio Structure

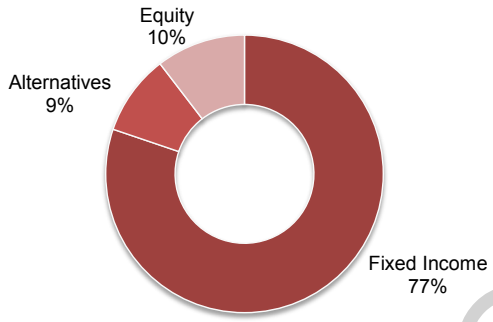


Figure 8: Asset classes in High Fixed Income Portfolio Structure

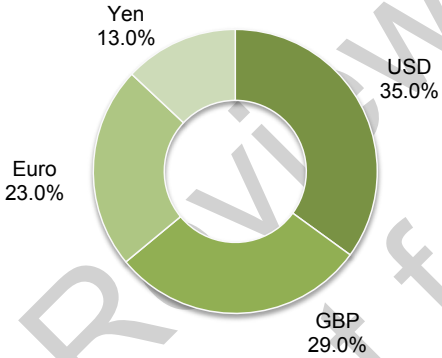


Figure 9: Geographic market spread of High Fixed Income Portfolio Structure

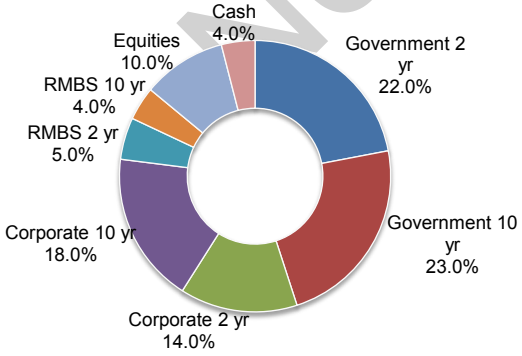


Figure 10: Detailed asset class breakdown of High Fixed Income Portfolio Structure

## Conservative portfolio structure

| | USD | GBP | Euro | Yen | Total |
|---|---|---|---|---|---|
| Government 2 yr | 4% | 3% | 3% | 0% | 10% |
| Government 10 yr | 3% | 3% | 3% | 1% | 10% |
| Corp. Bonds 2yr | 6% | 5% | 5% | 1.5% | 17.5% |
| Corp. Bonds 10yr | 6% | 5% | 5% | 1.5% | 17.5% |
| RMBS 2 yr | 1.5% | 0.5% | 0.5% | 0% | 2.5% |
| RMBS 10 yr | 1.5% | 0.5% | 0.5% | 0% | 2.5% |
| Equities | 19% | 8% | 8% | 5% | 40% |
| Cash | 0% | 0% | 0% | 0% | 0% |
| Total | 41% | 25% | 25% | 9% | 100% |

Table 8: Composition of the Conservative Portfolio Structure

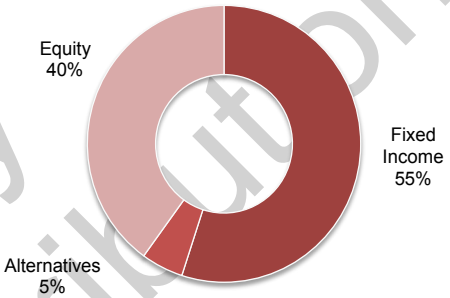


Figure 11: Asset classes in Conservative Portfolio Structure

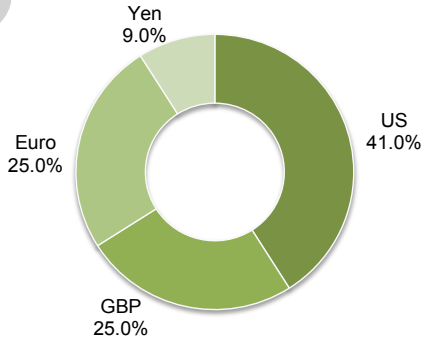


Figure 12: GeographicmarketspreadofConservative Portfolio Structure

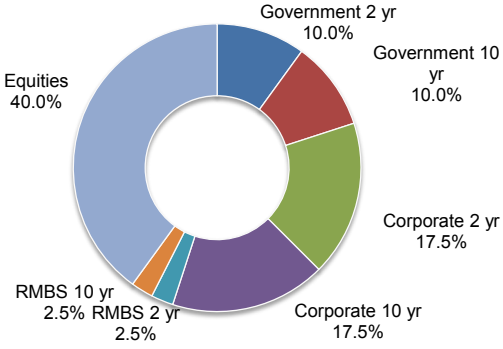


Figure 13: Detailed asset class breakdown of the Conservative Portfolio Structure

## Balanced portfolio structure

| | USD | GBP | Euro | Yen | Total |
|---|---|---|---|---|---|
| Government 2 yr | 3% | 2% | 2% | 1% | 8% |
| Government 10 yr | 3% | 3% | 3% | 1% | 10% |
| Corp. Bonds 2yr | 4% | 3.5% | 3.5% | 2% | 13% |
| Corp. Bonds 10yr | 4% | 2.5% | 2.5% | 0% | 9% |
| RMBS 2 yr | 2.5% | 1% | 1% | 0.5% | 5% |
| RMBS 10 yr | 2.5% | 1% | 1% | 0.5% | 5% |
| Equities | 25% | 10% | 10% | 5% | 50% |
| Cash | 0% | 0% | 0% | 0% | 0% |
| Total | 44% | 23% | 23% | 10% | 100% |

Table 9: Composition of the Balanced Portfolio Structure

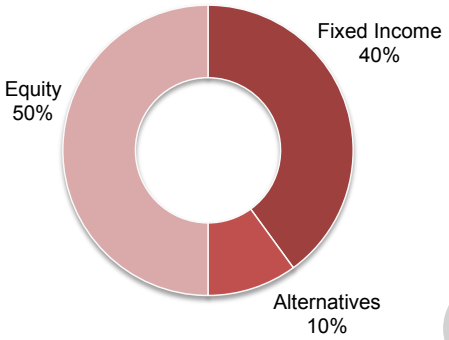


Figure 14: Asset classes in Balanced Portfolio Structure

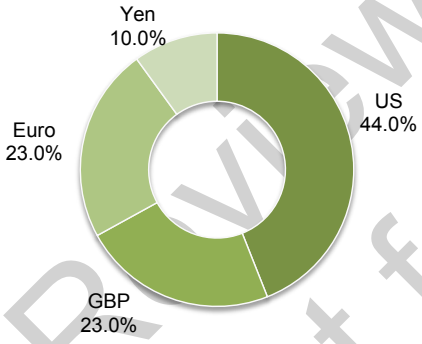


Figure 15: Geographic market spread of Balanced Portfolio Structure

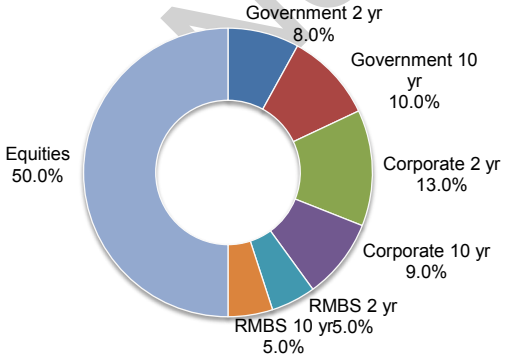


Figure 16: Detailed asset class breakdown of Balanced Portfolio Structure

## Aggressive portfolio structure

| | USD | GBP | Euro | Yen | Total |
|---|---|---|---|---|---|
| Government 2 yr | 1.5% | 1% | 1% | 0.5% | 4% |
| Government 10 yr | 1.5% | 1% | 1% | 0.5% | 4% |
| Corp. Bonds 2yr | 3% | 2.5% | 2.5% | 0.5% | 8.5% |
| Corp. Bonds 10yr | 3% | 2.5% | 2.5% | 0.5% | 8.5% |
| RMBS 2 yr | 3% | 2% | 2% | 0.5% | 7.5% |
| RMBS 10 yr | 3% | 2% | 2% | 0.5% | 7.5% |
| Equities | 30% | 12% | 12% | 6% | 60% |
| Cash | 0% | 0% | 0% | 0% | 0% |
| Total | 45% | 23% | 23% | 9% | 100% |

Table 10: Composition of the Aggressive Portfolio Structure

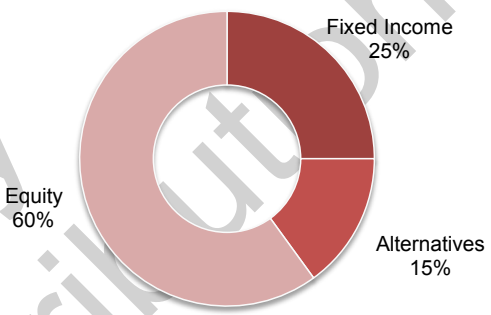


Figure 17: Asset classes in Aggressive Portfolio Structure

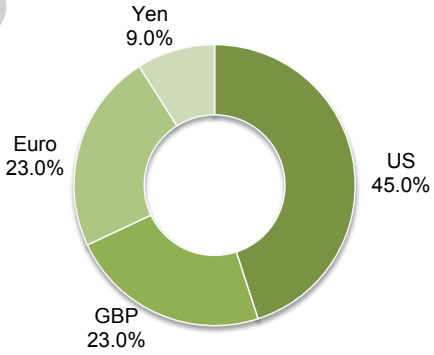


Figure 18: Geographic market spread of Aggressive Portfolio Structure

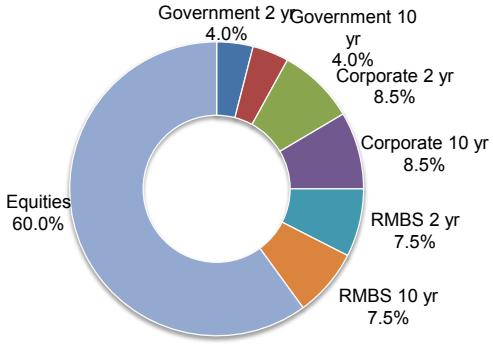


Figure 19: Detailed asset class breakdown of Aggressive Portfolio Structure

## Computation of returns

The estimation of portfolio returns is carried out using the following method.

Market price changes or Mark to Market (MtM) are calculated for all government bonds using equation (1) and for corporate bonds and RMBS using equation (2).

(1) $\Delta MtM_{Gov,t} = (D_b)(-\Delta I/100)$

(2) $\Delta MtM_{Corp,t} = (D_b)(-\Delta I/100) + (SD_b)(-\Delta CS/100)$

Where $D_b$ is the bond duration, for which we assumed the following values: $D_b$ =7 for ten years bonds and $D_b$ =1.8 for two years bonds. $SD_b$ represents the spread duration. The change in interest rates, $\Delta I$ on government and corporate bonds and the change in credit spreads, $\Delta CS$ are taken from the output of the macroeconomic analysis discussed in the previous chapter.

Government bond yields are estimated using a representative quarterly yield. While corporate yields are estimated using a representative quarterly yield and the period averaged credit spread.

Defaults on corporate bonds are accounted for through the introduction of a discount factor in the calculations. The 2008 volume-weight corporate default rates from Moody's are shown in Table 11.[1]

The actual corporate bond default rates used were calculated as the weighted average of default rates by credit rating and geographic regions.

| Bond Credit Rating | Corporate |
|---|---|
| AAA | 0.000% |
| AA | 0.816% |
| A | 2.370% |
| BBB | 1.108% |
| BB | 8.097% |
| B | 1.287% |
| CCC | 11.019% |

**Table 11: Annual default probabilities for corporate bonds**

Equities market prices are calculated using the change in equity value from the macroeconomic modelling. The equity dividends are estimated using a representative quarterly yield.

Exchange rate affects are taken into to account to ensure that all reported portfolio returns are with respect to US dollars.

[1] Annual Default Study; Corporate Default and Recovery Rates, 1920-2013. Moody's Investor Services. February 28, 2014.

## Portfolio returns

Results of our analysis are presented in Figure 20, Figure 21, Figure 22 and Figure 23.

Figure 20 shows the scenario impacts by variant for the Conservative portfolio structure. In all variants we observe a significant departure from the baseline (blue line) projections. For the Dollar Deposed scenario the economic shocks were applied over a five year period starting in Yr1Q1. After three years, we see the S1 variant begin to recover, while the S2 variant has not recovered. The maximum downturn experienced for the Conservative portfolio in the S1 variant is -19% nominal occurs in Yr1Q4.

Figure 21 shows the scenario variant impacts by portfolio structure. For the Dollar Deposed scenario, we see the aggressive portfolio structure underperform compared with the other structures. This implies that investments in heavy equity portfolios will yield the worst returns.

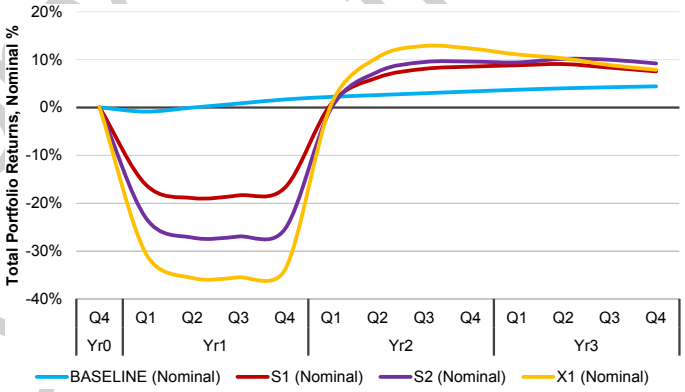


**Figure 20: Dollar Deposed scenario impact by variant, Conservative Portfolio (nominal %)**

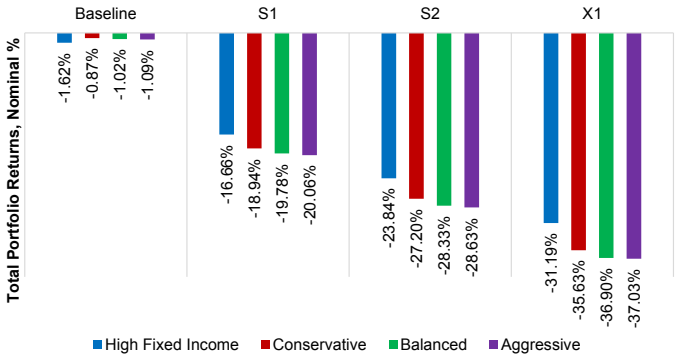


**Figure 21: Dollar Deposed scenario max downturn by portfolio structures (nominal %)**

Figure 22 shows market impacts on equity performance by geography for the least extreme variant, S1. Although, all the stocks are performing poorly in the first year, the US (W5000) stock is impacted the most, followed by the Japanese stocks. All the stock indexes start generating positive returns after the first year.

Figure 23 shows the market impact on fixed income performance by geography for the most least variant, S1. Over the three year analysis window, US Fixed Income is impacted the most, yeilding the largest negative returns. The largest negative impact to a single equity asset is almost 30%, while on average the shocks to equities is over 10% in the first year. After the first year all equities are generating positive returns. For fixed income, the shocks are greater than 35% for the US and 20% for the Japan, but no bigger than 5% for Germany and the UK. This confirms the finding that a high equity portfolio performs better than a high fixed income structure.

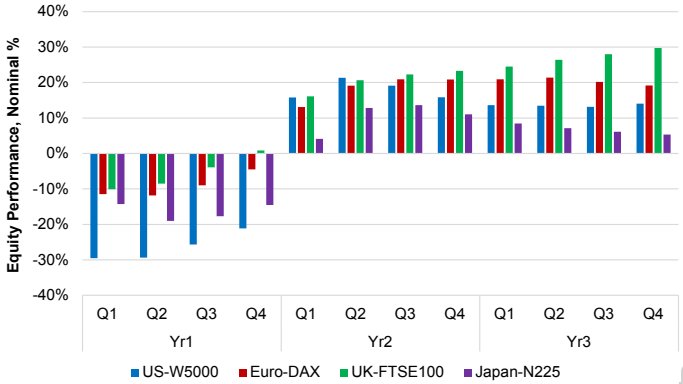


**Figure 22: Dollar Deposed equity performance by geography in nominal % for S1**

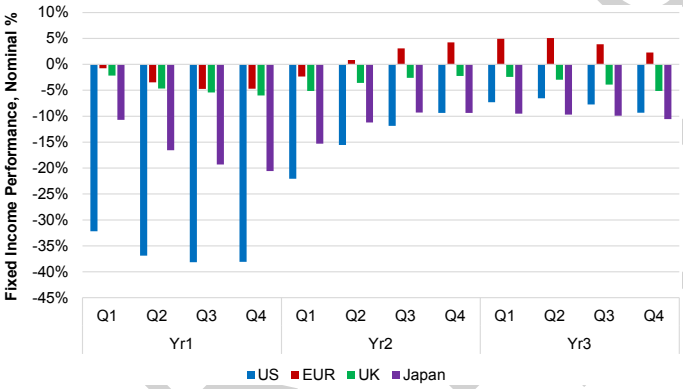


**Figure 23: Dollar Deposed High Fixed Income performance by geography in nominal % for S1**

## Correlation Structure

A new market analytics tool called Financial Network Analytics (FNA) is used to monitor market dynamics for each scenario. A daily correlation map was created for a pre-scenario and post-scenario view, see Figure 24 and Figure 25.

Assets in the Conservative portfolio are shown as nodes and the correlations are shown as links. Shorter links represent strong correlations. The size of the nodes represent asset returns in relation to the portfolio, the larger the node the larger the return. Nodes that are coloured red represent a negative correlation and thus negative asset returns.

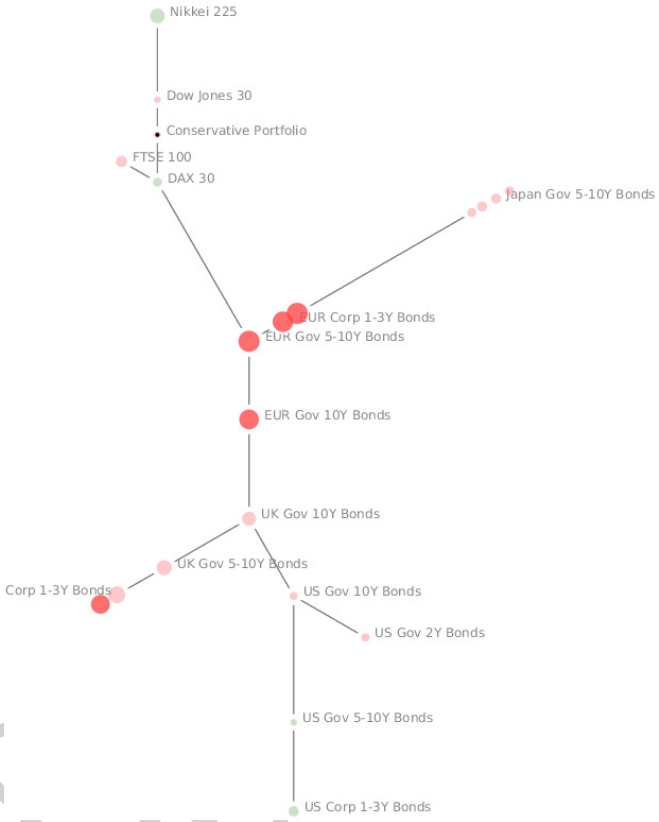


**Figure 24: Conservative Portfolio before stress test**

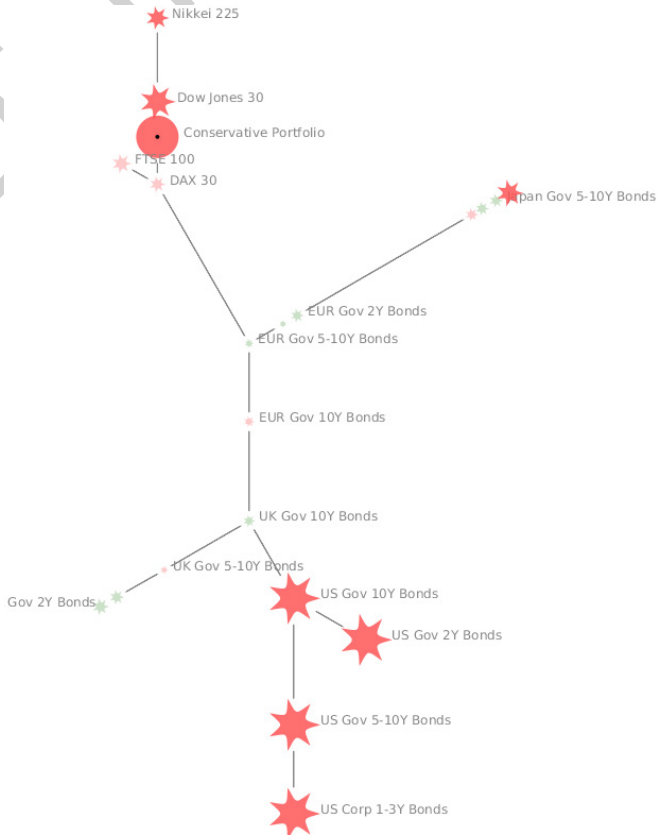


**Figure 25: Conservative Portfolio after X1 stress test at Yr1Q1**

## Summary of investment portfolio analysis

In this part of the scenario analysis we have taken the output from the macroeconomic model and used it as an input to assess the performance of the four different portfolio structures.

We have estimated the performance of the portfolio under the different variants of the Dollar Deposed scenario and compared it with the business as usual performance or baseline. The Aggressive portfolio structure performs the worst in this scenario, with a loss of -20% in the least extreme variant, S1. Table 12 summarises the max downturn by portfolio structure and scenario variant.

The analysis presented in this section assumes a passive investment strategy. Nonetheless, it represents a useful benchmark to compare more asset management strategies. In particular, it can be used to discuss strategies that improve portfolio performance on a counterfactual basis under the scenario.

An important issue that we have not addressed in our analysis is that of systematically testing the stability of the results with respect to the parameter settings used in the earlier stages of the scenario development. This is to a certain degree taken into account given that we considered different variants of the scenario, but a more systematic analysis will be needed in this respect.

| | Baseline | S1 | S2 | X1 |
|---|---|---|---|---|
| High Fixed Income | -2% | -17% | -24% | -31% |
| Conservative | -1% | -19% | -27% | -36% |
| Balanced | -1% | -20% | -28% | -37% |
| Aggressive | -1% | -20% | -29% | -37% |

**Table 12: Summary of portfolio performance (max downturn) by structure and scenario variant, nominal %.**

| REAL USD PERCENTAGE VALUES | | Baseline Yr1Q4 | Short-Term Impact at Yr1Q4 | | | Baseline Yr3Q4 | Long-Term Impact at Yr3Q4 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | S1 | S2 | X1 | | S1 | S2 | X1 |
| **US** | | | | | | | | | |
| Gov Bonds Short | 2 yr | -1% | -15% | -23% | -31% | -6% | -4% | -5% | -10% |
| Gov Bonds Long | 10 yr | -1% | -55% | -81% | -108% | -9% | -26% | -60% | -121% |
| Corp Bonds Short | 2 yr | 0% | -19% | -30% | -42% | -2% | 7% | 9% | 7% |
| Corp Bonds Long | 10 yr | 1% | -66% | -93% | -118% | -4% | -29% | -80% | -170% |
| RMBS Short | 2 yr | 0% | -19% | -30% | -42% | -2% | 8% | 11% | 8% |
| RMBS Long | 10 yr | 0% | -66% | -93% | -118% | -6% | -29% | -80% | -170% |
| Equities | W5000 | 8% | -22% | -36% | -49% | 15% | 9% | 7% | 3% |
| **UK** | | | | | | | | | |
| Gov Bonds Short | 2 yr | -5% | -4% | -1% | 3% | -9% | -7% | -4% | -2.2% |
| Gov Bonds Long | 10 yr | -6% | -8% | -9% | -7% | -13% | -10% | -9% | -13.9% |
| Corp Bonds Short | 2 yr | -4% | -3% | -1% | 3% | -8% | -6% | -4% | -2.0% |
| Corp Bonds Long | 10 yr | -5% | -8% | -8% | -6% | -11% | -9% | -8% | -12.8% |
| RMBS Short | 2 yr | -5% | -3% | -1% | 4% | -8% | -5% | -2% | -1% |
| RMBS Long | 10 yr | -6% | -8% | -8% | -6% | -12% | -9% | -8% | -13% |
| Equities | FTSE100 | 5% | 1% | 0% | 1% | 24% | 26% | 29% | 30% |
| **EU (Germany)** | | | | | | | | | |
| Gov Bonds Short | 2 yr | 0% | -5% | -2% | 3% | -2% | -9% | -6% | -2% |
| Gov Bonds Long | 10 yr | 0% | -17% | -20% | -22% | -7% | -12% | -10% | -17% |
| Corp Bonds Short | 2 yr | 2% | -4% | 0% | 5% | 2% | -6% | -3% | 0% |
| Corp Bonds Long | 10 yr | 3% | -15% | -18% | -20% | -1% | -8% | -6% | -14% |
| RMBS Short | 2 yr | -5% | -3% | 0% | 5% | -8% | -5% | -2% | 1% |
| RMBS Long | 10 yr | -5% | -15% | -18% | -20% | -12% | -8% | -6% | -13% |
| Equities | DAX | 3% | -5% | -7% | -8% | 12% | 16% | 22% | 23% |
| **Japan** | | | | | | | | | |
| Gov Bonds Short | 2 yr | -9% | -13% | -13% | -11% | -18% | -12% | -9% | -4% |
| Gov Bonds Long | 10 yr | -8% | -30% | -38% | -45% | -20% | -13% | -12% | -13% |
| Corp Bonds Short | 2 yr | -9% | -13% | -14% | -12% | -18% | -13% | -10% | -5% |
| Corp Bonds Long | 10 yr | -8% | -30% | -38% | -45% | -20% | -13% | -12% | -14% |
| RMBS Short | 2 yr | -9% | -13% | -13% | -11% | -16% | -13% | -9% | -5% |
| RMBS Long | 10 yr | -8% | -30% | -38% | -45% | -17% | -13% | -12% | -13% |
| Equities | N225 | -2% | -16% | -21% | -24% | -5% | 2% | 8% | 12% |

**Table 13: High Inflation World summary of asset class performance by variant and geography, in real %.**

# 8 Mitigation and Conclusions

In the Dollar Deposed Scenario the USA and China suffer in the short term. This would seem obvious for the USA whose currency and credit ratings both drop precipitously, and well as losing foreign direct investment which flies to China and emerging markets. At the same time the dramatic appreciation of the renminbi leads to deflation in China, further slowing economic its growth, in the most extreme X1 version of the scenario, resulting in a deep depression. Other regions are not badly effected economically beyond the short term turmoil inflicted on the global economy by a shift of this magnitude.

For the less severe scenario variants, the global economy recovers strongly and reasonably quickly with growing value in equities resuming after a year or so. Fixed income instruments are depressed over a long period however, predictably with US bonds taking the most severe and longest duration losses. Japanese bonds are also badly affected over several years.

To mitigate or reduce the impact of the Dollar Deposed Scenario would require an ability to withstand a sizeable shock, extending months to years depending on the performance measure, and potentially the depth to take advantage of shifting fortunes, e.g., a buy-and-hold approach to low-valued US equities in the wake of the US dollar crash. European markets will provide some financial stability and ultimately the transition to the Renminbi will provide for greater economic growth and business profitability. This scenario also reinforces the age-old message diversification of economic activities and financial market investments will offer some protection against catastrophes.

Signs of a shift from the US dollar to the Chinese Yuan are already apparent though whether or when such a shift would happen is impossible to predict. The next and arguably last significant foundation of a potential shift to the Chinese Yuan would be the massive development of, and international access to, China's domestic financial markets. Since a shift of this nature would be so shocking, if not viewed as completely heretical, even warning signs that are strong, persistent and accelerating are not likely to be acted on in a significant way until there is an avalanche of currency exchange and related trades that herald the arrival of the catastrophic event.

Such early warning signals can be monitored in real time but acting on these signals poses a risk in itself, since moving too early can be as damaging as moving too late. This is a reminder of why warning signs are inputs to what are only palliative or damage mitigation tools rather than complete solutions. Indeed we advocate that recognition of catastrophic events entails recognition of substantial losses, especially in the short term.

Stress tests such as the Dollar Deposed Scenario balance magnitude of impact and likelihood of that impact, and facilitate questions such as, "Is my organisation able to withstand a one-in-one hundred year catastrophe?" and "What would I do to improve the resilience of my organisation to such a shock?"

# 9 Bibliography


Amadeo, Kimberley, "US Dollar Collapse: Causes, Impact, and When It Would Happen," 14 January 2014 [Online] http://useconomy.about.com/od/criticalssues/p/dollar_collapse.htm

Bernstein, Jared, "Dethrone 'King Dollar'", *The New York Times*, Aug 27, 2014 [Online] www.nytimes.com/2014/08/28/opinion/dethrone-king-dollar.html

"China is seeking more exposure for the renminbi", *The Economist,* Global Forecasting Service, May 18 2011 [Online] https://gfs.eiu.com/Article.aspx?articleType=er&articleId=1778107562&secId=4

Ho, Candi, "Overview of RMB Internationalisation", HSBC, 8 May 2013 [Online] https://www.hsbc.com.tr/eng/corporate_sme_banking/business-withchina/_pdf/RMB_Internatinoalisation_Turkey_Corp_v2.pdf

HSBC, "RMB Internationalisation: RMB going global", August 2013 [Online] http://www.law.harvard.edu/programs/about/pifs/symposia/china/2013-china/rmbchicagohsbc--apratim-chakravarty.pdf

Kindleberger, Charles and Lewlis Lehrman, *Money and the Coming World Order*, (ed.) David Calleo, Lehrman Institute, New York University Press (1976)

KPMG, "China's 12th Five-Year Plan: Overview", KPMG Advisory (China) Ltd, March 2011; [Online] https://www.kpmg.com/cn/en/IssuesAndInsights/ArticlesPublications/Documents/China-12th-Five-Year-Plan-Overview-201104.pdf

The People's Bank of China, "The 12th Five-year Plan for the Development and Reform of the Financial Industry", [Online] http://www.csrc.gov.cn/pub/csrc_en/newsfacts/release/201210/W020121010631355001488.pdf

Walter, Andrew, *World Power and World Money: The Role of Hegemony and International Money Order,* Harvester Wheatsheaf, (1993)

Xiaochuan, Zhou (Governor of the People's Bank of China), *Reform the International Monetary System*, statement by the People's Bank of China; 23 March 2009 [Online] www.bis.org/review/r090402c

**Cambridge Centre for Risk Studies**
Cambridge Judge Business School
University of Cambridge
Trumpington Street
Cambridge
CB2 1AG

T: +44 (0) 1223 768386
F: +44 (0) 1223 339701
enquiries.risk@jbs.cam.ac.uk
www.risk.jbs.cam.ac.uk

Join our LinkedIn group at Cambridge Centre for Risk Studies

Follow us @Risk_Cambridge