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Geographical diversification with a World Volatility Index

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ABSTRACT

This paper proposes a new 'World Volatility Index', coined WVIX, by constructing the first index that approximates the aggregate volatility level of the G20 countries. The empirical analysis makes use of the factor dynamic conditional correlation model – with an automated methodology to detect the number of factors – in order to (i) sum up the information contained in the implied volatility indexes belonging to the US, the UK, the Eurozone, Japan and emerging countries, and (ii) examine the time-varying correlation between them. The results reveal that the WVIX evolves around 22%, but its activity can vary sharply depending on its exposure to various sources of geographical risks (e.g. the latest 2010–2011 European debt crisis). Thus constructed as an early warning device, the methodology behind the WVIX can be replicated by market practitioners to datasets that better suit their needs.

1. Introduction

The world economy has successively experienced the 2008 subprime crisis and the 2010–2011 European debt crisis, where even the emerging markets have been facing negative externalities (Warnes and Warnes, 2014). 'World risk' refers to the fact of investing in a defined economic area,

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where the risk is dependent on changes in the international macroeconomics and business environment affecting any financial market (Kenourgios and Padhi, 2012).

Computing an aggregate volatility index at the world level allows constructing a macro-financial benchmark that is not limited to financial markets, but encapsulates both financial markets and the real economy. Two important papers discuss recently this central issue. First, Bekaert et al. (2013) relate monetary policy to the VIX index as it strongly co-moves with measures of the monetary policy stance. In clear, the VIX does not reflect a risk limited to the stock market, as stocks are influenced by the Central Bank's policy. Hence, the implied volatility measure goes beyond financial markets, and reflects to a certain extent macro-financial stress. Second, Rey (2013) notes impressive co-movement in gross flows and discuss how they are related to global factors that she approximates by the VIX. Actually she notes the existence of an important common factor in international asset prices, which she believes, is also related to the VIX. Overall, Rey (2013) ranks the U.S. implied volatility index as the most influential variable among global macro-finance indicators. This is an important support for creating a real World Volatility Index that encompasses the VIX.

The objective of this paper is to provide an investor with a World Volatility Index to protect a financial investment exposed to geographical diversification. The motivation is to construct a World Volatility Index that encapsulates the main sources of volatility risks affecting the G20 economies, accounting for more than 80% of the world economy. In our setting, we consider the US, the UK, the Eurozone, Japan and emerging markets as proxies of the G20.

In the financial literature, the focus has been mainly centered at the country level by dealing with risk analyses and hedging (for a more theoretical discussion see Eaton (1986), and more generally see Saini (1984), Cosset (1992), Oetzel et al. (2001), Hassan et al. (2003), Andrade (2009) and recently Agliardi et al. (2012). Based on a dynamic mixed copula approach, Peng and Ng (2012) analyze the cross-market dependence between five popular equity indices (S&P 500, NASDAQ 100, DAX 30, FTSE 100, and Nikkei 225), and their corresponding volatility indices (VIX, VXN, VDAX, VFTSE, and VXJ). Unfortunately, no previous study has documented a strategy for hedging directly the aggregate volatility risk at the world level. Therefore, this study proposal of an aggregate volatility index is important because it provides an investor with a unique hedging instrument to mitigate, if not cancel, the world risk.

Nevertheless, performing this idea is not trivial for three reasons. First, a problem lies in determining the correct correlation function that captures precisely the time-varying nature of market data Guidolin and Hyde (2008), Gupta and Donleavy (2009). Second, the choice of the proper methodology to estimate loading factors from market data can be daunting. Third, there is a concern about the arbitrary choice of the number of factors to synthetize market information Lam and Yao (2012).

This paper reconciliates all three concerns by following and enriching the factor dynamic conditional correlation model (Factor-DCC) by Zhang and Chan (2009). This model dramatically simplifies the estimation process by estimating the correlation function on a small number of factors, instead of multiple pairwise DCCs. Factor methods arise from the need for economists to follow several time-series as proxies for the state of the economy. Thus, it appears necessary to gather as much information as possible from as many variables as possible.

To that end, factor models have been developed to extract the information in datasets with many variables while, at the same time, keeping the model parsimonious (see Stock and Watson (2005, 2006) for a survey). However, as Zhang and Chan (2009) allow an arbitrary choice of factors that enters the computation of the Factor-DCC model, we complement their methodology by implementing an optimal criterion that reduces this number of factors. This automated approach avoids any subjective interpretation likely to induce any kind of statistical bias.

The central contribution is to propose an empirical methodology (that combines the Factor-DCC methodology with an automated factors detection) in order to create a world-volatility index, coined WVIX, which serves for hedging the country risk at an aggregate level. The dataset includes five subgroups of implied volatility indexes from the CBOE. Jiang et al. (2012) have previously worked with international implied volatility indices at a daily frequency to study volatility spillovers between US and European markets, as well as within European markets. Kenourgios (2014) has investigated as well volatility contagion across markets using asymmetric conditional correlation dynamics. To our