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On the use of singular spectrum analysis for forecasting U.S. trade before, during and after the 2008 recession

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ABSTRACT

This paper is aimed at introducing the powerful, nonparametric time series analysis and forecasting technique of Singular Spectrum Analysis (SSA) for trade forecasting via an application which evaluates the impact of the 2008 recession on U.S. trade forecasting models. This research is felicitous given the magnitude of the structural break visible in the U.S. trade series following the 2008 economic crisis. Structural breaks resulting from such recessions might affect conclusions from traditional unit root tests and forecasting models which make use of these tests. As such, it is prudent to evaluate the sensitivity and reliability of parametric, historical trade forecasting models in comparison to the relatively modern, nonparametric models. In doing so, we introduce the SSA technique for trade forecasting and perform exhaustive statistical tests on the data for normality, stationarity and change points, and the forecasting results for statistical significance prior to reaching the well-founded conclusion that SSA is less sensitive to the impact of recessions on U.S. trade, in comparison to an optimised ARIMA model, Exponential Smoothing and Neural Network models. Ergo, we conclude that SSA is able to provide more accurate forecasts for U.S. trade in the face of recessions, and is therefore presented as an apt alternative for U.S. trade forecasting before, during and after a future recession.

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1. Introduction

Globalisation continues to augment the importance of international trade towards the smooth functioning of any given economy. In a highly interconnected world, international trade has a direct impact not only on the economic growth of trading partners, but also on the determination of exchange rates. For these reasons, and given the prevailing economic conditions around the globe, trade analysis remains a hot topic and we believe that it is opportune to analyse the effectiveness of trade forecasting models amidst the impact of recessions such as the 2008 financial crisis which appears to have left a major break in the U.S. trade series.

This study is motivated by the challenge of introducing and ascertaining the effectiveness of Singular Spectrum Analysis (SSA) for trade forecasting before, during and after recessions in comparison to other widely used trade forecasting models. To achieve this objective, we consider the United States (U.S.) imports and exports series. The choice of the U.S. economy was influenced to a lesser extent by the U.S.' continuing stance as a global economic superpower, and to a greater extent by the history of trading patterns in the U.S., and most importantly the impact of the 2008 recession which created a major structural break in the U.S. trade series (see Fig. 1). Structural breaks of such major magnitude are likely to have adverse impacts on forecasting models. In fact, a closer look at Fig. 1 enables us to identify a second structural break of a comparatively smaller magnitude caused by the 2001 recession, further justifying the selection of U.S. trade series for this research.

Krugman and Baldwin (1987) asserts that the U.S. was a net exporter in the 1950s and the 1960s. Since then, the U.S. trade position has deteriorated continuously. The United States Census Bureau indicates that the most recent U.S. trade surplus was recorded in the year 1970. Krugman and Baldwin (1987), through their exemplary work, identified the major strain imposed by persistent trade deficits on U.S. economic policy along with an in-depth analysis of the continuous trade deficits. Interestingly, 40 decades following the 1970 trade surplus the U.S. continues to experience prolonged and persistent trade deficits (as verified by the Trade data published online at the U.S. Department of Commerce and the U.S. Census Bureau). Accordingly, it is not surprising that trade analysis and forecasting continues to remain a core concern for policy makers.

Over the years a variety of forecasting models have been evaluated for trade forecasting. A concise report on trade forecasting models which have been utilised up until the late 1970s and their limitations can be found in Coccari (1978). In the past, as it is today, statisticians, academics, analysts and policy makers have constantly endeavoured to obtain the most accurate trade forecasts possible, so as to enable finalisation of crucial policy decisions which can aid in lucrative resource allocations. This ongoing effort to improve the accuracy of trade forecasts has resulted in the rapid development of trade forecasting models over time. Initially, such models were restricted to basic, linear, parametric

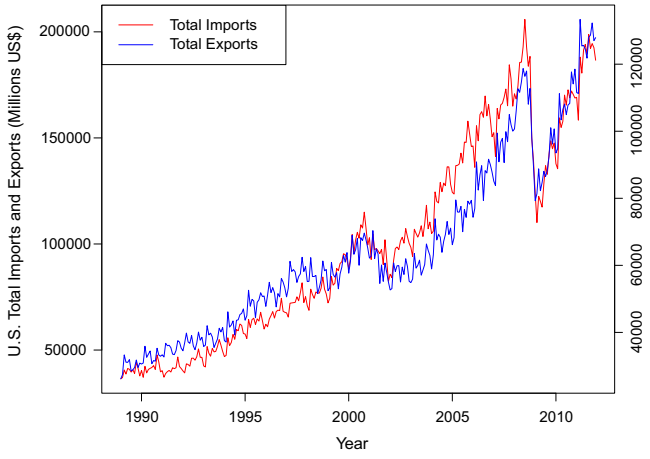

Fig. 1. U.S. imports and exports series (1989–2011). Data source: ⟨http://www.bea.gov/international/index.htm⟩.