"COMMON FACTORS" AND COINTEGRATION OF JAPAN'S AGGREGATE IMPORT DEMAND FUNCTION: AN EMPIRICAL STUDY

BY

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Addendum

p175-7 & p178-80 Tables 7.1 & 7.2: Comment: The study uses quarterly, biannual and annual data with 152, 76 and 38 observations, respectively. The statistical inference is based on the *p*-values of the Johansen tests (calculated from MacKinnon-Haug-Michelis) which are more accurate than any previously published versions. Generally speaking, the small sample bias of cointegration refers to situations where the test fails to reject the null hypothesis of non-cointegration. This concern has been taken into account by considering the 10% level of significance. In response to the examiner's suggestion I have calculated the critical values corrected for small sample with the Reinsel and Ahn (1988) formula. The results of this recalculation support my original findings (and are available on request). The same full rank is observed for specifications (8), (11), (20), (23), (11') & (20')."

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ABSTRACT

It is well documented in the literature that Japan's aggregate demand for imported goods and services is determined by income and relative price of imports. However, the findings based on cointegration methods are mixed and to some extent conflicting. The aim of this study is to examine the influence of a set of "common factors" on the empirical evidence of the long-run behavior of import demand relationship, and to identify whether any of the "common factors" are responsible for the ambiguous results reported in the literature. Three major candidate "common factors" have been empirically identified from the relevant literature and the data obtained from previous studies for Japan. These are data frequency, the choice of domestic activity variable and the cointegration testing method. The sample period of the present investigation covers nearly four decades, extending from 1970 to 2007.

The empirical results demonstrate that the three "common factors" do *simultaneously* explain the divergent findings of cointegratedness of Japan's aggregate import demand function as well as the differences in the long-run elasticity estimates. The study yields some empirical support for the conclusion that the testing technique is the main factor that explains the divergence in cointegration findings for Japan's import demand relation. Generally speaking, the existing empirical studies of long-run aggregate import demand have indiscriminately employed the standard empirical specifications, the latest cointegration tests and the updated data available.

The significance of this study derives from the fact that the cointegration findings for Japan's aggregate import demand function convey useful information to policy-makers for formulating Japan's trade policies. More explicitly, the long-run responses of imports of goods and services to their macroeconomic determinants (real income and relative price) support the view that fiscal policy and exchange rate policy would be effective in influencing Japan's external imbalances.

On the other hand, the open economy macro equilibrium perspective shows that the financial sector (financial factors) also plays a role in determining the aggregate demand for imports. Aggregate import demand functions derived from this general equilibrium model are supported by positive cointegration findings from Japan's data. The cointegratedness of the general equilibrium equations as well as the estimated elasticities of domestic activity and relative price are also influenced by the "common factors" and their interactions.

DECLARATION

I hereby declare that this thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

This thesis includes eight chapters. The core theme of the thesis is the cointegration analysis of the aggregate import demand function for Japan. The ideas, development and writing up of all the chapters in the thesis were the principal responsibility of me, the candidate, working within the Department of Economics under the supervision of Dietrich K. Fausten, Russell L. Smyth and Ergun Dogan.

Signed:

Date: July 2, 2012

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CHAPTER 1

INTRODUCTION

1.1 Overview

Empirical investigations of Japan's import demand behaviour have revealed an 'import demand puzzle'. The puzzle derives from the ambiguous and often conflicting cointegration findings produced by empirical studies. This puzzle is important and worthy of study because empirical identification of the cointegration properties of long-run aggregate import demand functions conveys theoretical understanding of the responses of aggregate imports to their determinants. This knowledge assists policymakers in formulating appropriate trade and exchange rate policies, especially to rectify trade account imbalances.

The aggregate demand behaviour for imports of goods and services has been one of the most intensively researched areas in the field of international economics (Santos-Paulino, 2002). Indeed, Japan has been widely used in both group and individual country studies of aggregate demand behaviour for imports, and in investigations of the policy implications based on empirical analysis. The prominence of Japan in group country studies reflects the fact that Japan is a prominent industrial country and a member of the Organisation for Economic Co-operation and Development (OECD). As such she plays a potentially important role in cross-country comparisons. Japan is one of a few exceptional industrialized countries that have frequently intervened in foreign exchange markets over the past decade (Nagayasu, 2004). Another reason for studying

Japan's long-run aggregate import demand relation is the persistent surplus on her trade balance (Hamori & Matsubayashi, 2001).

Indeed, Japan is being considered a sample country to be studied for her demand behaviour for imports because of the nature of her trade position. Since 1980 Japan has experienced continuing surpluses on the two component accounts of her balance of payments, namely the trade account and the current account. This phenomenon has led to international tension, especially between Japan and the United States. In 1989 the US characterised Japan as an 'unfair' trading partner and has had extensive negotiations with Japan aimed at reducing structural impediments to mutual trade such as distribution and investment practices, and to stimulate domestic demand. Eventually, the trade situation did change when Japan emerged in 2009 as a major importer behind the US, China, Germany, and France. In the period 2000-2005, the average share of Japan's imports of goods and services in Gross National Expenditure (GNE) was about 10.8% per annum. For the periods 1990-1999, and 2000-2005, Japan's imports grew at an average annual rate of 2% and 7%, respectively, notwithstanding negative growth rates during 1991-1993 and 1998-1999. In 2005, the total amount of gross imports was about ¥65,000 billion with a growth rate of 15%.[1]

1.2 Motivation

The motivation for this thesis is two-fold. In the first instance, the empirical evidence of long-run equilibrium, or cointegration, reported in previous studies of Japan's aggregate import demand function is not only ambiguous but also inconsistent with

[1] The figures are calculated from the statistics obtained in the *World Tables*, World Bank.

estimates of their elasticities. Tang (2006b) surveyed the empirical evidence on the cointegration of Japan's aggregate import demand with particular reference to the testing methods employed in the various studies and the time horizon of estimations of the long-run elasticities of income and relative price of imports. Some studies have found empirical evidence that Japan's imports are cointegrated with real income and the relative price of imports whilst other studies reject this finding. Furthermore, the existing studies show inconsistency in the elasticity estimates for income and the relative price of imports. Indeed, the inconsistency of long-run estimates of Japan's aggregate import demand function can be explained by the choice of cointegration tests employed (Tang, 2006b).

Secondly, the specification of the conventional framework for modelling aggregate import demand behaviour may be inadequate. Relating the volume of imports to real income and the relative price of imports has been widely employed by empirical researchers. Generally speaking, this research strategy might be explained by its modest data requirements. By the same token, '*augmented*' or '*extended*' versions of import demand specifications are available in the literature. Such specifications include variables like exchange rates and foreign direct investment as additional determinants of import demand, and employ alternative measures of the activity variable such as particular expenditure components (private consumption, public consumption, fixed investment, exports and stock building), Gross Domestic Product (GDP) minus exports or '*national cash flow'*. Different specifications and measures of activity variables, testing methods and data frequencies give different answers on the cointegration properties of aggregate

import demand behaviour (i.e. Hakkio & Rush, 1991; Zhou, 2001; Haug, 2002; Pesavento, 2004; Harb, 2005).

This thesis considers the work by Harb (2005) and Tang (2006b). In general, Harb's (2005) study has contributed to the existing literature of import demand by finding that GDP is favoured over GDP minus exports (Senhadji, 1998) as proxy for economic activity. Also, the study illustrates that the income and price elasticities in developing countries are higher than in developed countries. While Tang (2006b) has studied the Japanese import demand behaviour by employing three forms of data frequency (quarterly, biannual and annual data) and a set of cointegration testing techniques such as Harb (2005) have not yet been fully explored.

1.3 Aims of the Thesis

The main objective of this thesis is to study the long-run behaviour (or cointegration) of Japan's aggregate demand for imports of goods and services. Existing work has applied different cointegration testing methods with different time horizons, data frequencies and proxies for explanatory variables (Tang, 2008a). It is this set of differences in model specification and research strategy, and their potential implications for the cointegration findings, which the present study examines in detail. The differences in specification and testing methods - "common factors" for short - influence the empirical identification, as distinct from the true structural relationship, of long-run relationships. That is to say, they influence the observed cointegration of aggregate demand behaviour and its potential explanators.

More specifically, the objectives of this thesis are:

1) To clarify the nature of the cointegration relationship of Japan's aggregate import demand function by examining the influence of several "common factors" on the empirical findings of cointegratedness. This covers the following specific clusters:-

    - To examine whether different proxies for the domestic economic activity or income variable - such as real GDP, real GDP minus exports and national cash flow - affect the empirical identification of long-run aggregate import demand behaviour (i.e., its cointegration property).
    - To investigate whether the evidence of cointegration for Japan's aggregate import demand function is affected by the frequency of the data employed - quarterly data, biannual data and annual data.
    - To study whether the finding of cointegration for Japan's aggregate import demand behaviour is affected by the specific testing procedure for cointegration – Engle & Granger (1987), Johansen & Juselius (1990), and Pesaran, *et al.* (2001).

This thesis also examines the joint influences of the identified set of "common factors" on the cointegration findings of Japan's aggregate import demand function. This exercise involves the empirical estimations of the cointegration between aggregate imports and its determinants. The empirical setup involves a 3 X 1 matrix representation of the three "common factors" to assess their individual effects in the first part, while the joint effects of the three "common factors" are captured by a 3X 3 matrix representation.

2) To explore an alternative formulation of the aggregate import demand relation from a general equilibrium perspective that takes into account both the goods market and the financial market (i.e. bonds and money markets). More specifically, a structural aggregate import demand relation is analytically derived from the conditions for aggregate income-expenditure equilibrium and portfolio balance. The existing approach to aggregate import demand analysis which is widely applied by researchers is based on partial equilibrium approach, thus ignoring the role of the financial sector.

1.4 Contributions of the Thesis

The contributions of this thesis are two-fold. First, this thesis makes a valuable addition to the body of knowledge by identifying a set of "common factors" that may affect the empirical evidence on the cointegratedness between Japan's aggregate import demand and its determinants - real income and relative price of imports. More specifically, this thesis tests, with a systematic procedure within a properly developed analytical framework, the influence of the set of "common factors" on the existing cointegration findings. The existing works have empirically examined this issue but their results are incomplete and subject to further consideration. For example, Tang (2006b) has observed from his results that the empirical evidence of cointegration of Japan's aggregate import demand function is sensitive to the cointegration tests regardless of the data frequency used (quarterly, biannual and annual data).

However, Tang (2006b) ignored the relevance of other specifications for analyzing long-run aggregate import demand such as alternative proxies for domestic activity variables while Harb's conclusion is based on the panel cointegration testing approach for a fixed time horizon of 28 years (annual data). Therefore, the findings of these studies remain inconclusive with respect to identifying the factors determining the cointegratedness of Japan's aggregate import demand relation. The present thesis fills this gap by a properly designed framework that generates richer and robust empirical evidence of the influence of "common factors" on the observed cointegratedness of the import demand relation. The explanatory framework must also permit the examination of the *simultaneous* influence of the set of "common factors" on cointegration. That task constitutes one contribution of this thesis. It will improve our understanding of the sources determining the cointegration of Japan's aggregate import demand function.

The second contribution of this thesis lies in the development of an alternative structural specification of the aggregate import demand function. Most of the existing studies follow the conventional import demand function in their empirical analysis that relates the volume of imports to their relative price and domestic economic activity (real income). This empirical specification is strictly partial equilibrium, restricted to the market for imported (or traded) goods and services. This alternative formulation, derived from the general equilibrium perspective, captures both real factors and financial factors in the economy. It utilises the market clearing conditions and sectoral budget or wealth constraints to derive structural equations for import demand. This alternative structural settingis employed to test the robustness of the determinants of cointegration findings identified previously. Complementary empirical evidence would generalise the

earlier findings about the susceptibility of empirical evidence of cointegration to the influence of “common factors”.

1.5 Outline of the Thesis

The structure of the thesis is as follows. Chapter 2 reviews the aggregate import demand functions which have been typically applied by researchers, and discusses the nature of stationarity and cointegration tests in studying aggregate import demand behaviour. The chapter also discusses the basic concerns with the “common factors” that can potentially influence the nature of conflicting cointegration findings.

Chapter 3 proposes an explanatory framework that explores how the “common factors” can influence cointegration findings. The identified “common factors” from the literature survey - small sample study, high-frequency data, residual-based cointegration tests, omitted relevant variables, and so on - can lead to non-cointegration conclusions. That is to say, thee cointegration findings from existing studies of Japan’s aggregate import demand function are not robust with respect to these “common factors”. By the same token, a systematic examination of data derived from the existing studies of Japan’s aggregate import demand function illustrate the power of a potential set of “common factors” - sample size, data frequency, cointegration tests, income variable and other elements such as time trend, exchange rate, and correction for small sample size - to affect cointegration findings.

While Chapter 3 illustrated the potentially distorting influence of the “common factors” on cointegration findings Chapter 4 conducts a systematic examination of their

influence. This explanatory framework employs a 3 X 1 matrix representation of the three identified "common factors" – data frequency (**F**), testing methods for cointegration (**C**) and domestic activity variable(s) (**DA**). The explanatory specifications proposed in this chapter have been employed to identify empirically the potential "common factors" that may explain the cointegration of Japan's aggregate import demand behaviour.

In Chapter 5, an '*extended*' version of the explanatory framework is proposed to study the *simultaneous* influence of the three "common factors" on the empirical finding of cointegratedness of Japan's aggregate import demand functions. It reflects a 3 X 3 matrix of explanatory specifications which includes all three variants of each "common factor". This provides the possibility for estimating a set of long-run import demand equations which allow for the *simultaneous* influence of data frequency, alternative proxies for the activity variable and different cointegration testing methods. In addition, the elasticity estimates for real income and the relative price of imports will be used to clarify whether Japan's aggregate import demand relation conforms to the (neoclassical) theoretical expectation of unitary income and price elasticities.

Chapter 6 derives a macro-based structural specification for analysing aggregate import demand behaviour that employs a general equilibrium. The general equilibrium perspective incorporates the equilibrium conditions in the real and financial sectors of the economy. Conventional partial equilibrium aggregate import demand functions neglect the potential role of financial factors. This chapter fills the gap.

Chapter 7 is an empirical chapter that extends the empirical examination of Japan's aggregate import demand function of Chapter 6 to the general equilibrium specification. The chapter covers the cointegration results and their long-run estimates. The empirical tests include the examination of the influence of "common factors" on cointegration findings and also their domestic activity and relative price elasticities.

Chapter 8 summarises the key findings of the thesis and discusses the policy implications suggested by the empirical analysis and some recommendations for future research.