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An empirical model for Japan's business fixed investment

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ABSTRACT

This paper estimates a dynamic empirical model for Japan's business fixed investment. A multivariate cointegration analysis of Japan's time series data over the past two decades shows that the term spread (the difference between long-term and short-term interest rates) and various diffusion indices in the Bank of Japan's business survey tend to synchronise with fixed investment. The term spread and diffusion indices are then all judged to be not only weakly exogenous but also super exogenous for parameters of interest. Thus, a single-equation equilibrium correction model for fixed investment is estimated with no loss of information and can be used for policy analysis. The equilibrium correction model sheds useful light on economic policies aimed at achieving stable investment growth in Japan.

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1. Introduction

This paper estimates a dynamic empirical model for Japan's business fixed investment in order to derive some policy implications. It is demonstrated that a cointegrated vector autoregressive (VAR) system reduces to a parsimonious dynamic model subject to economic interpretations. The introductory section briefly reviews recent developments in time series econometrics and empirical modeling of aggregate fixed investment. Significant aspects of the present paper are then described.

Economic time series data tend to exhibit non-stationary behavior, and often need to be treated as processes integrated of order 1 (denoted as $I(1)$ hereafter) rather than stationary. The concept of cointegration introduced by Granger (1981) therefore plays a crucial role in time series econometrics,

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and a cointegrated VAR model developed by Johansen (1988, 1996) has become a major econometric tool for macro and financial economists (see Juselius, 2006, for extensive empirical research using cointegrated VAR models). The cointegrated VAR model is well fitted in general-to-specific econometric approach, for its analysis usually starts with the investigation of general unrestricted VAR models (see Campos, Ericsson, & Hendry, 2005, for details of the approach). Hendry and Mizon (1993) discuss a model reduction procedure using the cointegrated VAR model. See also Hendry and Doornik (1994), Hendry (1995), and Kurita (2007) for the general-to-specific modeling methodology built on a cointegrated VAR analysis.

In addition to non-stationarity and cointegration, the concept of weak exogeneity introduced by Engle, Hendry, and Richard (1983) has also played an important role in econometrics. Weak exogeneity allows us to model a partial or conditional system alone, instead of a full system, for the purpose of making efficient inferences for parameters of interest. Weak exogeneity in the cointegrated VAR system is explored by Johansen (1992) and Urbain (1992).

Empirical modeling of business fixed investment has been of great interest in applied macroeconomics. See Chirinko (1993) and Caballero (1999) for surveys of the literature. In accounting for the performance of the Japanese economy over the post-war era, corporate fixed investment is considered as one of the most important macroeconomic variables (see Yoshikawa, 1995, 2002, 2007). Fixed capital investment in Japan has been subjected to empirical investigations; see Hoshi, Kashap, and Scharfstein (1991), Yoshikawa (1995, Ch. 7), Motonishi and Yoshikawa (1999), Kiyotaki and West (2004), *inter alia*. Motonishi and Yoshikawa (1999) conduct a noteworthy analysis of Japanese fixed investment using new empirical methodology based on *financial and real factors*: the factors are represented by diffusion indices in the short-term economic survey of enterprises in Japan, published quarterly by the Bank of Japan (BoJ). The survey is well-known as “TANKAN” (in Japanese) for economists analyzing the Japanese economy. Motonishi and Yoshikawa (1999) perform a regression analysis of the Japanese investment in four groups of firms: large/small and manufacturing/non-manufacturing. The results of their analysis suggest that the small firms are subject to financing constraints while the reverse is true for the large firms. It is also indicated that the real factor plays a more significant role than the financial factor in explaining the behavior of the overall investment.

The present paper, inspired by Motonishi and Yoshikawa (1999), adopts the cointegrated VAR approach to modeling Japanese business fixed investment over the past two decades. From the standpoint of macroeconomic policies, an empirical analysis of aggregate fixed investment would be of particular interest. This paper thus analyzes aggregate data for fixed capital investment of all industries in Japan, in order to examine the effects of various economic factors on the overall investment. Considering non-stationary properties of the data in question, the cointegrated VAR modeling seems to be a better approach rather than the conventional regression analysis. Furthermore, the present paper introduces the term spread (the difference between long-term and short-term interest rates) in the VAR model, in addition to the financial and real factors used by Motonishi and Yoshikawa (1999). It is often pointed out that the term spread contains information about expected future economic growth and business conditions. See Stock and Watson (1989), Bernard and Gerlach (1998), Hamilton and Kim (2002), and Ichiue (2004), *inter alia*. Thus the term spread may be treated as an *additional real factor* for fixed investment, shedding useful light on the model's policy implications.

The cointegrated VAR analysis shows that all of these factors convey critical information on the long-run behavior of fixed investment. It is noteworthy, in particular, that the term spread plays a significant role in the estimated cointegrating relationship. Further analysis finds that all the variables except fixed investment are weakly exogenous with respect to parameters of interest. It is therefore justified to estimate a single-equation equilibrium correction model for the aggregate investment conditional on these weakly exogenous variables. The conditional equilibrium correction model passes various diagnostic and parameter-constancy tests, thereby being judged to be a parsimonious data-congruent representation. To the best of the author's knowledge, it is only the present paper that is successful in achieving such a parsimonious data-congruent model of Japan's fixed investment over the past two decades, a period of economic turmoil, during which an asset-price bubble economy reached its peak and then collapsed. Furthermore, the conditional equilibrium correction model may be utilized for policy analysis, due to the finding that all of the financial and real factors are seen as super exogenous for the parameters of the conditional model. With regard to the model's policy implications

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