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Time-varying saving–investment relationship and the Feldstein–Horioka puzzle☆

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ABSTRACT

Numerous studies have been devoted to the Feldstein–Horioka puzzle. However, no consensus has been reached in the literature. This paper examines the dynamic saving–investment relationship by using a time varying cointegration model. The saving-retention coefficients are found to be high for developed economies, but low for less developed economies, which could be explained by the difference of the long-run solvency constraint between developed and less developed economies. While more evidence is found for time-varying cointegration using quarterly data, the magnitudes of saving retention coefficients have no substantial difference from those of annual data.

1. Introduction

In a highly influential paper, Feldstein and Horioka (1980) examined the relationship between saving and investment, and they found a large value for the saving–investment (saving-retention) coefficient. They documented that the saving–investment correlation measured the degree of international capital mobility. Therefore, if the capital markets are integrated, domestic investment could be financed by foreign savings, and domestic saving could also seek out higher foreign return, thereby implying a low correlation between saving and investment. Given the prevailing integration of current financial markets, this finding reveals a contradiction, which is currently known as the Feldstein–Horioka puzzle. Obstfeld and Rogoff (2000) regarded the Feldstein–Horioka puzzle as "the mother of all puzzles" in international monetary economics.

For the past three decades, many theoretical and empirical studies have attempted to resolve this puzzle. The vast literature regarding the Feldstein–Horioka puzzle can be classified into three categories.[1] The first category attempted to reconcile the high saving–investment correlation with high capital mobility by constructing new theoretical models and/or providing new explanations. For example, Coakley et al. (1996) showed that the long-run solvency constraint implied the stationarity of the current account balance and thus the cointegration between saving and investment. Therefore, the high saving–investment correlation might be driven by the long-run solvency constraint, rather than low capital mobility. Bai and Zhang (2010) found that when two types of financial frictions—limited enforcement and limited spanning are combined, they interact to generate a high saving–investment correlation and endogenously restrict capital flows, thereby solving the Feldstein–Horioka puzzle. Chang and Smith (2014) showed that the introduction of the long-run risk component in the shock process helped solve the Feldstein–Horioka puzzle. Murphy (1984), Harberger (1980), Baxter and Crucini (1993), and Ho and Huang (2006) attributed the high saving–investment correlation to the large country effect. They documented that a large country tended to finance investment projects from domestic saving rather than the foreign saving. In this sense, Feldstein and Horioka (1980) claimed that, if a country was large, it would behave like a closed economy.

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[1] Given that the literature related to the Feldstein–Horioka puzzle is enormous, we are not intending to give an exhaustive review. We would like to offer our sincere apologies to those who made contributions in this field for our omission. For an excellent survey, see Apergis and Tsoumas (2009) and Coakley et al. (1998).

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The second category casts doubt on the findings of Feldstein and Horioka (1980) on the high saving–investment correlation. For example, Chu (2012) showed that a common deflator—final domestic demand might cause the spurious saving–investment correlation. Krol (1996) argued that the Feldstein–Horioka puzzle was related to the estimation technique and found a lower saving–investment correlation using a fixed-effect panel data model. While the findings of Krol (1996) were criticized by Coiteux and Olivier (2000) and Jansen (2000) because of the inclusion of Luxembourg, Ho (2002) found that the inclusion or exclusion of Luxembourg did not affect the results when using the nonstationary panel data approach.

The third category employed more advanced econometric techniques. Most of the studies, however, tended to support the Feldstein–Horioka puzzle. Tobin (1983) first criticized the OLS methodology employed by Feldstein and Horioka (1980) because both saving and investment are possibly endogenous. In addition, given that both saving and investment ratio are likely to be unit root nonstationary, the cointegration approach attracted much attention to the study of the Feldstein–Horioka puzzle. These recent works include those by Alexakis and Apergis (1994), Miller (1988), De Vita and Abbott (2002), and Narayan (2005a,b). Another group of studies adopted the panel data approaches, such as those by Fouquau et al. (2008), Herwartz and Xu (2010), Krol (1996), Narayan and Narayan (2010), and Oh et al. (1999).

It follows that there is no consensus in the existing literature regarding the Feldstein–Horioka puzzle. In the literature, Narayan and Narayan (2010) did not find any cointegration relationship between saving and investment. Thus, they showed that the capital in G7 countries was highly mobile. However, Narayan and Narayan (2010) focused only on the G7 countries. As Coakley et al. (1999) pointed out, the relationship between saving and investment for less developed countries was different from that of developed countries. For this reason, this paper studies the relationship between saving and investment for both developed and less developed economies by using the time-varying cointegration approach developed by Park and Hahn (1999).

This paper contributes to the literature in two ways. First, to the best of our knowledge, this paper is the first to apply the time-varying cointegration approach to examine the relationship between saving and investment. Even though Chen and Shen (2015), Ho (2000), Ho and Huang (2006), Özmen and Parmaksiz (2003), andTelatar et al. (2007) employed the regime-switching or time-varying coefficient approach, none of them used the time-varying coefficient or regime-switching cointegration. Second, this paper analyzes both annual and quarterly data. As far as we know, we are the first to investigate the robustness of the Feldstein–Horioka puzzle to the data frequency. As Narayan and Sharma (2015) showed, a hypothesis test might be dependent on data frequency, given that relatively high-frequency data provided additional information. By virtue of the additional information, the statistical and economic relationship between variables might be changed. Phan et al. (2015b), Narayan et al. (2013), and Narayan et al. (2015) have shown that the profitability of the commodity market was dependent on data frequency. Narayan and Sharma (2015) also found that data frequency did matter relative to the impact of forward premium on spot exchange rate. Phan et al. (2015a) showed that the effect of oil price change on stock returns was robust to the data frequency. Apart from the prevalent annual data, the quarterly data was used to study the Feldstein–Horioka puzzle. Such studies include those by Chang and Smith (2014) and Ketenci (2012). Therefore, one may wonder whether the relationship between saving and investment is robust to data frequency.

The correlation between domestic saving and investment might not be invariant to the policy regime change. Thus, international capital mobility is essentially a time-varying phenomenon that cannot be represented by a fixed coefficient model. The well-known Locas critique pointed out, "given that the structure of an econometric model consists of optimal decision rules of economic agents and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter the structure of econometric models."

The possible structural change for the saving-retention coefficient was also noted in the literature, such as in the studies of Sinha (2002), Özmen and Parmaksiz (2003), Narayan and Narayan (2010), and Ketenci (2012), who all employed the cointegration model with structural breaks; Chen and Shen (2015), Ho (2000), Ho and Huang (2006), and Telatar et al. (2007), who adopted the regime-switching model; Fouquau et al. (2008), who used the panel smooth transition regression model; and Herwartz and Xu (2010), who applied the function coefficient model. This paper employs the smooth time-varying coefficient cointegration model, in which model parameters change smoothly rather than abruptly in the model with structural breaks. Conventional wisdom suggests that the model parameters in the cointegration model might have some structural breaks. However, as Hansen (2001) pointed out, "it may seem unlikely that a structural break could be immediate, and it might seem more reasonable to allow a structural change to take a period of time to take effect." Indeed, given the menu cost, the effect of technological progress and policy switch might have time lags.

This paper examines the time-varying relationship between saving and investment for both developed and less developed economies, namely Australia, Bolivia, Canada, Chile, Denmark, France, Germany, Hong Kong, Iceland, India, Israel, Japan, Malaysia, Norway, Paraguay, Peru, the Philippines, South Korea, Thailand, Iran, the United Kingdom, and the United States, given that we can obtain sufficient annual and quarterly data for these economies. We show that the saving-ratio and investment-ratio are unit root nonstationary. Given that debt cannot explode, the long-run solvency constraint requires the current account balance to be stationary, thus implying that saving and investment are cointegrated with a unit coefficient. In the literature, Chen (2011, 2014), Chen and Xie (2015), and Christopoulo and Leon-Ledesma (2010) found that the current account balance was stationary. By the conventional Johansen cointegration and the autoregressive distributed lag (ARDL) bounds testing approach of Pesaran et al. (2001), we do not find any cointegration relationship between saving and investment for most of the cases. The time-varying cointegration relationship between saving and investment is found for Australia, Canada, Chile, Israel, South Korea, and the United States. However, using the quarterly data, saving and investment are time-varying cointegrated for more economies. The less evidence for time-varying cointegration given by annual data might be attributed to the serious size distortion of the time-varying cointegration test in the small sample case. Indeed, the magnitudes of saving-retention coefficients for quarterly data have no substantial difference from those of annual data.

The remainder of this paper is organized as follows: Section 2 presents a brief discussion of the time-varying coefficient cointegration. Section 3 summarizes the data and results for unit root tests. Section 4 provides the empirical results and analysis. Section 5 discusses the results of the cointegration with structural breaks, as well as the robustness of the time-varying cointegration results to data frequency. Section 6 concludes.

2. Time-varying coefficient model

The relationship between saving and investment was first examined by the traditional linear regression model. Let *IR* and *SR* denote