Capital mobility and global factor shocks

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\textbf{HIGHLIGHTS}

\begin{itemize}
  \item We focus on the effects of global factors on the saving–investment relationship.
  \item We show that if investments and savings are affected by idiosyncratic and global components, they must be cointegrated.
  \item When global shocks are taken into account through common factors, the estimated saving-retention coefficient is close to zero.
\end{itemize}

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\textbf{ABSTRACT}

This paper focuses on the effects of global factors on the saving–investment relationship. We prove that, if investments and savings are affected by idiosyncratic and global components, they must be cointegrated to obtain reliable estimates of the saving-retention coefficient.\textsuperscript{1} We then estimate the saving-retention coefficient for a sample of 21 OECD countries over the period 1970–2008 using the panel CUP-FM estimator of Bai and Kao (2006) that models cross-sectional dependence through a common factor structure. In order to make a comparison, we also apply the panel dynamic OLS (DOLS) and fully modified OLS (FMOLS) estimators of Kao and Chiang (2000) that assume the hypothesis of cross-sectional independence. The results show that the retention coefficient is very close to zero when cross-sectional dependence among countries is taken into account.

The paper is organized as follows. In Section 2, the motivation and methodology are described. Section 3 offers the empirical application.

\textsuperscript{1} Recent works show that saving and investment are nonstationary processes, and the retention coefficient should be interpreted as a cointegration relationship (see, e.g., Coakley and Kulasi, 1997; Caporale et al., 2005).
2. Motivation and methodology

As shown by Andrews (2005), cross-section dependence induced by common factors can yield bias and inconsistent estimates in the context of a single cross-section. Since common factors could reflect global shocks (see, e.g., Byrne et al., 2009; Giannone and Lenza, 2010), the Feldstein–Horioka’s (1980) estimates based on cross-section regressions may be unreliable. Unfortunately, for a single cross-section, not much can be done about common shocks, but by using panel cointegration analysis that assumes cross-sectional dependence through common factors reliable estimates of the retention coefficient can be obtained (see Bai et al., 2009).

In this section, we show that, if savings and investment rates are affected by country-specific and common factor components, they must be cointegrated to obtain reliable estimates of the saving-retention coefficient. To this end, we follow the approach of Gengenbach et al. (2006) and Urban and Westerlund (2011) that models cross-sectional dependence through common factors. Specifically, we assume that the relationship between investment ($I_t$) and saving ($S_t$) can be decomposed as

$$\begin{bmatrix} I_t \\ S_t \end{bmatrix} = d_t + A f_t + e_{it}, \quad i = 1, \ldots, N; \ t = 1, \ldots, T, \quad (1)$$

where $d_t$ is a deterministic component, $f_t$ is a common component that affects all the countries, and $e_{it}$ is an idiosyncratic (country-specific) component. The common and the idiosyncratic components can be further partitioned as $f_t = (f_{it}^C, f_{it}^S)'$ and $e_{it} = (e_{it}^C, e_{it}^S)'$.

Assuming for simplicity that the number of common factors for investment and saving is $k_I = k_S = 1$, then the matrix of factor loadings, $A$, can be partitioned as

$$A = \begin{bmatrix} \lambda_{II} & \lambda_{IS} \\ \lambda_{SI} & \lambda_{SS} \end{bmatrix} \quad (2)$$

where $\lambda_{ii}$ represents the realization of global shocks for $I_t$ and $S_t$, the factor loadings in $A_i$ denote the sensitivity of the saving and investment to global shocks in country $i$, and $e_{it}$ accounts for country-specific shocks.

According to Eq. (1), three different cases that involve nonstationarity and cointegration can be distinguished.

(i) If $f_t$ is nonstationary and $e_{it}$ is stationary, investment and saving are nonstationary by definition, and cointegration among them depends on $A_i$. More specifically, if $A_i$ is block diagonal, i.e., $\lambda_{II} \neq 0, \lambda_{IS} \neq 0$ and $\lambda_{SI} = \lambda_{SS} = 0$ for all $i$, investment and saving are cross-member cointegrated but are not cointegrated with each other. However, the saving-retention coefficient cannot be estimated under this set-up.

(ii) When the common and idiosyncratic components are nonstationary and stationary, respectively, but $A_i$ is no longer block diagonal, saving and investment are cross-member cointegrated as in (i), but they are also cointegrated with each other.

(iii) If the idiosyncratic and common components are both nonstationary, cointegration between investment and saving exists if and only if there is cointegration in the common and idiosyncratic components.

Therefore, we proceed as follows.

1. A preliminary PANIC analysis is carried out on $I_t$ and $S_t$ to test for nonstationarity (see Bai and Ng, 2004).

2. (a) If $I(1)$ common factors and $I(0)$ idiosyncratic components are found in $I_t$ and $S_t$, then there is cross-member cointegration (see case (i)). In this case, cointegration between $I_t$ and $S_t$ occurs only if $f_{it}^C$ and $f_{it}^S$ are cointegrated (see case (ii)). To test for cointegration among common factors, the trace test of Johansen (1988) can be used.

(b) If both the common and idiosyncratic components are $I(1)$ (see case (iii)), then we test for common component cointegration (see 2(a)) and for cointegration in the defactored data (using panel tests such as those of Pedroni, 2004), respectively. If both components are cointegrated, then $I_t$ is cointegrated with $S_t$.

In summary, using the previous testing procedure, one is able to estimate the saving-retention coefficient $\beta$ running the following panel regression:

$$I_t = \alpha_i + \beta S_t + e_{it}, \quad (3)$$

if and only if $I_t$ and $S_t$ are cointegrated as a result of case 2(a) or 2(b). Using Eq. (1) and case (ii), we have

$$I_t = \alpha_i + \lambda_{II} f_{it}^C + e_{it},$$

$$S_t = \alpha_s + \lambda_{IS} f_{it}^S + e_{it}. \quad (4)$$

From (4), it is clear that any linear combination can be written as

$$I_t = \alpha_i' + \beta S_t + v_{it} \quad (5)$$

where $\alpha_{ii}' = \alpha_i - \beta \lambda_{II}, \ v_{it} = e_{it} - \beta e_{it}$. Since $e_{it}$ and $e_{it}$ are i.i.d. by assumption, then $v_{it} \sim i(0)$ (i.e., $v_{it}$ is stationary).

In the empirical analysis, we use the CUP-FM estimator to estimate Eq. (5). In order to make a comparison, we also apply the dynamic OLS (DOLS) and fully modified OLS (FMOLS) estimators of Kao and Chiang (2000).

3. The empirical results

Our empirical analysis proceeds in three steps. First, we test for unit root in investment and saving using the PANIC approach. Second, we test for cointegration between those variables. Lastly, Eq. (5) is estimated using the DOLS, FMOLS, and CUP-FM estimators.

We consider a panel of 21 OECD countries over the period 1970–2008. Data is taken from OECD National and Annual accounts. Savings and investment rates are calculated here as the ratio of savings and investments to GDP, $I_t = \frac{I_t}{Y_t}$ and $S_t = \frac{S_t}{Y_t}$, where $Y$ is GDP, $I$ is the gross capital formation, and $S$ is the sum of consumption of fixed capital and net saving.

As a preliminary step, we use the CD statistics of Pesaran (2004) to test for cross-sectional dependence in the data. The results show evidence of dependence since the statistics for investment and saving are 42.485 (0.000) and 21.773 (0.000), respectively ($p$-values are given in parentheses).

As regards the unit root results, savings and investment rates are nonstationary when the PANIC approach is used (see Table 1). However, we also consider a more powerful panel unit root test of Moon and Perron (2004), $t^*_p$, since the tests of Bai and Ng (2004) suffer from a low power (see Gutierrez, 2006). The results show that both idiosyncratic components of saving and investment are stationary. Therefore we proceed to test for cointegration only in the common factors using Johansen’s (1988) trace test. The findings show the existence of one cointegrating vector (see Table 2).
Once cointegration is found, we estimate Eq. (5) using the DOLS, FMOLS, and CUP-FM estimators. The results can be summarized as follows (see Table 2). First, all the estimates are statistically significant. Second, the retention coefficient shows higher values when the DOLS and FMOLS estimators are considered. These findings are in line with those obtained in previous studies (see, e.g., Ho, 2002; Coakley et al., 2004; Adedeji and Thornton, 2008). Third, the estimated retention coefficient is very close to zero when the CUP-FM estimator is considered. This highlights that neglecting cross-sectional dependence may bias the saving-retention coefficient upwardly.

Table 2

<table>
<thead>
<tr>
<th>Variables</th>
<th>$BN_{ADF}$</th>
<th>$BN_{Z}$</th>
<th>$t$</th>
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<tbody>
<tr>
<td>$I_{t-1}$</td>
<td>-1.225</td>
<td>4.286</td>
<td>-12.18$^{**}$</td>
</tr>
<tr>
<td>$I_{t-2}$</td>
<td>-2.335</td>
<td>0.881</td>
<td>-9.482$^{***}$</td>
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<tr>
<td>$I_{t-3}$</td>
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Notes: $BN_{ADF}$ and $BN_{Z}$ denote Bai and Ng’s (2004) panel unit root tests on common factor and idiosyncratic components, respectively. The number of the common factors according to BIC Criteria is equal to 1. $t_i$ denotes the panel unit root test of Moon and Perron (2004). $p$-values are in parentheses.

- $^{*}$ Significance level at the 10%.
- $^{**}$ Significance level at the 5%.
- $^{***}$ Significance level at the 1%.

Table 1

<table>
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<th>Panel unit root results.</th>
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<tbody>
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