A Time-Varying Measure of Fiscal Crowding-Out Based on Financial Integration: Divergence between Advanced and Emerging Market Economies*

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Abstract

This paper investigates the fiscal crowding-out effect, measured as the extent to which private saving is offset by public saving, based on the degree of a country's international financial integration. Using heterogeneous panel data for 95 countries over the period 1970–2010, the results reveal that the dynamics for the private/public saving offset are highly nonlinear and time-varying. While the private/public saving offset has gradually declined in advanced economies, it has been relatively constant in emerging market economies. This pattern appears to reflect the differing paces of financial integration between advanced and emerging market economies. Since the early 2000s, the extent of the offset of advanced economies has been smaller than that of emerging market economies by approximately 16 percent.

JEL Classification: C33; E21; E62; F36; G15; O50

Keywords: Fiscal policy; International Financial integration; Private/public saving offset; Time-varying coefficient; Panel smooth transition regression model

*The authors are grateful to Stefan Eichler, Montfort Mlachila, Dong-Eun Rhee, two anonymous referees, and the participants at the 2014 INFINITI conference for their helpful comments and suggestions which helped us to substantially improve the manuscript. All remaining errors are solely the authors' responsibility.

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1 Introduction

As international financial markets have gradually become more integrated, the policy environments of individual countries have become increasingly vulnerable to external factors, such as international capital flows. For instance, during the global financial crisis, the simultaneous implementation of fiscal stimulus measures in many countries has raised questions regarding the effectiveness of fiscal policy, not only in terms of domestic difficulties such as higher debt levels, but also in terms of cross-country spillovers from both real and financial linkages. Contrary to the autarky setting in which policymakers consider only domestic environments when implementing policy measures, the increased international trade and financial investment across countries affects the policy propagation channels, especially regarding the responses of both consumers and firms.

Consequently, this study examines the effects of public saving (or fiscal deficit) on private saving from an open economy perspective. In particular, it measures the public-private saving offset as a proxy of fiscal crowding-out with respect to the country's international financial integration. There are two theoretical explanations regarding the effect of fiscal deficits in a domestic economy. First, fiscal deficits caused by public dissaving merely postpone taxes, and therefore "rational" agents increase their private saving to meet delayed taxes according to the Ricardian equivalence (RE) theorem. Second, the crowding-out from a Keynesian perspective is the other explanation. Fundamentally, expansionary fiscal policy is believed to spur private consumption effectively because of the marginal propensity of consumption. However, the expansionary policy can crowd out domestic consumption or investment by a subsequent increase in the domestic interest rate because the higher interest rate tends to increase the opportunity cost of consumption or the cost of investment.[1]

Our study is built on the latter theoretical perspective of fiscal crowding out and argues that greater financial integration prevents the domestic interest rate from rising to a certain extent

[1] Previous studies have made cross-country comparisons of the private/public saving offset in the context of the RE. When RE holds (i.e., fiscal policy is ineffective), a reduction in public saving is offset one-for-one by an increase in private saving, with the national saving constant. This so-called RE coefficient has been empirically estimated as a value greater than -1 (i.e., a full offset), implying that RE partially holds. Seater (1993) provides an extensive survey of the empirical literature regarding RE and concludes that RE is valid. However, Stanley (1998), and others refute the empirical validity of RE. While previous studies interpret the private/public saving offset coefficient as the RE coefficient, we focus on the indication of this offset in the context of the crowding-out effect–that is, the degree of crowding-out of consumption.

(given the world interest rate), and thus reduces the degree of the fiscal crowding out of both consumption and investment. Frankel (1986) already gauged the relationship between international capital flows and the crowding-out effect in the United States in the 1980s. Although Frankel (1986) did not find any significant relationship between international capital mobility and the crowding-out effect of domestic investment, our work is primarily motivated by this question about the role of international financial integration that promotes capital mobility across countries in influencing the crowding-out effect, not only for the United States but also for other countries.[2]

As for the pattern of international financial integration across countries, Lane and Milesi-Ferretti (2007) (LMF, henceforth) show that the trend of international financial integration between advanced and emerging market economies differs in that emerging economies lag behind advanced economies in the scale of cross-border asset trade. Since the financial markets of advanced economies became more globally integrated to the world market compared to those of emerging market economies, it is conjectured that the fiscal crowding-out of advanced economies is seemingly less than that of emerging market economies.

Therefore, our analysis covers a rich data set of 95 countries and compares the fiscal crowding-out effect between advanced and emerging market economies. By employing the panel smooth transition regression (PSTR) model developed by González et al. (2005), the results reveal that the dynamics of the private/public saving offset are highly nonlinear and time-varying with respect to the international financial integration of the two groups of countries. Moreover, the extent of the offset has been decreasing since 1980. We also find that the pattern of the private/public saving offset appears to be different between advanced and emerging market economies. Specifically, advanced economies exhibit a gradually decreasing public-private saving offset over time, implying a relatively lower crowding-out effect compared to emerging market economies. In contrast, emerging market economies display a relatively constant offset over time but it is more volatile as it shows some jumps that may be linked to financial crisis periods.

[2] Frankel (1986) emphasizes that the fiscal crowding-out effect occurred not because of the imperfect integration of financial markets, but because of the imperfect integration of the goods markets, which led the real interest rate parity to fail. As opposed to Frankel (1986), our results suggest that international capital mobility is still important in determining the effectiveness of fiscal policy for all countries in our sample. However, we also find the private/public saving offset coefficient was very close to -1 in the United Sates in the 1980s, a figure that has gradually risen to -0.7 during the global financial crisis.

Additionally, this paper uses a similar approach to Giavazzi et al. (2000), who introduce a saving function to investigate the effectiveness of fiscal policy. The cited study emphasizes the advantage of examining the saving function and fiscal policy is that we can compare the results directly with the RE proposition. Moreover, this approach (i.e., examining private saving offset by public saving) allows us to consider the comprehensive effect of changes in both taxes and government spending. The choice of private saving in our analysis is also meaningful in that private saving is a mirror image of consumption and is channeled to investment.

Previous work by Caballero and Krishnamurthy (2004) is also closely related to this study. Using a theoretical model of fiscal policy and financial constraints, they show that the fiscal crowding out in advanced and emerging market economies differs in terms of financial depth. They subsequently find that lack of financial depth in emerging economies, that is, a low supply of funds available to the governments of emerging market countries amplifies the fiscal crowding out as compared to advanced countries. Our findings are consistent with Caballero and Krishnamurthy (2004)'s and compatible with their explanations on crowding-out because financial integration is, generally, positively associated with financial development or depth (Claessens et al. (2001) and Stiglitz (2000)). However, our work differs from Caballero and Krishnamurthy (2004) in that we examine differences in "external" financial conditions between advanced and emerging market economies, while they focus more on crisis periods that deteriorate liquidity more in emerging market economies.

Kuralbayeva (2013)'s study is also related to our work in that she distinguishes between developed and developing countries that have different degrees of access to the world capital market in order to compare their cyclical patterns of fiscal policy.[3] However, our work is distinct from that of Kuralbayeva (2013) because we focus on the fiscal crowding-out effect in terms of international financial integration, not on the cyclical pattern of fiscal policy. Claeys et al. (2012) also examine the spillover effect of the bond market integration on crowding-out. While we investigate the effect of public saving on private saving, they consider the effect of public debt on domestic long-term interest rates for empirically in measuring crowding-out.[4] Furthermore, our work

[3] She shows that the responses of public consumption and investment to an external shock over the business cycle are different between the two groups because given the world interest rate, the elasticities of the foreign capital supply differ between developed and developing countries.

[4] Our finding is also in line with Ilzetzki et al. (2013)'s, and we explain that the cross-sectional difference (as well as the time series difference) in fiscal policy effectiveness is influenced by the different paces of international financial

contributes to previous studies that examine international financial integration, in particular debt market integration, and their consequences on the macroeconomy (Kumar and Okimoto (2011) and Lucey and Steeley (2006)).

As such, in Section 2, we provide the specifications for the PSTR model and briefly describe the estimation procedure. In Section 3, we describe the data set and present the empirical results. Concluding remarks are given in Section 4, and detailed data sources and variable constructions are provided in the Appendix.

2 Methodology

2.1 Model specifications for private savings

We set up a private saving function based on the life cycle model proposed by Modigliani and Brumberg (1955). This function explains the saving pattern in terms of income and demographic structure, which the theory considers as basic components. For example, Giavazzi et al. (2000) control for output gap (income) and dependency ratio (demography) in their baseline (national) saving regressions and add a fiscal policy variable. Consequently, a saving function can be extended in several ways including other macroeconomic variables such as financial market condition, macroeconomic volatility, and so on. (Loayza et al. (2000)).[5] Our saving function includes standard determinants of private savings such as income and its growth, demographic structure and fiscal policy variables.

According to the theory, a higher level of income (measured as GDP per capita) is expected to generate a higher saving rate. A high income growth rate increases the level of aggregate income for the working age population, and it can also increase aggregate saving if it is temporary (Modigliani and Brumberg (1955) and Mason (1988)). However, if income growth is expected to be "permanently" high, an increase in current income results in an increase in consumption and not savings because people expect their permanent income to increase as well. Therefore, the effect of a change in income on the private saving rate is significant but ambiguous. Further-

integration across the two heterogeneous groups of countries.

[5] According to the original life-cycle model, people earn income and save (relative to their income) when they are working age. However, they dissave for their children. An increase in youth population is expected to reduce saving rates because youths that require consumption cannot earn income. Furthermore, people dissave when they are old, and thus, private saving increases when the old-age dependency ratio is low.

more, a large youth population increases consumption requirements at the expense of savings. Recent studies have indicated that a higher youth dependency ratio as well as a higher old-age dependency ratio is associated with lower saving rates.

We also include public saving rate in the private saving function. A reduction in public saving (i.e., an increase in fiscal deficit) can be offset by an increase in private saving because public dissaving crowds out consumption or investment through an increase in the interest rate. This reduction can also be explained by the RE behavior, whereby agents expect that the current benefit is levied as a tax in the near future.

2.2 The panel smooth transition regression model

To investigate the nonlinear effect of public saving on private saving using the heterogeneous panel data set, we employ the PSTR model with fixed individual effects introduced by González et al. (2005). The model generalizes the panel threshold regression (PTR) model developed by Hansen (1999), allowing regression coefficients to change smoothly and gradually between two extreme regimes. That is, the model allows for heterogeneity in the regression coefficients–assuming that these coefficients are continuous functions of a specific transition variable selected using the transition function–and change between the two regimes. The PSTR model with the two regimes is given by

$$\begin{aligned} s_{it}^{p} = {} & \mu_i + \beta_{01} s_{it}^{g} + \theta_{01} y_{it} + \delta_{01} g_{it} + \phi_{01} d_{it}^{y} + \omega_{01} d_{it}^{o} \\ & + \left[\beta_{11} s_{it}^{g} + \theta_{11} y_{it} + \delta_{11} g_{it} + \phi_{11} d_{it}^{y} + \omega_{11} d_{it}^{o}\right] G\left(z_{it}; \gamma, c\right) + u_{it} \end{aligned} \tag{1}$$

for $i = 1, ..., N$ and $t = 1, ..., T$, where N and T denote the cross-section and time dimensions of the panel data set, respectively.[6] μ_i is the fixed individual effect, and the error term u_{it} is independently and identically distributed. In Equation (1), s_{it}^{p} is the private saving ($\%$ of GDP), s_{it}^{g} is the public saving ($\%$ of GDP), y_{it} is the log of the per-capita real GDP, g_{it} is the per-capita real GDP growth rate, d_{it}^{y} is the young-age dependency ratio (i.e., the ratio of the population aged below 14 to that aged 15–64), and d_{it}^{o} is the old-age dependency ratio (i.e., the ratio of the population aged above 65 to that aged 15–64). Further details are given in the Appendix.

[6] We allow for an unbalanced panel.

In Equation (1), $G(\cdot)$ is the transition function that governs the speed of reversion between the two regimes. Following Granger and Teräsvirta (1993) and Teräsvirta (1994), the transition function is chosen as the following logistic function

$$G(z_{it};\gamma,c) = (1+\exp(-\gamma(z_{it}-c)))^{-1} \text{ with } \gamma > 0, \tag{2}$$

where z_{it} is the transition variable, γ is a slope parameter, and c is a location parameter. The restriction on the parameter ($\gamma > 0$) is an identifying restriction. The logistic function, which is bounded between 0 and 1, depends on the transition variable z_{it} for individual i at time t. Therefore, $G(z_{it};\gamma,c) \to 0$ as $z_{it} \to -\infty$, $G(z_{it};\gamma,c) = 0.5$ as $z_{it} \to c$, and $G(z_{it};\gamma,c) \to 1$ as $z_{it} \to +\infty$. When $\gamma \to \infty$, $G(z_{it};\gamma,c)$ becomes an indicator function, the PSTR model becoming the two-regime PTR model introduced by Hansen (1999), nesting a two-regime threshold model. For $\gamma = 0$, $G(z_{it};\gamma,c) = 0.5$ for all z_{it}, in which case the PSTR model reduces to a linear panel regression model with individual fixed effects. The values taken by the transition variable z_{it} and transition parameter γ determine the speed of reversion between the two extreme regimes.[7] Parameter c can be interpreted as the threshold between the two regimes corresponding to $G(z_{it};\gamma,c) = 0$ and $G(z_{it};\gamma,c) = 1$ in the sense that the logistic function changes monotonically from 0 to 1 as z_{it} increases, whereas $G(c;\gamma,c) = 0.5$.

The transition variable used is the *de facto* international financial integration index constructed by LMF (2007). It may be argued that the real interest rate could be directly used to distinguish the ease of access to the world capital market among countries. However, constructing the real interest rate series is not an easy task as the appropriate nominal interest rate needs to be chosen in addition to the inflation rate. We try to collect the provided measure for the real interest rate from the World Development Indicators (WDI) of the World Bank. When including the real interest rate series, emerging market countries have a considerable number of missing values, the sample size shrinking from 3134 to 2408, indicating a 30 percent decline.[8] While we

[7] Lower values of the transition parameter γ imply slower transitions.

[8] A decline in the sample size caused by an inclusion of the real interest rate series makes it difficult to compare between advanced and emerging market economies since emerging market economies have many missing observations. Based on our primary purpose of comparisons, using the real interest rate series as a transition variable may be inappropriate. However, we have estimated the model using the real interest rate series instead of the international financial integration index. As expected, the results are not informative because of the many missing values for the emerging market economies.

also consider *de jure* measure proposed by Chinn and Ito (2006), we prefer to use the *de facto* measure, which exploits observable phenomena resulting from increased capital mobility such as the magnitude of gross capital flows. Following LMF (2007), the international financial integration index is measured as the ratio of external assets and liabilities to GDP as below:

$$fi_{it} = \frac{(fa_{it} + fl_{it})}{gdp_{it}}, \tag{3}$$

where fa_{it} and fl_{it} denote the stocks of total external assets and liabilities, respectively. These include equity, foreign direct investment (FDI), debt, and financial derivatives. For a robustness check, we also use the foreign debt integration index, similar to fi_{it}, as an alternative transition variable, which is measured as the ratio of foreign debt assets and debt liabilities to GDP as follows:

$$fdi_{it} = \frac{(fda_{it} + fdl_{it})}{gdp_{it}}, \tag{4}$$

where fda_{it} and fdl_{it} denote a country's foreign debt assets and foreign debt liabilities, respectively. Although we use "foreign" debt holdings to construct the debt market integration measure following LMF (2007), domestic public debt is an important variable that influences the fiscal crowding-out effect. For example, previous studies by Abbas and Christensen (2010) and Kumar and Baldacci (2010) show that the effect of "domestic" public debt on macroeconomic variables including growth and the yield curve. Additionally, Berben and Brosens (2007) and Cho and Rhee (2013) focus on the role of the debt level in determining the heterogeneous RE.

Finally, estimating the coefficients in the PSTR model involves eliminating the individual effects μ_i in Equation (1) by removing individual-specific means. Subsequently, we implement the nonlinear least squares (NLS) estimation using the transformed data.[9]

[9] It is worth noting that while eliminating fixed effects using the within transformation is standard in linear panel data models, nonlinear panel data models such as the PSTR model require more steps to take as in González et al. (2005).

3 Empirical analysis

3.1 Data

The data include annual observations for 95 countries during the period 1970–2010. In Table 1, we report a list of countries according to three subgroups: advanced economies, emerging market economies, and other economies. Private and public saving is obtained from the World Economic Outlook (WEO) and from the International Financial Statistics (IFS), and other economic determinants of saving rates are from the WDI and the IFS. For the dependent variable, we use the private saving rate as a share of GDP.[10] We consider determinants for the private saving rate such as the public saving rate, the per-capita real GDP, the per-capita real GDP growth rate, and the youth- and old-age dependency ratios. Public saving is constructed by subtracting "current" government expenditure from current revenue, which does not include net capital transfer receivable (net capital grants and capital taxes). Note that government balance (i.e., total revenue minus total expenditure) adds net capital transfer to public saving. The international financial integration index is constructed by LMF (2007) using data on external assets and liabilities. Higher values of this index denote a higher degree of capital mobility, which, in turn, implies a higher degree of international financial integration. (see the Appendix for detailed variable definitions).

Descriptive statistics for the entire sample are reported in column (1) of Table 2. In columns (2), (3), and (4), we report the descriptive statistics for each subgroup: advanced economies, emerging market economies, and other economies, respectively. We observe possible heterogeneity across the three subgroups. Specifically, while the private saving rate is higher in advanced economies than in emerging market economies, the public saving rate (or fiscal deficit to GDP) is lower (or higher) in advanced economies than in emerging economies. In column (2), advanced economies have a higher level of per capita real GDP than the rest of the world. In column (3), emerging market economies including China and India show the highest growth rate, 2.66 percent on average, among the three subgroups. Both dependency ratios show differences between advanced and emerging market countries. The sample including the other

[10] We also use GNI instead of GDP to construct the private saving rate. The results with the private saving rate based on GNI are very similar to our baseline results. Sarantis and Stewart (2001) mention that as a proxy of income, GDP causes measurement errors. However, our fixed-effect estimation method can control for measurement errors.

countries in column (4) has the highest youth dependency ratio, whereas the advanced countries in column (2) have the highest old age dependency ratio, which is twice that of emerging market economies. This is consistent with the fact that advanced countries are facing the problem of population aging. The average value of the international financial integration index that is measured by the sum of total foreign assets and foreign liabilities over GDP is 6.43 for advanced economies during the sample period 1970–2010. This implies that the foreign investment stock includes FDI, equity and debt of advanced economies and is around 6 times the size of their GDP. However, the average value of financial integration for emerging market economies is 0.92 during the sample period.

Panels (a) and (b) of Figure 1 depict the average values of financial integration and foreign debt market integration (i.e., an alternative measure for financial integration), respectively, for advanced and emerging market economies over the sample period. We also display the average values of public saving rates (fiscal deficit to GDP) and government balance (including net capital transfer), respectively, in panels (c) and (d) of Figure 1 for both groups of countries. Both financial integration measures employed in our study exhibit divergence between advanced and emerging market economies, which is consistent with LMF (2007). Obviously, the average public saving rate does not show any trend in the two groups of countries. However, it appears to be overall higher in emerging market economies than in advanced countries over the sample period. Interestingly, in the late 1990s and the early 2000s when financial crises affected emerging market countries, the average public saving rate of emerging market economies became lower compared to that of advanced countries. Since the global financial crisis, the average public saving rate had plummeted for both groups of countries, particularly in advanced countries. The average value of government balance (over GDP) exhibits a similar pattern with the average public saving rate over the sample period. However, the average value of government balance to GDP (total balance) shows deficit during most of the sample period, which is lower than that of the average public saving rate (operating balance). Considering this difference, we subsequently compare the offset coefficients of the two subgroups according to the international financial integration index.

3.2 Results from the PSTR model

We consider the PSTR model for which the transition variable is the *de facto* international financial integration index. For the transition variable, we first test a linear specification of the international financial integration index against a specification with threshold effects. When the null hypothesis of linearity is rejected, we estimate the PSTR model to capture all nonlinearity or all coefficients' heterogeneity. The result of the linearity test is reported in Table 3. For the specification of the transition variable, we calculate the statistic for the likelihood ratio (LR) test. The linearity test dictates the rejection of the null hypothesis of linearity in the model, indicating that the international financial integration index is an appropriate transition variable. Table 3 reports the parameter estimates of the PSTR model.[11] The estimated slope parameter γ is relatively small, implying that the transition function cannot be reduced to the PSTR model. The estimated threshold level c of regime switching regarding the international financial integration index is 57.8 percent. The threshold level is a location parameter determining the midpoint of the transition between two extreme regimes. Given that the estimated parameter of public saving in the linear part is negative ($\beta_{01} = -1.249$) and that the estimated parameter of public saving in the nonlinear part is positive ($\beta_{11} = 0.643$), it reveals the threshold level of 0.578, below which the effect is negative, and above which the effect is still negative, but has a smaller magnitude.

Our main interest is the change in the offset coefficient estimate over time in the form of saving function specifications. As explained in González et al. (2005), based on PSTR specifications, we derive the private/public saving offset, which varies not only across countries but also over time. As the transition variable is individual-specific and time-varying, the regression coefficients for each of the individuals in the panel are changing over time. The time-varying offset coefficient is defined as a weighted average of two parameters, β_{01} and β_{11}. As such, the structural coefficients consist of linear and nonlinear parts because of the nonlinearity of the model. Therefore, the time-varying offset coefficient obtained from the PSTR model for the *i*th country at time *t* is given by

$$\beta_{it} = \frac{\partial s_{it}^{p}}{\partial s_{it}^{g}} = \beta_{01} + \beta_{11} G\left(z_{it}; \gamma, c\right), \tag{5}$$

[11] As suggested by one of the referees, we have also estimated the PSTR model in Equation (1) with the financial integration index being included as one of the explanatory variables. The estimation results confirm that our main results remain qualitatively unaltered.

where β_{01} is the parameter from the linear part of the model and β_{11} is the parameter from the nonlinear part. Since the transition function $G(z_{it};\gamma,c)$ is bounded between 0 and 1,

$$\begin{aligned} \beta_{01} &\leq \beta_{it} \leq \beta_{01}+\beta_{11} \quad \text{if } \beta_{11}>0 \\ &\text{or} \\ \beta_{01}+\beta_{11} &\leq \beta_{it} \leq \beta_{01} \qquad\quad \text{if } \beta_{11}<0. \end{aligned}$$

Based on the estimated PSTR model, Figure 2 (1) and (2) depict the time-varying offset coefficients for advanced and emerging market economies, respectively. In the figures, we divide the countries in our sample into three regional subgroups: (a) Asia, (b) Latin America, and (c) Europe. The estimated time-varying offset coefficients are all negative, and they range from -1 (full offset) to -0.6, implying that private saving is partially offset by public saving. For advanced economies, the degree of the offset for each country has gradually decreased over time except in the cases of Belgium and the United Kingdom, which display a constant pattern over time. Specifically, the two countries have exhibited a relatively low degree of the offset of -0.6 since around 1985. For the rest of the countries in the advanced group, the plots exhibit a similar pattern featuring small variations over time. For example, the saving offset coefficient of the United States was -0.97 in 1970 and -0.64 in 2010, implying that the degree of the offset has gradually decreased over time. For emerging market economies, the offset coefficients move within a narrower range than those of advanced economies. However, each time-varying offset coefficient in the emerging market economies exhibits a high level of volatility across countries. In particular, the degree of the offsetting effect has been reduced during financial crises, which implies that fiscal policy has been more effective during these periods. In the 1997–1998 Asian crisis, the private/public saving offset in Indonesia, Korea, Malaysia, the Philippines, and Thailand decreased, which means that the offset coefficient increased. Similarly, the offset in all three subgroups decreased after the global financial crisis.[12] For example, among the Latin American countries, Mexico showed that the degree of offset decreased during the 1994 financial crisis and the global financial crisis. Among the emerging European countries, Poland and Russia

[12]The finding that there was less crowding-out of advanced economies in recent years can also be supported by some previous studies that showed the higher fiscal multiplier of the advanced economies during the global financial crisis (see Christiano et al. (2011), Corsetti et al. (2012), and Pyun and Rhee (2015)).

show offset coefficients only after 1991 and 1993, respectively, because of data limitations. In Russia, the time-varying offset demonstrates its volatile nature despite the short sample period. In summary, while the private saving offset by public saving has gradually declined in advanced economies, it has remained relatively constant in emerging market economies.

To analyze the distinct pattern observed in Figure 2 (1) and (2), we calculate the average values for the two groups separately. Figure 3 displays the average values of the estimated time-varying offset coefficients from the PSTR model for both advanced and emerging market economies. Overall, the gap between the two offset coefficients has widened over time. This pattern holds since the average value of the offset coefficients for emerging market economies moves within a smaller range than for advanced economies. This suggests that fiscal policy has become more effective over time in advanced economies as international financial integration has intensified. We also implement a difference-in-means test for the offset coefficients between the two groups given in Figure 3. The null hypothesis that the means of the offset coefficient of the two groups are the same can be readily rejected at the 1 percent significance level with the t-statistic being 5.397. In the 1970s, there was not a substantial difference between the time-varying offset coefficients of the two groups, which were -0.96 and -0.88, respectively. However, in the 1980s and 1990s, the gap increased, and the average difference over the two decades was approximately 10.4 percent, while the difference in the offset coefficients between the two groups in the period of 2006–2010 was 16.3 percent on average. Furthermore, the average offset coefficients in this period were -0.63 in advanced economies and -0.79 in emerging market economies for the most recent five years. That is, the extent of the offset in emerging market economies appears to be, on average, approximately 16 percent greater than that in advanced economies.[13] This suggests that in recent years, fiscal policy has been relatively more effective in advanced economies than in emerging market economies, and this pattern is in accordance with the more financially integrated markets of the advanced countries.

[13]When we use the foreign debt integration index as a transition variable for a robustness check, as discussed in the next subsection, the extent of the offset in emerging market economies becomes, on average, approximately 20 percent greater than that in advanced economies.

3.3 Robustness check

In this subsection, we check the robustness of our empirical results from the PSTR model. For the transition variable, we also use another measure for the international financial integration index, the foreign debt market integration index between countries as defined in Equation (4). LMF (2007) state that another financial integration index based on portfolio equity and FDI stocks is similar to the index based on total assets and liabilities. This implies that using the equity and the FDI integration index should generate similar results to the baseline case when the international financial integration index is used. Therefore, we introduce a country's foreign debt holding, which is affected more by changes in the interest rates than are other financial market indices.

The results for the robustness check are reported in Table 4. Among the parameters estimated, β_{01} from the linear part of the model and β_{11} from the nonlinear part are our main focus since these two parameters, along with the estimated transition function, determine the time-varying offset coefficient as defined in Equation (5). When the foreign debt integration index is employed, the two estimated parameters are also statistically significant at the 1 percent level and are similar to those of the baseline case reported in Table 3. More specifically, using an alternative transition variable, we can see that β_{01} changes from -1.249 to -1.146, β_{11} changes from 0.643 to 0.477, and a similar transition function is estimated. The estimated time-varying offset coefficients exhibit a qualitatively similar pattern across the two country groups within a slightly narrower range than the baseline case and appear to confirm our main hypothesis that freer capital mobility through international financial integration implies that the offsetting effect becomes smaller in more financially integrated markets. The results are omitted to conserve space but are available from the authors on request.

4 Conclusion

We have analyzed the effect of fiscal policy on private saving with respect to the degree of international financial integration. The existing literature is controversial about the offset coefficient of public saving on private saving, not only in terms of whether the coefficient is -1, implying a full offset, but also in terms of whether it changes over time and which factors affect the variation

in the offset. Using the PSTR model, we provide evidence that the time-varying offset of private saving by public saving has been decreasing since 1980, which is closely related to the global trend for international financial integration. Moreover, the private saving offset by public saving exhibits a remarkably different pattern between advanced and emerging market economies. The saving offset for advanced countries have shown a gradually decreasing trend, particularly since 1980, and the degree of the private saving crowding-out of advanced economies is smaller than that of emerging market countries. However, it is observed that the private/public saving offsets in emerging market economies have been relatively constant over time. Furthermore, the emerging market offset coefficients appear to be more volatile during financial crises.

Our findings show that the fiscal crowding-out has been decreasing in the financially globalized world. The results imply that a country with a higher extent of global financial market integration enjoys a smaller saving offset. Because of the unprecedented global financial crisis, concerns have been raised over financial globalization, focusing on the negative consequences of international financial integration. However, with regard to the effectiveness of fiscal policy, increasing capital mobility throughout international financial integration implies that the effect of the offsetting is anchored at the level of the world interest rate; therefore, it becomes smaller in more financially integrated markets.

5 Appendix: Data sources and variable construction

In this appendix, we provide data sources and the methods to construct the various series used in the paper.

(1) Private saving rate: gross private savings over GDP. Source: The World Economic Outlook (WEO).

(2) Public saving rate: gross public savings over GDP. Source: The World Economic Outlook (WEO).

(3) Log of real per-capita GDP and real per-capita GDP growth rate: per-capita GDP is converted into constant US dollars, and the GDP per-capita growth is calculated based on the real term. Source: the World Development Indicator (WDI).

(4) Age dependency ratio, "young": the ratio of the population aged 0–14 to the population aged

15–64. Source: the World Development Indicator (WDI) and the United Nations Population Division (http://www.un.org/popin/data.html).

(5) Age dependency ratio, “old”: the ratio of the population aged over 65 to the population aged 15-64. Source: the World Development Indicator (WDI) and the United Nations Population Division (http://www.un.org/popin/data.html).

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Table 1: List of countries by group

Advanced economies (24)	Emerging market economies (23)	Other economies (48)	
Australia	Argentina	Algeria	Lao PDR
Austria	Brazil	Bahrain	Lebanon
Belgium	Bulgaria	Bangladesh	Libya
Canada	Chile	Bolivia	Madagascar
Denmark	China	Botswana	Mauritius
Finland	Colombia	Cameroon	Mongolia
France	Estonia	Costa Rica	Morocco
Germany	India	Cote d'Ivoire	Namibia
Greece	Indonesia	Cyprus	Nepal
Iceland	Israel	Czech Republic	Nigeria
Ireland	Republic of Korea	Democratic Republic of the Congo	Panama
Italy	Latvia	Dominica	Paraguay
Japan	Malaysia	Dominican Republic	Romania
Luxembourg	Mexico	Ecuador	Saudi Arabia
Netherlands	Pakistan	Egypt	Senegal
New Zealand	Peru	El Salvador	Seychelles
Norway	Philippines	Equatorial Guinea	Slovenia
Portugal	Poland	Gabon	Sri Lanka
Singapore	Russia	Gambia	Suriname
Spain	South Africa	Ghana	Trinidad and Tobago
Sweden	Thailand	Guatemala	Tunisia
Switzerland	Turkey	Iran	United Arab Emirates
United Kingdom	Venezuela	Kenya	Uganda
United States		Kuwait	Uruguay

Note. The numbers in parentheses indicate the number of countries in each group.

Table 2: Descriptive statistics

	(1) All		(2) Advanced		(3) Emerging market		(4) Other	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Private saving rate (%) [s^p_{it}]	18.02	8.69	20.85	6.27	18.66	7.95	15.89	9.76
Public saving rate (%) [s^g_{it}]	3.78	7.92	2.24	6.81	3.47	5.21	4.92	9.47
Log of real per-capita GDP [y_{it}]	8.18	1.48	9.85	0.44	7.80	1.00	7.39	1.28
Real per-capita GDP growth (%) [g_{it}]	2.13	4.60	2.09	2.62	2.66	4.72	1.86	5.43
Young-age dependency ratio [d^y_{it}] (% of working-age population)	53.42	22.60	31.16	6.85	54.97	18.13	66.64	20.36
Old-age dependency ratio [d^o_{it}] (% of working-age population)	11.89	6.97	20.38	4.47	9.81	5.05	7.67	3.69
International financial integration index [f_{it}]	2.94	14.50	6.43	26.48	0.92	0.54	1.93	4.27
Number of observations	3134		915		783		1436	

Note. S.D. denotes the standard deviation.

Table 3: Estimation results of the PSTR model based on the financial integration index

$$s_{it}^{p} = \mu_i + \beta_{01} s_{it}^{g} + \theta_{01} y_{it} + \delta_{01} g_{it} + \phi_{01} d_{it}^{y} + \omega_{01} d_{it}^{o} + \left[\beta_{11} s_{it}^{g} + \theta_{11} y_{it} + \delta_{11} g_{it} + \phi_{11} d_{it}^{y} + \omega_{11} d_{it}^{o}\right] G\left(z_{it}; \gamma, c\right) + u_{it},$$

where $G\left(z_{it}; \gamma, c\right) = \left(1 + \exp\left(-\gamma\left(z_{it} - c\right)\right)\right)^{-1}$ and $z_{it} = fi_{it}$.

Parameter estimates			
Linear part		Nonlinear part	
β_{01}	–1.249***	β_{11}	0.643***
	(0.050)		(0.120)
θ_{01}	0.107***	θ_{11}	–0.047***
	(0.010)		(0.006)
δ_{01}	0.308**	δ_{11}	–0.183
	(0.139)		(0.208)
ϕ_{01}	–0.188***	ϕ_{11}	0.063
	(0.033)		(0.062)
ω_{01}	–1.750***	ω_{11}	1.623***
	(0.141)		(0.207)
Transition parameters		Test statistic and p-value	
γ	1.229	LR	98.326
	(1.080)		(0.000)
c	0.578		
	(0.037)		
AIC	–5.950		
BIC	–5.931		
Number of obs.	3134		

Notes. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. Standard errors adjusted for heteroskedasticity are reported in parentheses below the corresponding parameters. The likelihood ratio (LR) test result for linearity using the financial integration index (fi_{it}) as a transition variable is reported. H_0: Linear model is tested against H_1: PSTR model with at least one transition variable. AIC and BIC denote the Akaike and the Bayesian Information Criteria, respectively.

Table 4: Robustness check using the debt market integration index as a transition variable

$$s_{it}^{p} = \mu_i + \beta_{01} s_{it}^{g} + \theta_{01} y_{it} + \delta_{01} g_{it} + \phi_{01} d_{it}^{y} + \omega_{01} d_{it}^{o} + \left[\beta_{11} s_{it}^{g} + \theta_{11} y_{it} + \delta_{11} g_{it} + \phi_{11} d_{it}^{y} + \omega_{11} d_{it}^{o}\right] G\left(z_{it}; \gamma, c\right) + u_{it},$$

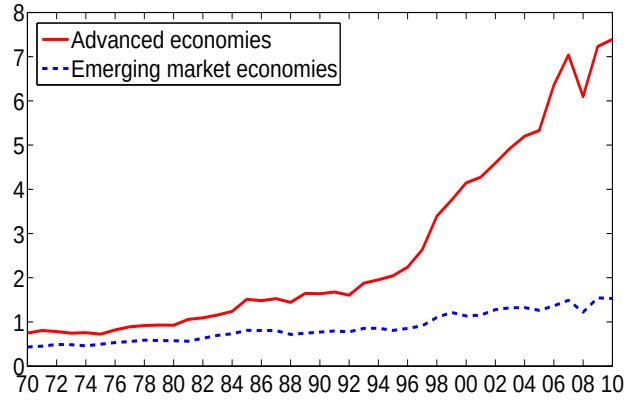
where $G\left(z_{it}; \gamma, c\right) = \left(1 + \exp\left(-\gamma\left(z_{it} - c\right)\right)\right)^{-1}$ and $z_{it} = di_{it}$.

Parameter estimates			
Linear part		Nonlinear part	
β_{01}	–1.146***	β_{11}	0.477***
	(0.036)		(0.106)
θ_{01}	0.094***	θ_{11}	–0.035***
	(0.009)		(0.006)
δ_{01}	0.284**	δ_{11}	–0.207
	(0.123)		(0.191)
ϕ_{01}	–0.126***	ϕ_{11}	0.037
	(0.028)		(0.051)
ω_{01}	–1.472***	ω_{11}	1.223***
	(0.143)		(0.214)
Transition parameters		Test statistic and p-value	
γ	2.095	LR	130.231
	(1.576)		(0.000)
c	0.546		
	(0.024)		
AIC	–5.932		
BIC	–5.912		
Number of obs.	3134		

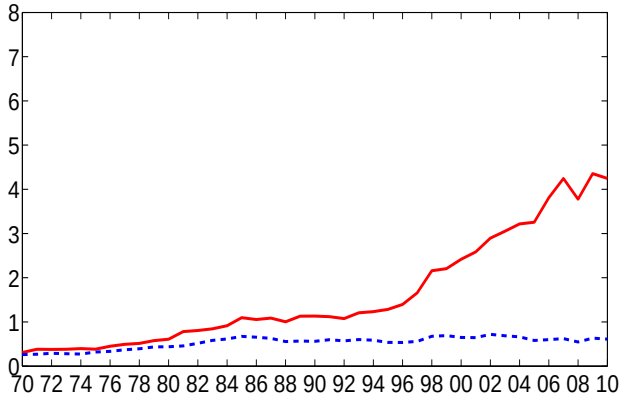
Notes. Same as Table 3. The likelihood ratio (LR) test result for linearity using the debt market integration index (di_{it}) as a transition variable is reported.

Figure 1: Average values of financial integration index, foreign debt market integration index, public saving rate and government balance for advanced and emerging market economies

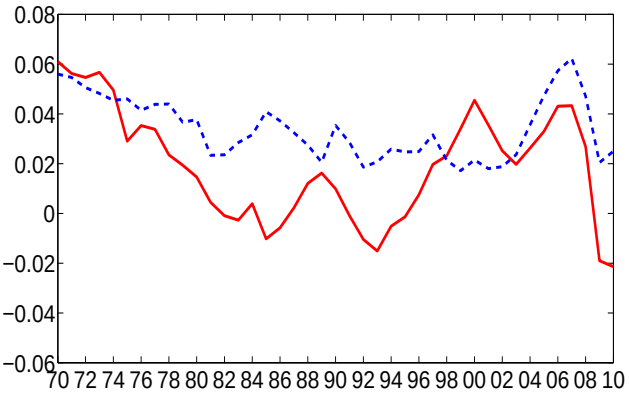
(a) Financial integration index



(b) Foreign debt market integration index



(c) Public saving rate (fiscal deficit to GDP)



(d) Government balance

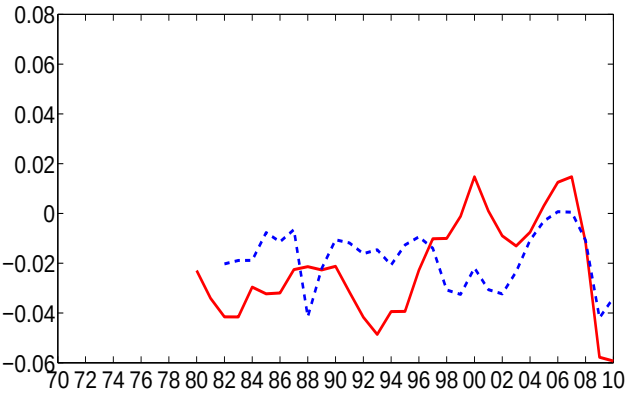


Figure 2: Estimated time-varying offset coefficients from the PSTR model based on the financial integration index–(1) Advanced economies

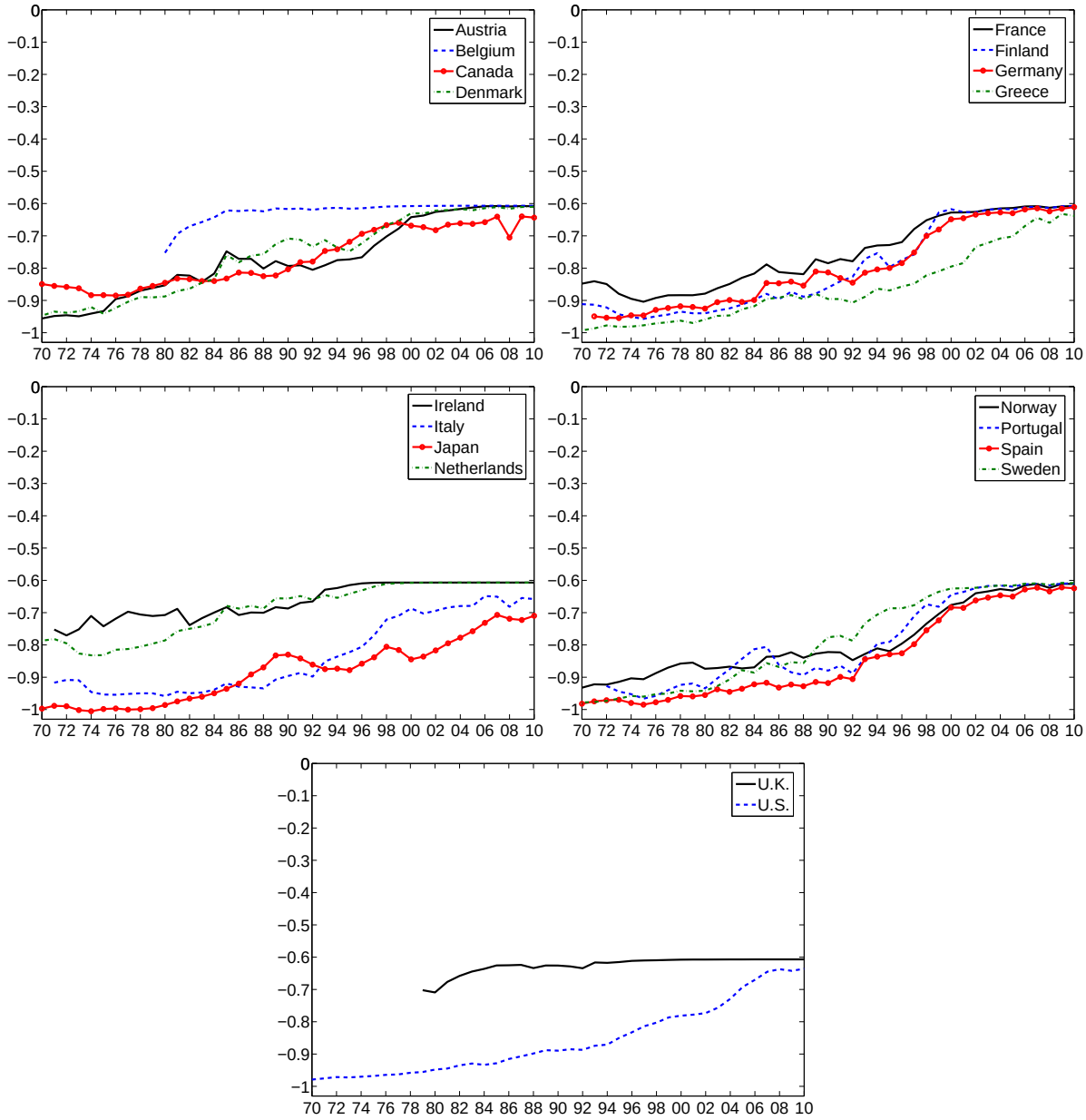
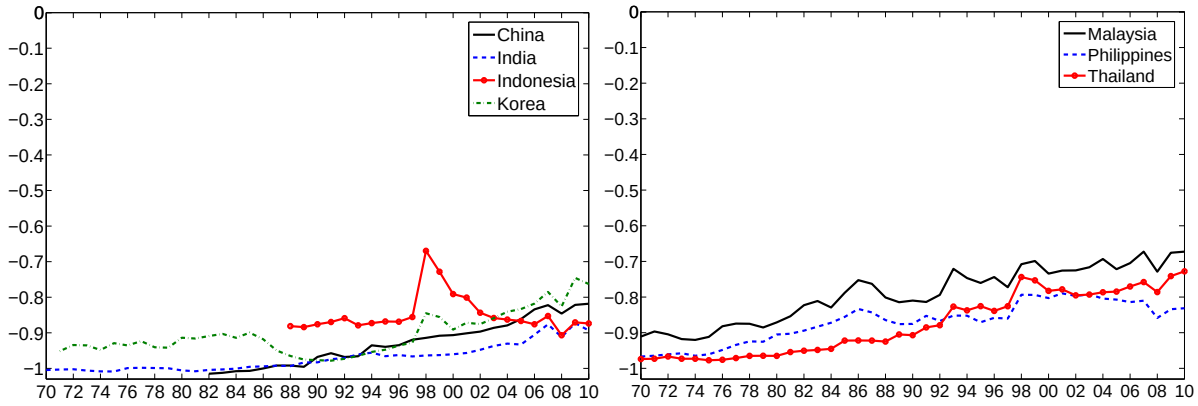
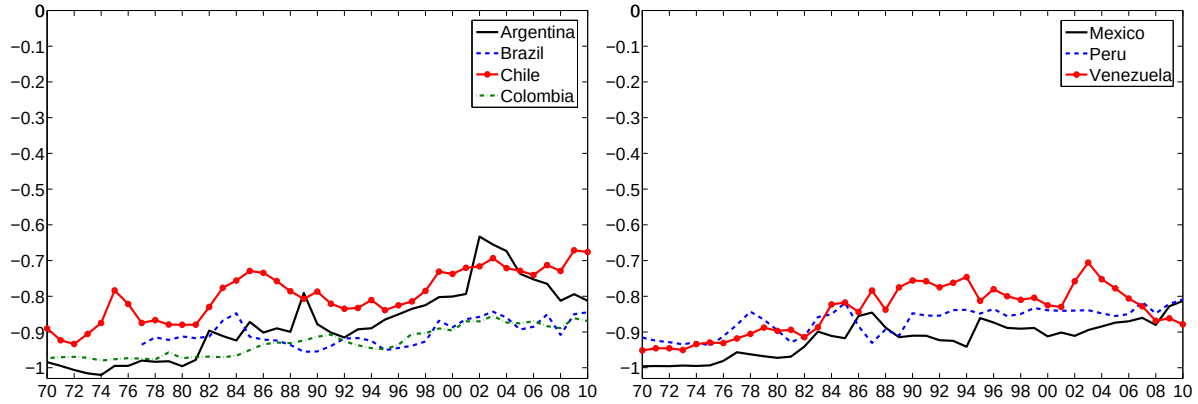


Figure 2: Estimated time-varying offset coefficients from the PSTR model based on the financial integration index–(2) Emerging market economies

(a) Asia



(b) Latin America



(c) Europe

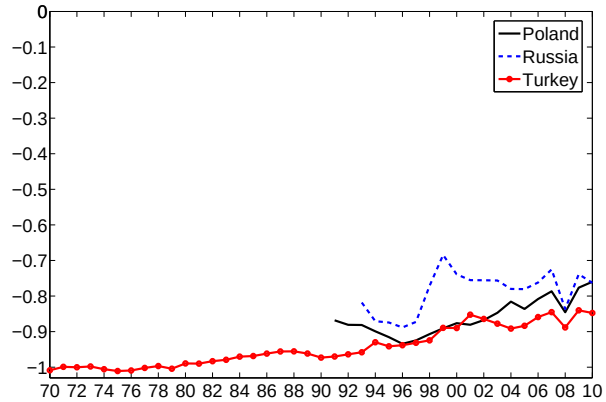


Figure 3: Average values of the estimated time-varying offset coefficients from the PSTR model– Advanced economies versus emerging market economies