



Exchange rate regimes and fiscal discipline: The role of trade openness



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ABSTRACT

This study revisits the relationship between exchange rate regime (ERR) choice and fiscal discipline focusing on the role of trade openness. The conventional theoretical view is that fixed regimes bring about more fiscal discipline, while the recent literature argues that flexible regimes are more disciplinary. Empirical studies have provided mixed evidence. Using a panel dataset for a large number of developing and developed countries, as well as pooled panel OLS and instrumental variables (IV) estimation techniques, we find support for both views. We document that a fixed ERR is disciplinary at low levels of trade openness, while a flexible regime produces a greater fiscal discipline above a certain level of trade openness. Moreover, this relationship applies to only developing countries. These findings remain robust across different measures of fiscal outcomes, a number of controls, across different sub-samples, and are supported by both annual and five-year averaged panel data.

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1. Introduction

High and persistent budget deficits and the resulting public debt have become a serious concern for many countries in recent years. The [International Monetary Fund \(IMF\) \(2011\)](#) reveals that the overall fiscal deficit in advanced countries stood at 7.6% of GDP in 2010. In a perhaps surprising contrast, the budget deficit in emerging market economies and low-income countries were comparatively lower, that is, 3.7% and 3% of GDP, respectively. On the other hand, the average public debt escalated to about 100% of GDP in advanced economies in 2010. The case of Greece where the public debt reached as high as 143% of GDP, is well-known in both public and academic sphere. Although the average public debt in emerging countries was not very high, it was still 70% to 80% of GDP in countries like India, Brazil and Hungary. It is argued (see [Eichengreen, Feldman, Liebman, von Hagen, & Wyplosz, 2011](#); [Fatas, 2010](#)) that this surge in deficit and public debt across the world is not solely the result of the recent global financial crisis in 2008, but started much earlier, and reflects the failure of governments to accumulate large enough surpluses in good times.¹

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¹ As [Fatas \(2010, p 2\)](#) states, the 'surge in government debt among many OECD countries in recent years is a wake-up call for their government to increase fiscal discipline'.

The concern about a high and persistent budget deficit is mainly due to its impact on other parts of the economy. For example, an ‘aggressive use of discretionary fiscal policy’ induces macroeconomic instability, such as output volatility, which may, in turn, reduce economic growth (Fatas & Mihov, 2003, p 1440). Also, as the ‘twin deficit’ hypothesis posits, a persistent budget deficit may lead to a current account deficit. In this vein, [Bluedorn and Leigh \(2011\)](#) show that a decrease in the ratio of budget deficit to GDP by 1% is associated with a decrease in the ratio of current account balance to GDP by 0.6%. Thus, fiscal discipline and the factors that can bring in such discipline are an important research agenda for academics, policymakers and alike.

Against this backdrop, this study revisits the role of exchange rate regime (ERR) in fiscal discipline. Although the idea that ERR choice can discipline fiscal policy dates back at least to [Keynes \(1923\)](#),² considerable debate at the theoretical level remains as to which exchange rate regime, fixed or flexible, provides more fiscal discipline (see [Aghevli, Khan, & Montiel, 1991](#); [Frenkel & Goldstein, 1988](#) who favour fixed regimes, and [Tornell & Velasco, 1995, 2000](#) who favour flexible regimes). Existing empirical studies (e.g. [El-Shagi, 2011](#); [Fatas & Rose, 2001](#); [Hamann, 2001](#); [Kim, 2003](#); [Tornell & Velasco, 2000](#); [Vuletin, 2013](#)) investigating the direct effect of ERR on fiscal discipline also fail to provide a definitive answer.

In this paper, we argue that one reason for the inconclusive empirical evidence is that ERR's effect on fiscal outcomes may work through its interaction with other theoretically important variable(s). This possibility has generally been ignored in previous work. Motivated by this idea, we investigate the interaction effects of ERR and trade openness on fiscal discipline. In doing so, we disentangle the direct and interaction effects of the ERR on fiscal discipline.³

There are several arguments that can shed light on the interaction effect between trade openness and exchange rate regime in explaining the budget balance. The most straight-forward argument is related to the (real) shock channel. Trade openness is inherently associated with external shocks. By making countries more exposed to external shocks, greater trade openness imposes adverse pressures on budget balance (see [Cameron, 1978](#); [Combes & Saadi-Sedik, 2006](#); [Rodrik, 1998](#)). Given that flexible exchange rates have well-established shock absorbing role in the literature,⁴ it can thus be argued that shocks induced by greater trade openness can be mitigated by a flexible regime. This means that, where trade openness is higher, flexible regimes are expected to exert a positive impact on the budget balance. Other possible channels are discussed in [Section 2](#).

In our analysis, we use the *de facto* exchange rate regime classifications to proxy countries' exchange rate regime choice. Particular emphasis is placed on the *de facto* classification proposed by [Reinhart and Rogoff \(2004\)](#) that distinguishes as many as 14 different categories of exchange rate regimes.⁵ The categories are ordered on a scale of 1 to 14, where 1 refers to the least flexible regime and 14 to the most flexible. This index allows us to overcome the fixed *versus* flexible dichotomy typically faced by existing empirical studies. Our trade openness indicator is the standard measure of the share of trade in GDP. More specific contributions of this study are as follows. First, we examine whether the hypothesized interaction between ERR and trade openness differs between developing and developed countries. Second, in contrast to several other studies, we consider three fiscal policy related variables, which allows us to perform a comprehensive check of the robustness of our findings.⁶ These variables are the overall budget balance, the primary budget balance, and the government cash surplus. Third, unlike most other studies, we address the possible endogeneity of exchange rate regime choice and trade openness using instrumental variables (IV) estimation.

Our empirical analysis uses a panel dataset for a large number of developing and developed countries, covering the period from 1971 to 2010. We use pooled panel OLS as our benchmark estimation technique, and use instrumental variables (IV) estimation to account for the endogeneity that can potentially result from reverse causality. Both the OLS and IV results provide significant and robust evidence in support of the hypothesis that there is an interaction effect between ERR and trade openness that affects fiscal outcomes. However, this relationship is applicable only to developing countries, and not to developed countries, presumably because there is little variation in the ERR choice within developed countries. The findings reveal that there is a threshold level of trade openness, below which a fixed exchange rate regime provides fiscal discipline and above which a flexible regime has a disciplinary effect. Although this threshold varies across different measures of fiscal discipline, it is around 80% when fiscal discipline is measured with overall budget balance. These findings are supported by both annual and five-year averaged panel data, and remain robust across various measures of fiscal outcomes and to the use of a number of controls, including a country-specific recession dummy, the level of development, central bank independence, institutional quality, and a number of country-level fixed factors.

The above findings have important policy implications. For instance, our results suggest that Brazil, a relatively closed economy by the measure of ratio of trade to GDP, would probably improve its overall budget balance if it moved from its current flexible regime to a more fixed one. Conversely, the budget balance of a highly open economy like Singapore might deteriorate if the country abandoned, in a hypothetical scenario, its current flexible regime and embraced a fixed regime.

² [Keynes \(1923\)](#) considered the Gold Standard, a form of fixed exchange rate, as a way to ‘strap down the Ministers of Finance,’ who are always tempted to create budget deficits.

³ There is another strand in the empirical literature that examines the influence of ERR on fiscal consolidation by focusing on the size of the fiscal or government expenditure multiplier under alternative exchange rate systems (fixed and flexible), studying the system under which the negative effect of a government expenditure cut will be smaller (see [Born, Juessen, & Muller, 2013](#); [Ilzetzki, Mendoza, & Végh, 2011](#)). We, however, examine whether an appropriate choice of ERR could contain the budget deficit in the first place.

⁴ For example, [Friedman \(1953\)](#) made the argument that in the absence of nominal rigidity, flexible exchange rate regime acts as a shock absorber. The shock absorbing role of flexible exchange regimes is also empirically well-established (see [Broda, 2004](#)).

⁵ IMF has been publishing the exchange rate arrangements of its member countries since 1945. However, IMF's official or *de jure* classification, which is based on countries' announced regime choice, does not always reflect actual ERR (see [Calvo and Reinhart, 2002](#); [Reinhart & Rogoff, 2004](#)). This observation has resulted in a number of *de facto* classifications that are based on countries' actual behaviour rather than announced behaviour. Three major *de facto* classifications are [Reinhart and Rogoff \(2004\)](#); [Levy-Yeyati and Sturzenegger \(2005\)](#) and [Shambaugh \(2004\)](#) classifications.

⁶ Except for the study by [Fatas and Rose \(2001\)](#), all empirical studies have examined the effect of regime choice on only one or two fiscal variables.

The rest of the paper is organised as follows. Section 2 outlines the theoretical arguments. Section 3 discusses the data sources and provides some descriptive statistics. The empirical methodology is described in Section 4, which includes model specifications and estimation methods. Section 5 contains a detailed discussion of the results. Finally, Section 6 concludes.

2. Theoretical underpinnings

This section provides theoretical arguments regarding both the direct effect of ERR and the effect of the interaction between ERR and trade openness on fiscal discipline.

2.1. Exchange rate regime and fiscal discipline

The direct effect of exchange rate regimes on fiscal discipline is theoretically ambiguous. The conventional argument is that a fixed exchange rate regime provides more fiscal discipline; that is, it reduces the budget deficit (see *inter alia*, Aghevli et al., 1991; Frenkel & Goldstein, 1988; Chari & Kehoe, 2008 and Duttagupta & Tolosa, 2006). This is because fiscal authorities are inherently prone to generating budget deficits, and the fixed exchange rate regime limits central banks' ability to monetise the budget deficit (see Corden, 2002). The restriction imposed on the behaviour of the central banks by a fixed regime may require governments to contain the budget deficit.

The conventional view puts forward several other explanations regarding the direct and beneficial role of ERR in fiscal discipline. For example, Canavan and Tommasi (1997) argue that a fixed exchange rate regime can be treated as a credible promise from the government to the economy, and the fiscal policy should be compatible with the fulfilment of this commitment. A chronic budget deficit resulting from an imprudent fiscal policy will lead to a high domestic inflation and reserve loss if the deficit is monetised.⁷ In the event of high domestic inflation, the real exchange rate will appreciate if a fixed exchange rate is maintained, resulting in a loss of competitiveness and a higher trade deficit. The devaluation of a currency is then an option in order to maintain competitiveness, but this means breaking the fixed exchange rate promise, which can be economically costly (see Frankel, 2005). Further, the public can easily monitor exchange rate change and detect a 'broken promise' (Canavan & Tommasi, 1997). The breakdown of a peg may therefore be politically costly for the governments as well.⁸ Thus, it is argued that the economic and political costs of deficit-induced domestic inflation should lead the government or fiscal authority to refrain from pursuing a lax fiscal policy under a fixed regime. Putting forward a different channel, Hefeker (2010) develops a model to show that a credibly fixed exchange rate in a low inflation country can reduce corruption and improve the fiscal system.⁹ The reason is that, a credibly fixed regime implies a lower domestic inflation, which means a reduced scope for the government to generate seigniorage revenue. This will induce a country to fight against corruption and the 'looting' of the budget. This implies an improvement in the budget balance. Thus, the conventional view posits that fixed regimes are more disciplinary.

Conversely, Tornell and Velasco (1995, 2000) argues against the conventional view by positing that lax fiscal behaviour is costly under both fixed and flexible exchange rate regimes, but each regime differs with respect to the inter-temporal distribution of such costs. They argue that, under fixed regimes, lax fiscal policies result in either declining reserves or soaring debts, which will punish the policymakers when the situation becomes unsustainable in the future. By contrast, flexible regimes allow the consequences of imprudent fiscal policies to manifest themselves instantly through fluctuations in the exchange rate and the price level. The conclusion of their arguments is that "if inflation is costly for the fiscal authorities, then flexible rates — by forcing the costs to be paid up-front — can provide more fiscal discipline" (Tornell & Velasco, 2000, p. 401). Similarly, Ghosh, Gulde, and Wolf (2002) and Fatas and Rose (2001) argue that monetary policy becomes ineffective as a stabilisation tool under fixed exchange rate regimes and high capital mobility. Consequently, fiscal policy has to shoulder the entire burden of macroeconomic stabilisation, which implies that fiscal policy has to be larger and more responsive to business cycles under a fixed regime. Such a problem would not arise under flexible regimes, because monetary policy is an effective stabilisation tool.

Mimicking the afore-mentioned mixed theoretical views on the direct effect of ERR on fiscal discipline, the empirical literature has also produced conflicting results. For example, Kim (2003) finds support for the conventional view that fixed regimes have a stronger disciplinary effect on budget balance. Fatas and Rose (2001) show that, while a hard peg regime such as currency board has some disciplinary effects on fiscal policy, other hard peg regimes like multilateral currency union and dollarization fail to induce such discipline. Similarly, El-Shagi (2011), using new debt as a proxy for fiscal discipline, finds that adoption of a fixed regime initially reduces new debt, but that it gradually returns to the original level over time. In contrast, Hamann (2001) does not find any evidence that fixed regimes, when adopted as a nominal anchor, increase fiscal discipline. Tornell and Velasco (2000) provide evidence that flexible regimes are more disciplinary. Vuletin (2013) finds that flexible regimes are more disciplinary than fixed regimes, while the dual exchange rate system has the worst disciplinary effect.

⁷ The budget deficit can be inflationary even if a government finances it by issuing nominal bonds that are not indexed to the price level (Leeper & Walker, 2012).

⁸ See Edwards and Santaella (1993) for evidence on these costs.

⁹ Hefeker (2010) argues that this argument is applicable to countries where monetary policy dominates fiscal policy, central bank independence is absent, corruption is widespread, and inflation and aggressive government spending are pervasive. Therefore, this effect seems to be more relevant for developing countries.

2.2. Trade openness, exchange rate regime and fiscal discipline

We first begin by discussing the direct effect of trade openness on fiscal policy outcomes; we will explain the effect of its interaction with ERR afterwards. [Rodrik \(1998\)](#) and [Cameron \(1978\)](#) posit that countries that are more open are more vulnerable to external shocks or risks. A higher government expenditure can mitigate these risks by providing more social insurance. Thus, greater extent of shocks associated with greater trade openness is likely lead to a larger budget deficit. Similarly, [Combes and Saadi-Sedik \(2006\)](#) argue that there is a negative relationship between terms of trade instability and budget balance, particularly for developing countries. By exposing a country to more external shocks, greater trade openness can exacerbate this negative relationship. Further, [Combes and Saadi-Sedik \(2006\)](#) argue that greater openness increases income inequality, which then increases the demand for redistribution. However, the very weak tax base in countries with high inequality reduces a government's ability to collect taxes, resulting ultimately in a higher budget deficit. All of these arguments suggest that higher trade openness reduces the budget balance. By contrast, [Combes and Saadi-Sedik \(2006\)](#) mention a different mechanism in which trade openness may improve the budget balance. Higher levels of openness, by ensuring a greater competition in the product markets, may result in reduction in rent-seeking or corruption. This may, in turn, result in a higher budget balance given the reduced scope for waste in government expenditure and increased room for higher tax revenue.

The key point of interest in this paper is the role of the interaction between ERR and trade openness in budget balance. The theoretical arguments that can be linked to this interaction effect predict relationship that can go either direction. One argument, which is related to the mitigation of the adverse impacts of real shocks, points to a positive interaction effect. As mentioned earlier, the effect of trade openness on budget balance works mainly through the external shock channel. In this vein, flexible exchange rate regimes can act as a shock absorber, especially in the absence of nominal rigidity in prices and wages ([Friedman, 1953](#)). Elaborating on the shock-absorbing role of flexible regimes, [Broda \(2004\)](#) mentions that when real exchange rate or relative prices are altered by an external shock, automatic changes in the nominal exchange rates under flexible regimes make the necessary adjustment in the real exchange rate. The same is not the case under fixed exchange rate regimes. So, it can be argued that the effects of external shocks induced by greater trade openness can be mitigated by a flexible regime. In other words, the negative effect of greater trade openness on budget balance will be smaller under flexible regimes than it would otherwise be, suggesting such regimes will lower the budget deficit at higher levels of trade openness.

In another theoretical argument, [Magud \(2010\)](#) considers two scenarios, open economy and closed economy, and models which exchange rate regime, fixed or flexible, is a better shock absorber in each scenario. He posits that under flexible regimes, a negative shock will result in a real depreciation. This will reduce the domestic demand and firms' sales in the domestic market. An additional adverse effect of such real depreciation is that it will increase foreign-currency denominated debt, and thus, the external finance premium of the firms. This will hamper the ability of the firms to borrow capital from abroad. However, a real depreciation will also increase competitiveness of firms in foreign markets. In a relatively open economy where a large number of producers with tradable goods operate, this increased competitiveness will nearly offset the effect of a drop in domestic demand. Therefore, in a relatively open economy, flexible regimes will better absorb shocks than fixed regimes (where such a positive effect of increased competitiveness will be absent). By contrast, in a relatively closed economy where non-tradable goods dominate, fixed regimes are better shock absorbers because they do not allow real depreciation. Given that the non-tradable sector does not experience a higher debt burden or external finance premium in such a regime, fixed regimes are better able to absorb shocks in a closed economy. In summary, Magud's arguments predict that in relatively open countries, flexible regimes will act as a better shock absorber, leading to better budget balance, and when trade openness is low, fixed regimes will result in more fiscal discipline.

In a third argument that points to a positive interaction effect between ERR and trade openness, trade openness is beneficial in improving the budget balance under flexible exchange rate regime ([Aizenman & Jinjara, 2011](#)). In the case of adverse aggregate demand shocks, output decreases, but interest rate also decreases, causing exchange rate to depreciate. The resulting improved competitiveness increases the demand for net exports ([Aizenman & Jinjara, 2011](#)). Thus, when exchange rate depreciates, output gains in an open economy will be larger than the gains in a closed economy. Other things being equal, higher (or smaller decrease in) output levels imply higher tax revenue, which in turn means improved budget balance. Therefore, due to its demand switching role, trade openness under flexible exchange rate regime is expected to be helpful (or less detrimental) in balancing budget.

By contrast, a different argument predicts that the interaction of trade openness and (flexible) exchange rate may lead to greater budget deficit. This argument is based on open economy macroeconomic theory. The slope of the short-run Phillips curve (the amount of inflation associated with a unit increase in output) is positively related to trade openness. The reason is that unanticipated increases in the money supply lead to depreciation of the nominal (and real) exchange rate, raising the relative price of imports and inflation, and thus, restricting the increase in output associated with monetary expansion. These effects will be stronger in more open economies, as the slope of the Phillips curve is steeper with openness. To the extent that the exchange rate plays an important role in output and inflation dynamics, any positive correlation between openness and the Phillips curve slope is likely to be stronger among countries that follow flexible exchange rate regimes ([Bowdler, 2005](#)). Under this circumstance, fiscal stimuli intended to raise aggregate demand will be less effective; in other words, a larger fiscal stimulus is required to achieve a given output increase, which would deteriorate the budget balance.

Given all these arguments, it can be concluded that the interaction of trade openness and EER in influencing the budgetary situation can be either positive or negative. It is likely to be positive in the case of a real external shock, and negative in the

Table 1

Descriptive statistics of the main variables.

Variable	Obs.	Mean	Median	SD	Max	Min
Overall budget balance	1955	−3.79	−3.02	5.94	38.38	−31.72
Primary budget balance	1797	−1.03	−0.67	4.83	21.22	−30.77
Government cash surplus	2093	−1.85	1.84	4.70	62.18	−31.34
Exchange rate regime (RR)	2093	6.79	7	3.94	14	1
Exchange rate regime (SH)	2078	3.80	4	1.53	5	1
Exchange rate regime (LYS)	1457	2.22	2	1.22	4	1
Exchange rate regime (IMF)	2066	2.31	2	1.20	5	1
Trade openness	2093	79.92	67.90	45.88	299.55	9.93

Note: RR, SH and LYS refer to Reinhart and Rogoff (2004); Shambaugh (2004) and Levy-Yeyati and Sturzenegger (2005) classifications, respectively.

case of a monetary shock. Thus, there is a significant room for empirical analysis to shed light on the direction of the theoretically compelling arguments on the interaction effect.

3. Data and descriptive statistics

We exploit an annual panel data set for a large number of developing and developed countries over the period 1971 to 2010. We use three measures of budget balance: overall budget balance (BB), primary budget balance (PBB), and government cash surplus (Cashsur). The data for these variables are obtained from the Government Finance Statistics (GFS) of the (IMF). The overall budget balance and primary budget balance are available for 114 developed and developing countries for the period 1971 to 2000, while cash surplus data are available for a longer period, from 1971 to 2010.¹⁰ All the three variables are used as a proportion of GDP.

We utilise the *de facto* exchange rate classifications to proxy countries' ERR choice. We use three *de facto* classifications; those proposed by Reinhart and Rogoff (2004), Levy-Yeyati and Sturzenegger (2005), and Shambaugh (2004).¹¹ Among these, we focus mainly on the Reinhart and Rogoff (2004) categorization, as updated by Ilzetzki, Reinhart, and Rogoff (2008). This classification covers the longest periods for a large number of countries. The index has 14 categories that run from the least flexible to the most flexible regimes (see Table A.1 in the appendix for a list of these categories). Higher values of this index indicate more flexible regimes. Two other *de facto* classifications—Levy-Yeyati and Sturzenegger (2005) and Shambaugh (2004)—have four and five categories, respectively.¹² The main criticism of these two classifications is that they rely on IMF official exchange rate data.¹³ In contrast, Reinhart and Rogoff (2004) classification is based on parallel exchange rate market data.¹⁴

A possible alternative classification of exchange rate regimes is the IMF categorization. The IMF has been publishing the exchange rate arrangements of its member countries since 1945. This classification is based on countries' announced regime choices, and is known in the exchange rate choice literature as *de jure* categorization. It has been observed that countries' announced regime choices differ considerably from their actual regimes and as such, the *de jure* exchange rate regime classification could be misleading (see Calvo and Reinhart 2002; Reinhart & Rogoff, 2004). Although some authors put forward view that the drawbacks of the IMF classification are less severe (e.g., Ghosh et al., 2002), we prefer to use the *de facto* classifications in order to allow a better testing ground for the theoretical arguments. For example, if a country implements actually a flexible (fixed) regime but reports a fixed (flexible) regime, then the aforementioned theoretical channels may be misleadingly accepted or refuted. In other words, if an exchange rate regime is actually a flexible regime, then its shock absorbing role must be accommodated appropriately; otherwise, a *de jure* fixed regime might be mistakenly assigned the credit of shock absorption. Nevertheless, we use the IMF classification for a robustness check too. The trade openness is measured as the sum of exports and imports as a percentage of GDP. A complete list of all variables, with their definitions, availability and data sources, is provided in Table A.2 of the appendix.

Table 1 provides descriptive statistics of the key variables. Table 2 provides an idea about the associations between the fiscal variables, ERR classification by Reinhart and Rogoff (2004), and trade openness. The table presents the average fiscal balance across different exchange rate arrangements and at different levels of trade openness. It can be observed from the table that flexible regimes are associated with higher fiscal deficits, which is compatible with the conventional wisdom. In contrast, countries with low levels of trade openness exhibit higher fiscal deficits.

¹⁰ These fiscal policy related variables are constructed according to the GFS 1986 manual. We use this dataset because it provides data for a wide range of fiscal policy related variables for a large number of countries. The current GFS database reports data on fiscal variables according to the GFS 2001 manual, but provides fiscal balance data for a smaller number of countries and for fewer years.

¹¹ Since 1998, IMF also published a *de facto* classification. However, until mid-2000, the classification was mainly based on countries' announced behaviour. Since 2009, IMF has announced a 'revised classification system' (see Habermeier, Kokenyne, Veyrune, & Anderson, 2009).

¹² These variables are constructed by us using the categorical information provided in those studies. For example, in the case of Levy-Yeyati and Sturzenegger 2005 measure, their "five-way" classification is converted into an ordinal variable (the 'inconclusive' category is excluded). The same is done using the information on peg versus non-peg and types of peg in the case of Shambaugh (2004) classification.

¹³ As Rose (2012) states, these classifications (Levy-Yeyati and Sturzenegger 2005 and Shambaugh, 2004) 'distrust' IMF official classification, but rely on IMF official exchange rates.

¹⁴ It should be noted here that different *de facto* measures are constructed using different methodologies, and as such are not directly comparable.

Table 2

Association between fiscal variables and explanatory variables.

	Fixed regimes	Intermediate regimes	Flexible regimes	Low trade openness	Medium trade openness	High trade openness
Overall budget balance	−3.38 (5.28)	−3.68 (6.34)	−4.89 (5.51)	−4.17 (4.37)	−3.83 (5.21)	−2.83 (8.70)
Primary budget balance	−0.83 (4.47)	−1.08 (4.79)	−1.31 (5.21)	−1.71 (4.26)	−1.12 (4.48)	−0.19 (6.06)
Cash surplus	−1.15 (6.22)	−1.43 (5.44)	−3.06 (4.63)	−2.79 (3.84)	−1.85 (4.21)	−1.03 (5.93)

Note: For each variable in the left column, the first figures in the row show the average value of that variable in the sample, while the figures in parentheses are standard deviations. Low refers to the 25th percentile value or lower, high refers to the 75th percentile value or higher, and medium is between the 25th and 75th percentile value of trade openness. The fixed, intermediate and flexible exchange rate regimes represent the re-categorisation of the Reinhart-Rogoff 14-category fine classification for the purposes of this table. The fixed regimes include the hard pegs (categories 1 to 4) of the Reinhart-Rogoff classification, the flexible regimes include freely floating and freely falling (categories 13 and 14), and intermediate regimes cover all other categories in between.

Fig. 1 presents the conditional relationship between exchange rate regime choice and the overall budget balance at low and high levels of trade openness.¹⁵ The relationship is negative at lower levels of trade openness and positive when trade openness is high. Thus, these figures provide preliminary evidence that the relationship between ERR and the overall budget balance is likely to be different at different levels of trade openness, and suggest the possibility of an interaction between the two variables. Similar evidence is obtained when the primary budget balance and the cash surplus are considered as measure of fiscal discipline (see Fig. A1(a) and (b) in the Appendix). We examine this possible interaction effect in greater detail in the following sections.

4. Estimation strategy

4.1. Estimating equation

We specify the following equation in order to estimate the direct and interaction effects of ERR and trade openness on the budget balance:

$$Y_{it} = \beta_0 + \beta_1 \text{ERR}_{it} + \beta_2 \text{Open}_{it} + \beta_3 \text{ERR}_{it} * \text{Open}_{it} + \delta X_{it} + \eta_t + \varepsilon_{it} \quad (1)$$

where Y_{it} represents budget balance-related variables, ERR is the exchange rate regime choice, and Open refers to trade openness.

As explained in Section 2, the expected sign of β_1 is ambiguous. If $\beta_1 < 0$, the conventional view that fixed regimes provide more fiscal discipline holds. Alternatively, $\beta_1 > 0$ implies a support for the non-conventional view, in which case flexible regimes are associated with improved budget balance. The expected sign of β_2 , which represents the direct effect of trade openness on the budget balance, is also theoretically ambiguous. The expected sign of the coefficient of the interaction term β_3 is also uncertain for reasons discussed in Section 2, and is ultimately an empirical question. If β_3 has the same sign as β_1 , then the direct effect of ERR will be reinforced at higher levels of trade openness. On the other hand, if β_3 and β_1 have opposite signs, higher levels of trade openness will weaken the direct effect of ERR.

X_{it} is a vector of other controls that might have a direct bearing on fiscal outcomes. These controls include commonly used variables in the literature, including a country-specific recession dummy (à la Bruckner & Ciccone, 2011), log income *per capita*, central bank independence (CBI), and institutional quality. In some specifications, X_{it} also includes fixed factors such as a dummy variable for major oil exporting countries, a dummy for European Monetary Union (EMU) membership, four dummies that represent countries' major colonial origins, as well as an institutional indicator representing the level of democracy. The recession dummy captures the cyclical behaviour of the economy. Income *per capita* accounts for the idea that the budget balance may be affected by the level of development. The oil dummy takes into account the fact that these countries' excessive reliance on oil revenue may affect their budget balances. The EMU dummy is intended to account for the common currency among member countries and the restrictions placed on them to maintain fiscal discipline. Institutional factors are important determinants of fiscal deficit. CBI reflects the fact that a highly independent central bank would have the power to resist the propensity to monetise extravagant government expenditure, thus introducing a greater fiscal discipline. We also use the democracy score, measured with the Polity2 variable, and four colonial origin dummies to capture the quality of governance and macro-political history of countries. The institutional quality should ideally cover labour and social policy arrangements, such as a welfare system, unemployment benefits and public medical insurance, which may have important bearings on the government budget. Detailed panel data on such arrangements are unfortunately not available for a large panel of countries. However, we believe that the level of development would account for such labour and social policy domain, albeit imperfectly.¹⁶ η_t represents year dummies that capture common shocks that are faced by all countries in different years. Finally, ε_{it} is an error term, which follows the standard Gaussian assumptions.

¹⁵ To construct this figure, we regress the overall budget balance on the trade openness, the central bank independence, the income level, institutional quality (Polity2), a country-specific recession dummy, a major oil exporting country dummy, and four colonial origin dummies, and obtain the budget balance residuals. Similarly, ERR (Reinhart & Rogoff, 2004 classification) is regressed on the same set of variables and the residuals are obtained (see Aghion et al., 2009).

¹⁶ Labour and social policies would constitute an omitted variables problem if, after controlling for an array of variables, they are still correlated with the interaction effect proposed in this paper as well as the budget deficit at the same time. If such policies are orthogonal to this interact effect, then our inability to measure these policies would only lead to a lower R^2 .

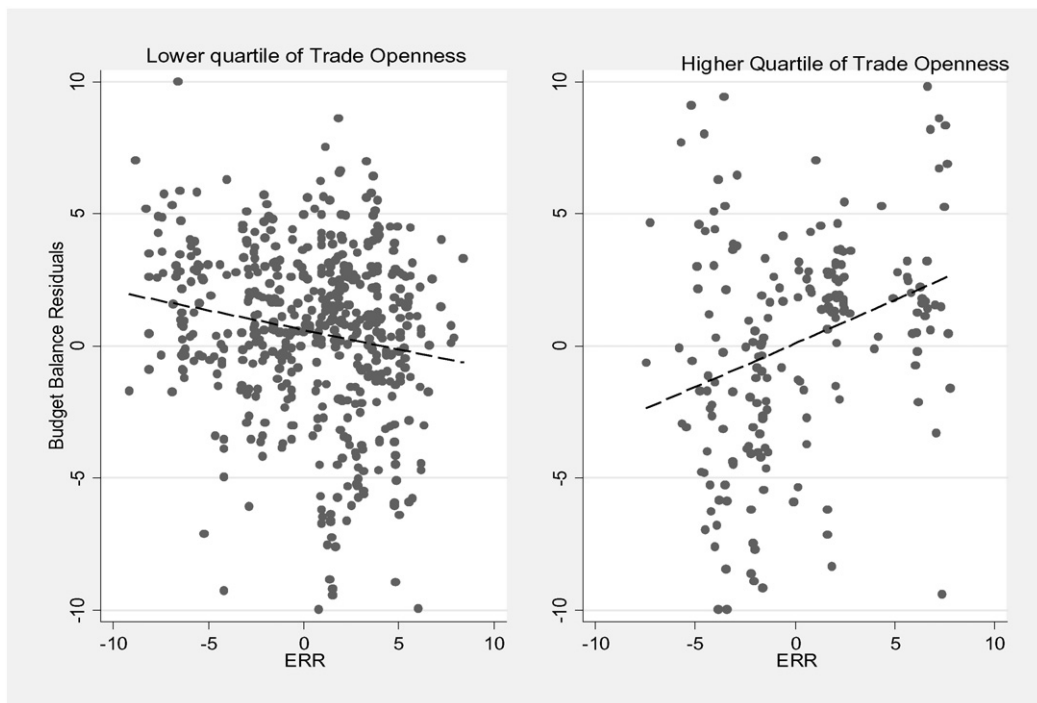


Fig. 1. Exchange rate regime choice, trade openness and the overall budget balance.

According to Eq. (1), the marginal effect of ERR on fiscal outcomes is the partial derivative of fiscal outcomes with respect to ERR, i.e., $\frac{\partial y_{it}}{\partial ERR_{it}} = \beta_1 + \beta_3 * Open$. We calculate the marginal effects of ERR at different levels of trade openness. We obtain the corresponding standard error of each marginal effect using the delta method, and examine the significance of each marginal effect by constructing upper and lower bounds for a confidence interval. Finally, we present all marginal effects in graphical form, along with their confidence intervals.

4.2. Estimation method

Our main analysis is based on annual panel data. We estimate Eq. (1) both with the full sample and separately with developing and developed country subsamples. The split of the full sample into developing and developed countries allows us to examine whether the relationship varies across different levels of development.¹⁷ We also use five-year average panel data and estimate the specifications as an additional robustness check.

We treat the ERR as a continuous variable. For Reinhart and Rogoff (2004) classification with 14 distinct categories, this can be justified as follows. Very often, countries make up their exchange rate regimes based on a set of exchange rate arrangements among a continuum of policy choices. The *de facto* classification of Reinhart and Rogoff (2004) categorises this spectrum into 14 groups. If the exchange rate arrangements of two countries differ only slightly, they are likely to be allocated to the same group. To be allocated to different groups, they must have made sufficiently different policy choices. Thus, the question is whether these 14 groups are ordinal variables, or continuous variables rounded to integers. Even if one views these categories as ordinal, the use of 14 different regimes makes the underlying categorization almost indistinguishable from a continuous measure (other empirical studies that have considered Reinhart and Rogoff's ERR classification as a continuous variable include those of Chowdhury, Bhattacharya, Mallick, & Ulubasoglu, 2014; Chowdhury, Bhattacharya, Mallick, & Ulubasoglu, 2015; Magud, Reinhart, & Vesperoni, 2012, and Aghion, Bacchetta, Ranciere, & Rogoff, 2009).¹⁸ In a similar vein, we treat the other *de facto* and IMF's *de jure* classifications as continuous variables.¹⁹

¹⁷ We follow the United Nations' convention in categorising developing and developed countries (see UN, 2012).

¹⁸ Furthermore, several other measures in the literature that are constructed in a similar way have also been treated as continuous. For instance, Polity IV indicators, Freedom House political rights and civil liberties measures, and corruption indexes are often used as continuous explanatory variables on the right hand side.

¹⁹ It can be recalled that these classifications are not as *fine* (do not have as many categories) as Reinhart and Rogoff (2004) classification. Nonetheless, they provide an important robustness check of our results.

4.2.1. Pooled OLS estimation

The fixed effects estimation of Eq. (1) provides altogether insignificant estimates because one of the main explanatory variables in the equation, ERR, changes very little over time for many countries. Most of the variation in ERR comes from variations across countries. Therefore, our benchmark estimation is pooled OLS using year dummies (common time effects), with the standard errors clustered at the country level.

In estimating Eq. (1), possible endogeneity as a result of reverse causation from a fiscal outcome to an exchange rate regime choice may be a concern. This reverse causality may arise, for example, if a country that is experiencing a higher budget deficit adopts a particular exchange rate regime in order to ensure the fiscal discipline that the regime will provide. Trade openness may also be endogenous in that a 'fiscal contraction' (i.e., a reduction in budget deficit) will result in a depreciation in the real exchange rate, and thereby, may affect trade (Bluedorn & Leigh, 2011, p. 583). In order to mitigate the endogeneity problem to some extent, we primarily use a one-period lag of all explanatory and control variables (except for that of the recession dummy).

4.2.2. Instrumental variables (IV) estimation

To address the endogeneity problem more formally, we adopt the instrumental variables estimation. We resort to previous studies (Harms & Kretschmann, 2009; Levy-Yeyati & Sturzenegger, 2003) in order to find suitable IVs for ERR. Ultimately, we select two sets of IVs for ERR. The first set contains an average exchange rate indicator of a country's neighbours, or the regional exchange rate indicator, and the ratio of a country's GDP to US GDP (see Levy-Yeyati & Sturzenegger, 2003).²⁰ The relative GDP chiefly reflects the relative size of an economy, which is an important determinant of ERR choice. The second set of instruments aims to check the robustness of the first set where we retain neighbours' exchange rates and replace the relative GDP with the population size (see Harms & Kretschmann, 2009).²¹

On the other hand, trade openness is instrumented with the predicted changes in bilateral trade owing to *foreign* natural disasters, as proposed by Felbermayr and Groschl (2013). Foreign natural disasters are clearly exogenous to a country's budget balance, and are most likely to affect a country's fiscal discipline through trade links. Despite the relevant and exogenous instruments, we sometimes run into a weak instruments problem in our estimation, as shown in the first stage results. Consequently, we estimate our IV models using the instrumental-variables limited information maximum likelihood (IV-LIML) method, which is robust to weak instruments.

Finally, we conduct a sub-sample analysis. Along this line, we estimate Eq. (1) using pooled panel OLS, omitting different regions of the world one by one, such as Sub-Saharan Africa (SSA), Latin America (LA), Middle East and North Africa (MENA), and Eastern Europe and Central Asia (EECA). Moreover, we run regressions excluding country groups such as EMU and major oil exporting countries, which differ significantly in their openness and fiscal stance. By omitting regions or country groups, this analysis accounts for the group-specific unobserved characteristics of the eliminated region or group, and aims to alleviate the endogeneity due to omitted variables in a different way.

5. Estimation results

We now turn to estimation results of Eq. (1). First, we present the results with the Reinhart and Rogoff (2004) classification, our preferred *de facto* ERR measure.

5.1. OLS results with annual data

Table 3 presents the benchmark pooled OLS regression results of Eq. (1) for the full, developing and developed country samples and with the overall budget balance as the dependent variable. Column 1 shows the regression results by including a common time effect (year dummies) but excluding controls. It can be seen that the direct effect of ERR is estimated with a negative coefficient, and is highly significant at the 1% level. The direct effect of trade openness is insignificant, with a negative coefficient. However, the interaction between ERR and trade openness is estimated with a positive coefficient and is significant at the 5% level, suggesting that the effect of ERR on the budget balance depends on the level of trade openness.

The inclusion of time-varying controls such as the central bank independence, a country-specific recession dummy, institutional quality variable (Polity2) and the level of development does not alter the signs of the estimated coefficient (column 2). In addition, the coefficients of both ERR and its interaction with openness are now significant at the 1% level. The coefficient of trade openness also becomes significant at the 5% level. Column 3, which includes time varying controls as well as some fixed factors such as a dummy for major oil exporting countries, EMU country dummy and four dummies for colonial origin, is the full specification with the full sample. The results show that the signs of the estimated coefficients are consistent with those in columns 1 and 2, and that the coefficients of both ERR and the interaction term are highly significant.

In order to investigate whether the effects of ERR, trade openness and their interaction on the budget balance differ between developing and developed countries, we estimate the full specification separately for developing and developed countries. The results are reported in columns 4 and 5 for developing and developed countries, respectively. Column 4 shows that the signs and significance of the coefficients of both ERR and the interaction term are quite consistent with those in column 3. By contrast, none

²⁰ The regional exchange rate may indicate explicit or implicit exchange rate coordination with countries that typically share strong trade links, as the trade literature has profusely illustrated through the use of gravity models' (Levy-Yeyati & Sturzenegger, 2003, p. 1185).

²¹ The population size and the relative GDP are highly correlated.

Table 3

Exchange rate regime choice, trade openness and the overall budget balance: pooled panel OLS estimation (annual data).

Sample	(1)	(2)	(3)	(4)	(5)
	Full	Full	Full	Developing	Developed
Variables					
ERR (RR)	−0.294*** (0.110)	−0.415*** (0.120)	−0.443*** (0.116)	−0.582*** (0.134)	−0.062 (0.184)
Open	−0.010 (0.015)	−0.040** (0.020)	−0.033* (0.019)	−0.035 (0.023)	0.001 (0.031)
ERR(RR) * open	0.003** (0.001)	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.002)	0.003 (0.003)
Time-varying controls	No	Yes	Yes	Yes	Yes
Fixed factors	No	No	Yes	Yes	Yes
Observations	1940	1591	1574	993	581
R ²	0.082	0.182	0.261	0.332	0.285
No. of countries	114	89	87	58	29

Note: The dependent variable is the overall budget balance. Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regression for the developing countries sample does not include the EMU dummy. All of the variables except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Reinhart and Rogoff \(2004\)](#) classification.

*** $p < 0.01$.** $p < 0.05$.* $p < 0.1$.

of the coefficients is significant when the regression is run with the developed countries sample (column 5). The significance of the negative coefficient of ERR and the positive coefficient of the interaction term in column 4 indicates that the findings hold only for the developing countries.

We next estimate the full model using two other measures of fiscal discipline as the dependent variable, namely the primary budget balance and the cash surplus. The estimation results using the full sample and the developing and developed country subsamples for each measure are reported in [Table 4](#). The results are qualitatively similar to those for the overall budget balance. To reiterate, the coefficients of ERR and the interaction term are negative and positive, respectively, and both are highly significant, while the coefficient of trade openness is negative but largely insignificant (columns 1 and 4). Further, the results hold strongly for the developing countries sample only (columns 2 and 5).

The robust results of the negative sign of the coefficient of ERR and the positive sign of the interaction term can be interpreted as follows. Taken alone, the negative coefficient of ERR signals that the budget balance improves (deteriorates) as countries move towards fixed (flexible) regimes. This finding provides qualified support for the traditional view that fixed regimes are associated with better fiscal discipline. However, the positive coefficient of the interaction term between ERR and trade openness suggests that the disciplinary effect of fixed regimes is weakened at higher levels of openness, and flexible regimes may become disciplinary at when trade openness is high.

The result that fixed regimes are disciplinary when trade openness is low can be explained as follows. When trade openness is low, countries do not need to worry too much about the negative consequences of external shocks. As a consequence, they can do without a shock absorber (flexible regime). Therefore, fixed regime may act as a nominal anchor for inflation and tie the hands of the government not to generate excessive fiscal deficits. This supports [Keynes \(1923\)](#) original idea and the conventional view

Table 4

Exchange rate regime choice, trade openness and the primary budget balance and cash surplus: pooled panel OLS estimation (annual data).

Dep. variables	Primary budget balance			Cash surplus		
Sample	(1)	(2)	(3)	(4)	(5)	(6)
	Full	Developing	Developed	Full	Developing	Developed
Variables						
ERR (RR)	−0.319**** (0.097)	−0.420*** (0.115)	−0.121 (0.145)	−0.337*** (0.096)	−0.444*** (0.116)	−0.032 (0.178)
Open	−0.015 (0.012)	−0.022 (0.015)	0.006 (0.009)	−0.005 (0.013)	−0.005 (0.014)	0.006 (0.031)
ERR(RR) * open	0.004*** (0.001)	0.005*** (0.001)	0.004* (0.002)	0.003*** (0.001)	0.004*** (0.001)	0.001 (0.003)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1460	891	569	1751	1115	636
R ²	0.338	0.377	0.335	0.265	0.347	0.257
No. of countries	86	57	29	92	60	32

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regressions for the developing countries sample do not include the EMU dummy. All of the variables except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Reinhart and Rogoff \(2004\)](#) classification.

*** $p < 0.01$.** $p < 0.05$.* $p < 0.1$.

Table 5

Exchange rate regime choice, trade openness and the budget balance: pooled panel IV estimation (annual data).

Dep. variables	Overall budget balance			Primary budget balance			Cash surplus		
Sample	(1) Full	(2) Developing	(3) Developed	(4) Full	(5) Developing	(6) Developed	(7) Full	(8) Developing	(9) Developed
Variables									
ERR (RR)	−1.958 (1.320)	−2.261** (0.962)	−0.685 (1.639)	−1.654** (0.840)	−1.370*** (0.373)	−0.147 (0.639)	−2.401 (2.529)	−1.607*** (0.590)	−2.249 (1.859)
Open	−0.231* (0.122)	−0.261*** (0.090)	0.001 (0.100)	−0.179*** (0.062)	−0.162*** (0.041)	−0.016 (0.041)	−0.104 (0.158)	−0.153* (0.084)	−0.098 (0.131)
ERR(RR) * open	0.026** (0.013)	0.029*** (0.009)	−0.003 (0.009)	0.021*** (0.007)	0.019*** (0.004)	0.007 (0.005)	0.012 (0.015)	0.019** (0.009)	0.001 (0.011)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1523	939	584	1502	857	645	1611	989	622
No. of countries	84	55	29	1419	847	572	86	54	32
Hansen test	0.89	0.33	0.44	0.77	0.72	0.76	0.50	0.12	0.64
p-value									

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regressions for the developing countries sample do not include the EMU dummy. All of the controls except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Reinhart and Rogoff \(2004\)](#) classification.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

about the ERR's disciplinary effect. This finding is also compatible with [Hefeker \(2010\)](#) on the role of fixed regime in improving budget balance. By contrast, when trade openness is high, moving towards more a flexible regime introduces more fiscal discipline. The reason for this may be that adopting flexible regimes acts as a buffer against possible external shocks induced by high openness, as argued by [Magud \(2010\)](#). As flexible regimes bear some of the burden of external shocks, government fiscal policy or expenditure has to shoulder less of the negative consequences of external shocks.

The reason for the relationship not holding for developed countries is not immediate. One econometric reason can be that there is little variation among developed countries in terms of their openness and exchange rate regime choice to produce significant coefficients. The little variation may stem from the fact that developed countries are already very open and have already made their ERR choice to either fully flexible or hard fixed regimes. Consequently, their ERR choice cannot exert any significant effect on their fiscal policy. Moreover, social issues may be more influential in determining the fiscal discipline in those countries than economic variables.

In the following sub-sections, we examine whether the above results also hold with IV estimation, other sub-samples and five-year averaged panel data.

5.2. Instrumental variable estimation results with annual data

We first discuss the first stage (FS) results for both the endogenous variables, namely ERR and trade openness, and then present the second-stage results.

5.2.1. First stage results

[Table A.3](#) in the appendix presents the FS regressions for ERR and trade openness. Column 1 in the table shows that the relative GDP and neighbours' average ERRs are significant predictors of a country's ERR when fiscal discipline is measured with the overall budget balance. Satisfying the rule of thumb, the first stage F-statistic is also greater than 10. When fiscal discipline is measured with the primary budget balance and the cash surplus, the F-statistics drops below 10 (column 2 and 3), suggesting that the respective second-stage results may suffer from weak instruments. Similar conclusions can be derived when the second set of IVs, i.e., the population size and neighbours' average ERRs, are used (columns 4–6). However, both sets of IVs are valid, as the p -values of the Hansen over-identification test show. On the other hand, foreign natural disaster is a strong IV for a country's openness (columns 7–9). The coefficient is highly significant with a positive sign for all three measures of budget balance. The first-stage F-statistics are between 8.3 and 14.5. As indicated before, given that we obtain mixed evidence regarding the strength of the IVs for both endogenous variables, we estimate the IV regressions with the IV-LIML technique.²²

²² We have also estimated Eq. (1) with instrumental-variables two-stage least squares (IV-2SLS). The results, which are available upon request, are consistent with the LIML results.

Table 6

Exchange rate regime choice, trade openness and the budget balance: sub-sample analysis – pooled panel OLS estimation (annual data).

Dep. variables	Overall budget balance				Primary budget balance				Cash surplus			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Excluded sample	SSA	LA	MENA	EECA	SSA	LA	MENA	EECA	SSA	LA	MENA	EECA
Variables												
ERR (RR)	−0.493*** (0.133)	−0.361*** (0.124)	−0.392*** (0.123)	−0.460*** (0.119)	−0.371*** (0.111)	−0.303*** (0.112)	−0.226** (0.095)	−0.335*** (0.101)	−0.405*** (0.101)	−0.275** (0.110)	−0.290*** (0.095)	−0.318*** (0.099)
Open	−0.047** (0.020)	−0.009 (0.015)	−0.035 (0.022)	−0.038* (0.020)	−0.024* (0.013)	−0.006 (0.012)	−0.008 (0.013)	−0.017 (0.013)	−0.014 (0.014)	0.005 (0.013)	−0.006 (0.014)	−0.008 (0.014)
ERR(RR) * open	0.007*** (0.002)	0.003** (0.001)	0.006*** (0.002)	0.006*** (0.002)	0.005*** (0.001)	0.003*** (0.001)	0.003** (0.001)	0.004*** (0.001)	0.004*** (0.001)	0.002** (0.001)	0.003*** (0.001)	0.004*** (0.001)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1406	1243	1405	1491	1325	1141	1315	1380	1626	1414	1547	1501
R ²	0.283	0.281	0.278	0.274	0.330	0.383	0.348	0.349	0.273	0.287	0.295	0.314
No. of countries	74	70	79	74	73	69	79	73	81	77	83	73

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. All of the variables except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Reinhart and Rogoff \(2004\)](#) classification. SSA: Sub-Saharan Africa, LA: Latin America, MENA: Middle East and North Africa, EECA: Eastern Europe and Central Asia.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

Table 7

Exchange rate regime choice, trade openness and the budget balance: pooled panel OLS estimation (five-yearly data).

Dep. variables	Overall budget balance			Primary budget balance			Cash surplus		
Sample	(1) Full	(2) Developing	(3) Developed	(4) Full	(5) Developing	(6) Developed	(7) Full	(8) Developing	(9) Developed
Variables									
ERR (RR)	−0.446*** (0.160)	−0.582*** (0.185)	−0.060 (0.226)	−0.211* (0.109)	−0.282** (0.126)	0.013 (0.219)	−0.192* (0.108)	−0.276** (0.123)	−0.144 (0.215)
Open	−0.039 (0.027)	−0.041 (0.031)	−0.019 (0.031)	−0.010 (0.016)	−0.016 (0.018)	0.014 (0.023)	0.002 (0.015)	0.004 (0.015)	−0.016 (0.032)
ERR(RR) * open	0.006** (0.003)	0.007** (0.003)	0.007* (0.004)	0.004** (0.001)	0.004** (0.002)	0.003 (0.003)	0.003** (0.001)	0.003** (0.001)	0.002 (0.003)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	317	203	114	298	185	113	357	239	118
R ²	0.286	0.330	0.367	0.381	0.414	0.397	0.321	0.362	0.471
Country	85	56	29	84	55	29	89	59	30

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regressions for the developing countries sample do not include the EMU dummy. All of the variables except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the *Reinhart and Rogoff (2004)* classification.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

5.2.2. Second stage results

We present the IV-LIML results for both the full sample and the developing and developed country sub-samples for the three measures of the budget balance (*i.e.*, the results corresponding to columns 3–5 of *Table 3*) in *Table 5*. Columns 1–3 present the results for the overall budget balance, columns 4–6 those for the primary budget balance, and columns 7–9 those for the cash surplus. Column 1 shows that the signs of the estimated coefficients of ERR, trade openness and the interaction terms are consistent with the OLS results, with the coefficients of trade openness and the interaction term being significant at the conventional level.²³ Moreover, the coefficients are all larger in magnitude compared to the OLS estimates. Similar to the OLS results, column 2 shows that the results hold only for developing countries as we do not find any significant coefficient in the case of developed countries (column 3). The results using the primary budget balance and the cash surplus as the dependent variables are also consistent with these results (columns 4 to 9). Next, the regressions using the second set of IVs for ERR, namely the population size and neighbours' size weighted ERR. The results, presented in *Table A.4* in the appendix, are somewhat less robust in terms of the significance of the estimated coefficients, particularly when the dependent variable is the cash surplus. This may be due to the fact that the log population does not vary over time very much. Nonetheless, the results are broadly consistent with those in *Table 5*. Overall, the IV-LIML results presented in *Table 5* and in the appendix are generally supportive of the OLS results presented in *Tables 3* and *4*.

5.3. Different sub-samples with annual data

This section presents the pooled OLS results with different sub-samples. The main objective here is not only to address the region-specific omitted variable bias, but also to test the robustness of our results to variations in the sample. For this analysis, we consider the pooled OLS results with the full-sample as the benchmark (*i.e.*, column 3 of *Table 3*), and drop observations for each of the four regions mentioned in *Section 4.2* one by one. The results are presented in *Table 6* for each dependent variable.

Columns 1 to 4 present the results with the overall budget balance as the dependent variable. Column 1 excludes the SSA countries, column 2 excludes the LA countries, column 3 excludes the MENA countries, and finally, column 4 drops the EECA countries. The results show that excluding different regions from the full sample does not change our key conclusions. The evidence from the results with the primary budget balance (columns 4–8) and the cash surplus (columns 9–12) are also similar. We also run regressions excluding EMU member countries which differ significantly in terms of their trade openness and fiscal position. It appears that our results are not driven by this group of countries. Omission of major oil exporting countries also produces similar results.²⁴

As our results only hold generally for the developing countries sample, we next replicate *Table 6* with that sample (*i.e.*, column 4 of *Table 3*). The results obtained still hold (see *Table A.5* in the Appendix).

²³ The coefficient of ERR though not significant has a *t*-statistics of 1.50.

²⁴ These results are available upon request.

Table 8

Exchange rate regime choice, trade openness and the budget balance: pooled panel IV estimation (five-yearly data).

Dep. variables	Overall budget balance			Primary budget balance			Cash surplus		
Sample	(1) Full	(2) Developing	(3) Developed	(4) Full	(5) Developing	(6) Developed	(7) Full	(8) Developing	(9) Developed
Variables									
ERR (RR)	−2.613 (1.890)	−3.482** (1.456)	0.038 (0.723)	−2.201 (1.486)	−1.718*** (0.516)	−0.106 (0.518)	−1.686 (4.957)	−2.111 (2.008)	−1.829* (0.978)
Open	−0.272 (0.189)	−0.358** (0.153)	0.042 (0.057)	−0.208* (0.111)	−0.202*** (0.060)	−0.019 (0.030)	−0.085 (0.286)	−0.122 (0.118)	−0.119* (0.066)
ERR(RR) * open	0.030 (0.019)	0.038** (0.015)	−0.005 (0.009)	0.024** (0.012)	0.022*** (0.006)	0.008 (0.005)	0.011 (0.027)	0.016 (0.012)	0.007 (0.006)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	312	195	117	294	178	116	346	225	121
No. of countries	83	54	29	82	53	29	86	55	31
Hansen test p-value	0.77	0.46	0.48	0.29	0.98	0.63	0.222	0.101	0.692

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regressions for the developing countries sample do not include EMU dummy. All of the controls except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Reinhart and Rogoff \(2004\)](#) classification.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

5.4. Analysis with five-year average panel data

We have re-estimated the OLS and IV regressions using five-year average data for a further robustness check. The results are reported in [Tables 7 and 8](#), respectively, for all dependent variables. In general, the signs and significance of the coefficients support the results obtained using annual data. To reiterate, with five-year data, ERR has a significant negative coefficient and the interaction term has a significant positive coefficient. Once again, the results hold only for the developing countries. We have also conducted the sub-sample analysis with five-year data, and found that the results (not reported) are also consistent with the main findings of the study.

Table 9

Exchange rate regime choice, trade openness and the budget balance: pooled panel OLS estimation (annual data).

Dep. variables	Overall budget balance			Primary budget balance			Cash surplus		
Sample	(1) Full	(2) Developing	(3) Developed	(4) Full	(5) Developing	(6) Developed	(7) Full	(8) Developing	(9) Developed
Variables									
ERR (SH)	−0.418 (0.366)	−0.521 (0.401)	−0.613 (0.570)	−0.172 (0.298)	−0.159 (0.332)	−0.172 (0.518)	0.122 (0.444)	−0.120 (0.511)	0.272 (0.462)
Open	−0.015 (0.022)	−0.008 (0.024)	−0.032 (0.035)	−0.004 (0.014)	−0.003 (0.015)	0.012 (0.026)	0.024 (0.019)	0.023 (0.021)	0.021 (0.030)
ERR(SH) * open	0.008* (0.005)	0.008* (0.005)	0.011 (0.007)	0.006** (0.003)	0.006* (0.003)	0.003 (0.006)	0.001 (0.004)	0.003 (0.004)	−0.004 (0.005)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1678	1094	584	1554	980	574	1796	1154	642
R ²	0.219	0.259	0.282	0.306	0.324	0.320	0.251	0.302	0.303
No. of countries	90	61	29	89	60	29	92	60	32

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regressions for the developing countries sample do not include EMU dummy. All of the variables except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Shambaugh \(2004\)](#) (SH) classification.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

Table 10

Exchange rate regime choice, trade openness and the budget balance: pooled panel IV estimation (annual data).

Dep. variables	Overall budget balance			Primary budget balance			Cash surplus		
Sample	(1) Full	(2) Developing	(3) Developed	(4) Full	(5) Developing	(6) Developed	(7) Full	(8) Developing	(9) Developed
Variables									
ERR (SH)	−1.586 (2.616)	−2.760 (2.261)	−2.618 (4.361)	−0.776 (1.562)	−0.716 (1.361)	0.080 (3.110)	16.503 (19.083)	15.610 (24.913)	−2.792 (8.753)
Open	−0.170 (0.151)	−0.215 (0.134)	−0.099 (0.237)	−0.149** (0.065)	−0.135** (0.056)	−0.038 (0.166)	0.341 (0.404)	0.142 (0.340)	0.088 (0.313)
ERR(SH) * open	0.045 (0.034)	0.056* (0.030)	0.026 (0.055)	0.041*** (0.015)	0.037*** (0.013)	0.017 (0.039)	−0.060 (0.078)	−0.020 (0.071)	−0.027 (0.065)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1585	998	587	1474	898	576	1619	992	627
No. of countries	86	57	29	85	56	29	86	54	32
Hansen test p-val	0.75	0.56	0.54	0.55	0.53	0.75	0.90	0.76	0.55

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regressions for the developing countries sample do not include the EMU dummy. All of the controls except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the Shambaugh (2004) (SH) classification.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

5.5. Robustness to alternative exchange rate classifications

The results presented so far are based on Reinhart and Rogoff (2004) *de facto* classification. As a further robustness check we replicate all our regression results using the *de facto* classifications proposed by Shambaugh (2004) and Levy-Yeyati and Sturzenegger (2005). In Table 9 we present the OLS results when ERR is measured with the Shambaugh (2004) classification. The first three columns of Table 9 show the results when overall budget balance is the dependent variable. It is noticeable that the signs of the estimated coefficients conform to the previous results obtained with the Reinhart-Rogoff classification. The direct effect of ERR, though not significant at the conventional level, has *t*-statistics greater than one. The interaction effect is significant for the full and developing countries sample at 10% (column 2). No coefficient is significant (and *t*-statistics are also very small) when developed country sample is considered (column 3). Similar patterns are observed when primary budget balance is the dependent variable (columns 4–6). However, when cash surplus is considered we do not find any significant coefficients (columns 7–9). The IV results corresponding to Table 9 confirm the OLS results (see Table 10).

In unreported regressions, the results are similar when Levy-Yeyati and Sturzenegger (2005) *de facto* classification and IMF's *de jure* classification are used as measures of ERR. Overall, the results with these two measures of ERR are less robust in terms of the significance of the coefficients but support the general conclusions of the paper.²⁵

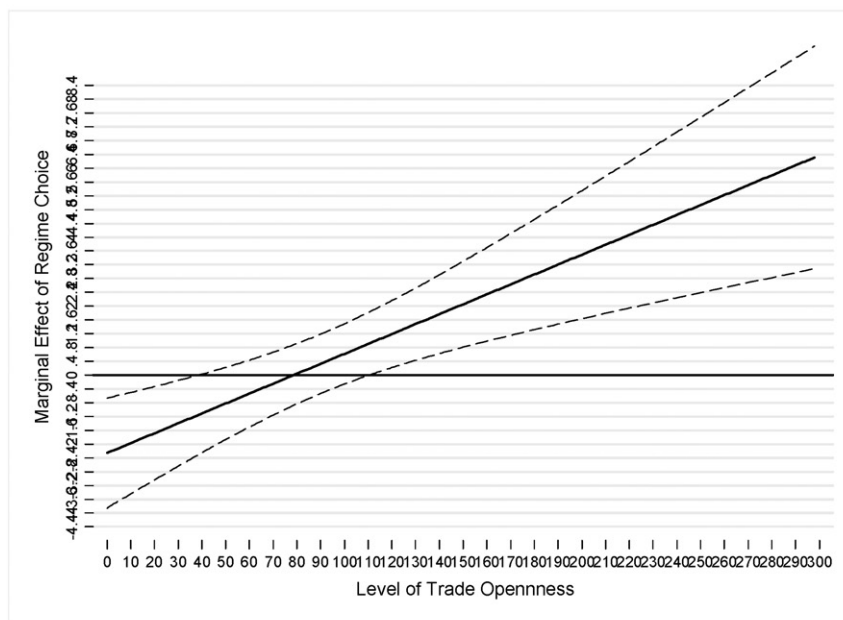
5.6. Marginal effect of exchange rate regime choice on fiscal discipline

From the results presented so far, it is evident that exchange rate regime choice has both a direct effect on fiscal discipline and an indirect effect through trade openness. However, the results have focused only on point estimates, and do not inform us about the marginal effects of ERR on fiscal discipline. We now discuss the marginal effects in order to elaborate the effects of ERR on the budget balance. Consider the IV results for developing countries, presented in column 2 in Table 5.²⁶ In the extreme situation where a country does not trade with rest of the world at all (trade openness is zero), the marginal effect of regime choice on the budget balance is −2.26. That is, if this country were to move one unit on the Reinhart-Rogoff flexibility scale from its current position towards fixed regimes, its budget balance would improve by 2.26 percentage points. If the trade openness of this country were to increase from zero to 46% of GDP (roughly the 25th percentile value), the marginal effect would decrease to 0.93. When the trade openness is more than 78% of GDP (about the mean value), the marginal effect of the regime choice becomes positive, and moving towards a flexible regime will

²⁵ The insignificant results with these alternative measures of ERR classifications may be related to the smaller number of categories they have as compared with Reinhart and Rogoff (2004) classification. Recall that Reinhart and Rogoff (2004) index has 14 categories, while Shambaugh (2004) and Levy-Yeyati and Sturzenegger (2005) classifications have only four and five categories, respectively. As a result, the lower variation in these explanatory variables is reflected in the lower significance of the estimated coefficients.

²⁶ Recall that the significance of the point estimates of ERR and the interaction term holds for the developing country sample only. Thus, we choose this model, which is also corrected for endogeneity.

(a) Marginal effect of the regime choice on the overall budget balance, conditional on trade openness



(b) Marginal effect of the regime choice on the primary budget balance, conditional on trade openness

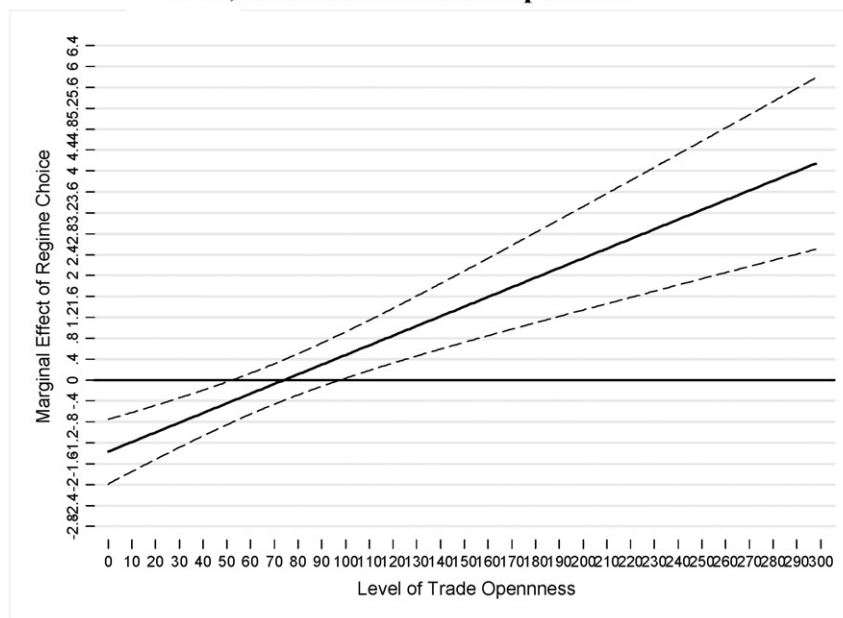


Fig. 2. (a): Marginal effect of the regime choice on the overall budget balance, conditional on trade openness. (b): Marginal effect of the regime choice on the primary budget balance, conditional on trade openness. (c): Marginal effect of the regime choice on the cash surplus, conditional on trade openness.

provide more fiscal discipline. We elaborate this in more detail by calculating the marginal effects of ERR at different sample values of the openness and constructing confidence intervals (CI) of the marginal effects.

The marginal effects of ERR and their CIs at different values of the trade openness are displayed in Fig. 2(a)–(c) for three different measures of the budget balance. Fig. 2(a) is based on column 2 of Table 5, while Fig. 2(b) and (c) are from columns 5 and 8,

**(c) Marginal effect of the regime choice on the cash surplus,
conditional on trade openness**

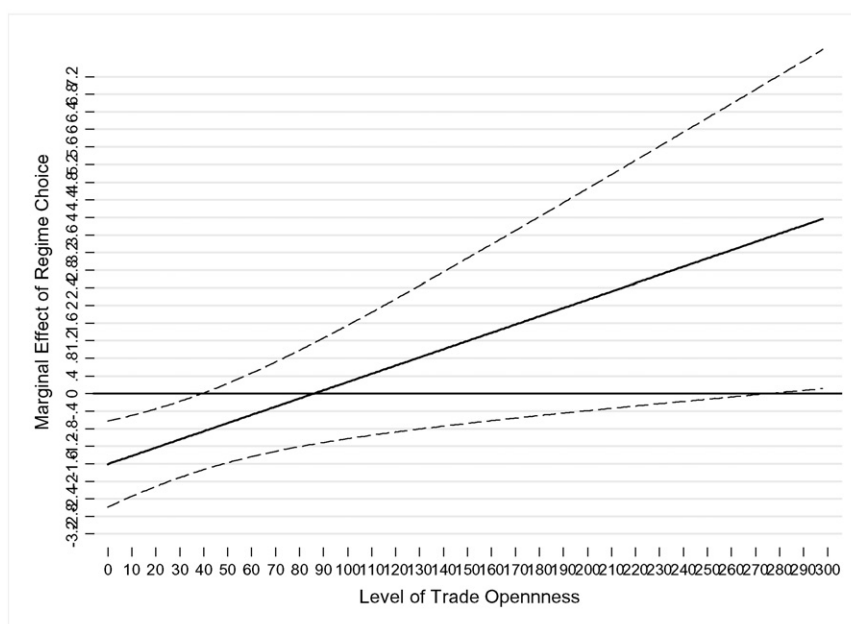


Fig. 2 (continued).

respectively. In each figure, the solid line represents the marginal effect of ERR over the varying levels of trade openness. In order for the marginal effect to be statistically significant, the upper and lower bounds of the CI (i.e., the dashed lines) must simultaneously be either above or below the horizontal line drawn at zero.

Fig. 2(a) shows the marginal effects of ERR on the overall budget balance at different levels of trade openness. The figure shows that the marginal effects are negative at lower values of the trade openness, i.e., when it is 78% of GDP (about the mean value of openness) or lower. This means that, at relatively lower values of the trade openness, fixed regimes contain the overall budget balance, thus introducing more fiscal discipline. However, the marginal effects are significant only when the openness is below 38% of GDP. In our sample, this applies to low-openness countries such as Argentina, Brazil, Columbia, the Democratic Republic of Congo, India, Iran, Mexico, Pakistan, Nepal and Peru. To elaborate further, we consider the case of Brazil. On average, Brazil is the least open country in our dataset (15%), and faces a high overall budget deficit (7.5% of GDP) over the period 1971 to 2000. This country is at the top end of the Reinhart-Rogoff exchange rate regime flexibility index (12), a managed floater. Our model predicts that, given its current level of trade openness, Brazil's fiscal balance will improve if it moves towards a fixed regime.

On the other hand, the marginal effects are positive (flexible regimes are more disciplinary) when the trade openness is higher than 78%. However, the positive marginal effects are only significant when the trade openness reaches 110% of GDP (higher than the 75th percentile value) or above. This includes highly-open countries such as the Bahamas, Bahrain, Kuwait, Mauritius, Malaysia, Panama, and Singapore. Singapore is the most open country in our sample, with an average openness of over 300% of GDP during the period 1971 to 2000. The actual regime choice of this country is at the floating end of the Reinhart-Rogoff flexibility index (category 11). During this period, this country has one of the largest average overall budget surpluses (5.15%). According to our model, at its current level of openness, Singapore's budget balance would deteriorate if its actual regime choice became less flexible.

The marginal effects of ERR on the primary budget balance, shown in Fig. 2(b), display a similar pattern. However, in this case, the marginal effects are negative when trade openness is 75% or below and positive when it is above this level. The marginal effects are significant when the openness is either less than 52% of GDP or over 98% of GDP. When the marginal effect of ERR on the cash surplus is considered (Fig. 2(c)), it is observed that negative marginal effects occur when the trade openness is 85% of GDP or lower, and the effects become significant when the openness values are 40% or lower, which is similar to the two previous figures. However, unlike in previous cases, the positive marginal effects become significant only at implausibly high values of trade openness.²⁷

²⁷ As the threshold value of significant marginal effects is larger with the primary budget balance and the government cash surplus, the numbers of countries for which fixed regimes provide more fiscal discipline are larger with these two measures. Similarly, larger numbers of countries show significant positive marginal effects for the primary budget balance. However, as the threshold value is very high (275%) when the cash surplus is considered, the positive marginal effects become significant for only a few countries in this case.

6. Conclusions

Against the backdrop of the high and persistent fiscal deficits and public debts that currently mar several economies, this study addresses the influence of exchange rate regime choice in disciplining fiscal policy. A considerable debate occurs as to which exchange rate regime – fixed or flexible – provides more fiscal discipline. The conventional view is that fixed regimes have more disciplinary effects, but some recent studies suggest that flexible regimes may provide better fiscal discipline. The extant empirical studies, which examine only the direct effect of an exchange rate regime choice on fiscal outcomes, fail to provide a definitive answer. This study is the first to stress that an exchange rate regime might have an interaction effect on fiscal outcomes through other variable(s), as well as a direct effect. In particular, we hypothesise that the interaction between ERR and trade openness is likely to have a bearing on the government budget balance. Several theoretical arguments in open economy macroeconomic theory, international trade, and public finance literatures suggest that such an interaction effect could explain, at least partly, budget balance and fiscal discipline.

In order to test the empirical validity of our hypotheses, we use both an annual and a five-year average panel dataset, covering the period 1971 to 2010, for a large number of developed and developing countries. We use three measures of fiscal outcomes, namely, the overall budget balance, the primary budget balance, and the government cash surplus. We measure the ERR choice mainly with [Reinhart and Rogoff's \(2004\)](#) *de facto* ERR classification, which distinguishes as many as 14 exchange rate regimes. Other *de facto* classifications proposed by [Levy-Yeyati and Sturzenegger \(2005\)](#) and [Shambaugh \(2004\)](#), and the official ERR classification of the IMF have also been used. Pooled panel OLS and IV estimation techniques have been employed to estimate the empirical model.

The results point to ERR having a direct effect on fiscal discipline, such that fixed regimes are more disciplinary. However, the findings reveal that ERR also affects fiscal discipline through an interaction with trade openness. Taking the direct and indirect effects together, the study documents that an exchange rate regime's marginal effects on fiscal discipline depend critically on a country's level of trade openness. In particular, we find that fixed regimes provide more fiscal discipline at low levels of trade openness, while flexible regimes become more disciplinary at higher levels of trade openness. Depending on the measures of budget balance, the threshold values of trade openness are in the range of 75% to 85%. However, these findings hold in the developing countries sample only, not in the developed country group. The reason may be that while developing countries in general (and emerging market economies in particular) experiment with different ERR, the ERR choice in developed countries exhibits little variation. The smaller variation can be attributed to the fact that developed countries have already made their ERR choice either to flexible or to hard peg regimes and do not deviate from that choice frequently (see [Chowdhury et al., 2015](#) for more on the persistence of exchange rate regimes in developed countries). Taken together, this study finds strong support for both the conventional and non-conventional views of the relationship between fiscal discipline and ERR, and sheds light on why previous empirical studies may not have provided conclusive evidence regarding the relationship between fiscal discipline and ERR.

Appendix A

Table A.1
[Reinhart and Rogoff's \(2004\)](#) *de facto* exchange rate classification.

Category	Exchange rate arrangements/regimes
1	No separate legal tender
2	Pre-announced peg or currency board arrangement
3	Pre-announced horizontal band that is narrower than or equal to $\pm 2\%$
4	<i>De facto</i> peg
5	Pre-announced crawling peg
6	Pre-announced crawling band that is narrower than or equal to $\pm 2\%$
7	<i>De facto</i> crawling peg
8	<i>De facto</i> crawling band that is narrower than or equal to $\pm 2\%$
9	Pre-announced crawling band that is wider than or equal to $\pm 2\%$
10	<i>De facto</i> crawling band that is narrower than or equal to $\pm 5\%$
11	Moving band that is narrower than or equal to $\pm 2\%$ (i.e., allows for both appreciation and depreciation over time)
12	Managed floating
13	Freely floating
14	Freely falling (hyper float)

Source: [Reinhart and Rogoff \(2004\)](#).

Table A.2

Variables, data sources and availability.

Variables	Description	Availability and data source
Overall budget balance	Revenue minus expenditure excluding grant	1971–2000, GFS, IMF
Primary budget balance	Overall budget balance net of interest payment	1971–2000, GFS, IMF
Government cash surplus	Similar to the overall balance except that net cash outflows from lending and repayment transactions are not subtracted	1971–2010, GFS, IMF
ERR (RR)	Exchange rate regime choice, Reinhart and Rogoff (2004) fine classification (1 to 14 scale), where higher values indicate more flexible regimes	1971–2010, Ilzetzi et al. (2008) updated data
ERR (LYS)	Exchange rate regime choice, Levy-Yeyati and Sturzenegger (2005) (1 to 4 scale), where higher values indicate more flexible regimes	1973–2004, Levy-Yeyati and Sturzenegger (2005)
ERR (SH)	Exchange rate regime choice, Shambaugh (2004) (1 to 5 scale), where higher values indicate more flexible regimes	1971–2010, Shambaugh (2004) updated data
ERR (IMF)	IMF official classification (1 to 5 scale) where higher values indicate more flexible regimes	1971–2010, Ilzetzi et al. (2008)
Open	Trade openness, the share of export and import of goods and services in GDP	1971–2010, PWT version 7.1
CBI	Central bank independence, measured by central bank governor turnover rate over five-year periods, where a higher value indicates a lower CBI	1971–2010, Dreher, Sturm, and de Haan (2008) updated
Level of development	Log of real <i>per capita</i> GDP in USD	1971–2010, PWT version 7.1
Institutional quality	Polity2 (– 10 to 10 scale, higher values indicate better institutional quality)	Polity IV database
Recession dummy	Calculated by the authors from income, following Bruckner and Ciccone (2011)	
Oil_dum	Major oil exporting country dummy	
Emu_dum	EMU membership dummy	
Colonial origin	Dummies for colonial origins	

Notes: GFS: Global Finance Statistics, PWT: Penn World Table.

Table A.3

First stage results (annual data).

ERR (RR)							Trade openness		
Dep. variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	BB	PBB	CashSur	BB	PBB	CashSur	BB	PBB	CashSur
Variables									
Relative GDP	17.301*** (4.461)	15.910*** (4.827)	16.214*** (4.957)						
Neighbours' ERR	0.156** (0.073)	0.132* (0.074)	0.039 (0.063)	0.167** (0.074)	0.150* (0.077)	0.048 (0.067)			
Population (log)				0.507** (0.215)	0.454** (0.220)	0.377* (0.202)			
Predicted openness							1.162*** (0.387)	1.159*** (0.396)	1.193*** (0.314)
Observations	1848	1714	1993	1862	1716	1970	1981	1824	1958
R ²	0.137	0.117	0.104	0.098	0.083	0.062	0.557	0.557	0.651
Country	107	106	106	107	106	106	114	113	109
F-stage F	10.33	7.56	5.68	5.99	4.36	2.20	9.01	8.28	14.45
Hansen test p-value	0.47	0.21	0.63	0.80	0.94	0.98	–	–	–

Note: Robust standard errors, clustered at the country level, are given in parentheses. BB: overall budget balance, PBB: primary budget balance, CashSur: Government cash surplus. All regressions include the year dummies. ERR is measured with the [Reinhart and Rogoff \(2004\)](#) classification.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

Table A.4

Exchange rate regime choice, trade openness and the budget balance: pooled panel IV estimation with the second set of IVs (annual data).

Dep. variables	Overall budget balance			Primary budget balance			Cash surplus		
Sample	(1) Full	(2) Developing	(3) Developed	(4) Full	(5) Developing	(6) Developed	(7) Full	(8) Developing	(9) Developed
Variables									
ERR (RR)	−1.600 (1.452)	−1.880* (0.979)	−0.813 (1.536)	−1.811* (0.955)	−1.306*** (0.433)	−0.172 (0.652)	−2.742 (2.661)	−1.298 (1.011)	−2.171 (1.773)
Open	−0.192 (0.127)	−0.238** (0.109)	−0.015 (0.094)	−0.171** (0.072)	−0.175** (0.070)	−0.018 (0.041)	−0.146 (0.162)	−0.111 (0.069)	−0.093 (0.124)
ERR(RR) * open	0.022* (0.013)	0.026** (0.011)	0.000 (0.008)	0.020*** (0.007)	0.020*** (0.007)	0.007 (0.005)	0.017 (0.015)	0.014** (0.007)	0.001 (0.010)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1523	939	584	1419	847	572	1611	989	622
No. of countries	84	55	29	83	54	29	86	54	32
Hansen test <i>p</i> -value	0.87	0.28	0.49	0.50	0.45	0.74	0.48	0.07	0.59

Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. Regressions for the developing countries sample do not include the EMU dummy. All of the variables except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Reinhart and Rogoff \(2004\)](#) classification.

*** $p < 0.01$.** $p < 0.05$.* $p < 0.1$.

Table A.5

Exchange rate regime choice, trade openness and the budget balance: sub-sample analysis with the developing country sample – Pooled panel OLS estimation with (annual data).

Dep. variables	Overall budget balance				Primary budget balance				Cash surplus			
Excluded sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	SSA	LA	MENA	EECA	SSA	LA	MENA	EECA	SSA	LA	MENA	EECA
Variables												
ERR	−0.699*** (0.160)	−0.582*** (0.141)	−0.508*** (0.138)	−0.561*** (0.135)	−0.512*** (0.141)	−0.485*** (0.146)	−0.278*** (0.112)	−0.416*** (0.118)	−0.534*** (0.123)	−0.450*** (0.151)	−0.363*** (0.112)	−0.404*** (0.121)
Open	−0.056** (0.025)	−0.001 (0.011)	−0.040 (0.027)	−0.035 (0.023)	−0.036** (0.017)	−0.013 (0.017)	−0.012 (0.017)	−0.022 (0.016)	−0.015 (0.016)	0.007 (0.009)	−0.008 (0.016)	−0.002 (0.014)
ERR * open	0.008*** (0.002)	0.004*** (0.001)	0.006*** (0.002)	0.006*** (0.002)	0.006*** (0.001)	0.004** (0.002)	0.003** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.003*** (0.001)	0.004** (0.001)	0.004*** (0.001)
Time-varying controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed factors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	825	662	824	969	756	572	746	867	990	778	911	1006
R ²	0.380	0.437	0.346	0.337	0.386	0.470	0.395	0.385	0.368	0.421	0.380	0.354
No. of countries	45	41	50	53	44	40	50	52	49	45	51	50

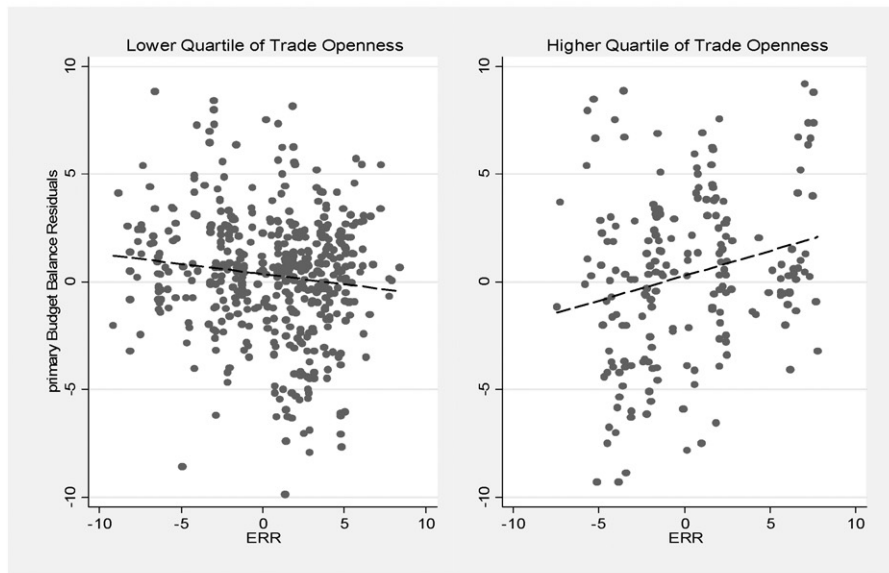
Note: Robust standard errors, clustered at the country level, are in parentheses. The time-varying controls are the central bank independence, a country recession dummy, the level of development and institutional quality (Polity2). The fixed factors include a major oil exporting country dummy, EMU membership dummy and four colonial origin dummies. All of the variables except for the dummies are utilised with a one-period lag. All regressions include the year dummies. Exchange rate regime choice is measured with the [Reinhart and Rogoff \(2004\)](#) classification. SSA: Sub-Saharan Africa, LA: Latin America, MENA: Middle East and North Africa, EECA: Eastern Europe and Central Asia.

*** $p < 0.01$.

** $p < 0.05$.

* $p < 0.1$.

(a) Exchange rate regime, trade openness and the primary budget balance



(b) Exchange rate regime, trade openness and the cash surplus

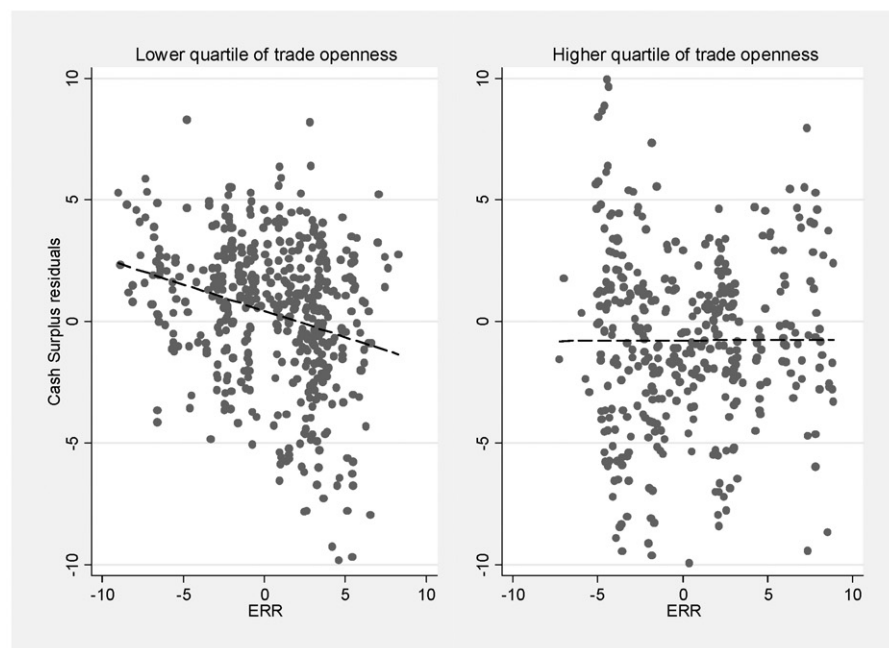


Fig. A.1. (a): Exchange rate regime, trade openness and the primary budget balance. (b): Exchange rate regime, trade openness and the cash surplus.

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