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Credit growth, current account and financial depth

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Exploring the determinants and dynamics of the current account balance is one of the priorities of academic literature and policy circles. Although the effects of structural variables are deeply analysed, a lesser attention has been paid to the impact of financial variables. Drawing on standard empirical current account models and with a large sample of industrial and developing countries, we report a significant deterioration in the current account balance in case of an increase in the credit growth. Moreover, we find that this link is substantially stronger for the developing ones motivating a closer examination. Therefore, we further advance our analysis and show that credit growth causes a stronger impact on the current account balance for lower levels of financial depth. In other words, at the early stages of financial development, acceleration in the credit growth might cause a larger deterioration in the current account balance; thus, it might be suggested that monetary policy and macro-prudential measures aimed at preventing financial excess might be more effective to reduce the external imbalances at the early stages of financial deepening.

Keywords: credit growth; current account balance; developing countries; financial depth; financial excess; global imbalances; panel data

JEL Classification: F31; F32; F37; F41

I. Introduction

The global imbalances, persistently widening at the pre-crisis period and suddenly narrowing afterwards, have drawn a lot of attention both within the policy circles and among academicians. Therefore, the efforts aiming to understand the determinants of the current account (CA) balance have been intensified.[1] However, although demographic factors, fiscal positions, growth prospects, net foreign asset (NFA) positions and level of oil dependency are identified as the main determinants

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[1] Calderon *et al.* (2002), Chinn and Prasad (2003), Gruber and Kamin (2007), Medina *et al.* (2010), Lane and Milesi-Ferretti (2012), Cheung *et al.* (2013) and IMF (2013) can be listed as some of the studies that empirically examine this issue.

of the CA balance, a lesser attention has been paid to the financial variables.[2]

When we look at the proposed financial variables in the literature, we observe that variables targeting to measure financial excess and financial depth have been used. While financial excess variables aim to capture boom-bust cycles in the financial markets by flow measures, financial depth variables focus on the size of the financial markets via using stock measures. Noting that it is not always trivial to empirically identify financial excess and financial depth, we undertake a challenging task of combining these two. First, by using a rich panel data set, we show that financial excess has a significant impact on the CA balance. Then, we investigate whether this relationship is conditional on the level of financial depth. We present strong empirical evidence that acceleration in financial excess might cause a larger deterioration in the CA balance for a lower level of financial depth.

Atoyan *et al.* (2013) and IMF (2013) are the two recent studies that include growth of private credit to gross domestic product (GDP) ratio to measure the degree of financial excess as a determinant of the CA balance.[3] Both studies report a significant relationship between the two, even when controlling for the output gap. This finding is consistent with Borio (2012), which proposes that financial and economic cycles do not necessarily coincide. Regarding the influence of financial excess on the CA balance, IMF (2013) explains the underlying mechanism as follows: if the authorities fail to implement policies to dampen financial excess, there might be a demand boom, which causes a weaker CA balance.

The influence of financial deepening on the CA balance has been discussed in a relatively more detailed way. The main reason behind this proposal is through the impact of financial deepening on the saving and investment decisions of the agents via economic growth.[4] Moreover, Chinn and Prasad (2003) argue that countries that are in the early stages of financial development run CA deficits by importing capital. As they reach to advanced stages, they export capital to pay their accumulated external liabilities thereby run CA surpluses.

As mentioned earlier, it is not easy to empirically distinguish between financial excess and financial depth. IMF (2013) uses a single variable, private credit to GDP ratio, to capture both while examining the determinants of the CA balance. There are some advantages of using the private credit data. First, it is very easy to collect a consistent and long time series data for most of the countries. Second, the results are comparable with the literature due to its common usage. There are some other variables used to capture financial excess in the literature. Fratzscher and Straub (2009), for instance, use asset price booms, where Adam *et al.* (2011) and Aizenman and Jinjarak (2009) employ house prices. Kraay and Ventura (2007) focus on stock market variables. Despite the variety of options, due to the above-mentioned advantages, we choose private credit data and use the other variables to check the robustness of the results. In this particular study, however, we are aiming at separating financial excess and financial depth. Therefore, as an indicator of former, we use the ratio of new lendings to the private sector within a year to GDP (credit growth later on) and use the historical average of private credit to GDP ratio to capture the latter.[5]

We construct a panel data set consisting of 49 countries including industrial and developing ones. While examining the influence of credit growth on the CA balance, we control for a number of other variables that are identified as the main determinants of the CA balance in the literature, such as the level of NFA, relative income, average growth rate, oil trade balance, fiscal balance, demographics and the terms of trade. We report an economically and statistically significant deterioration in the CA balance for the full sample in case of acceleration in the credit growth.

Several studies in the literature, such as Chinn and Prasad (2003), Chinn and Ito (2007), Gruber and Kamin (2009) and Cheung *et al.* (2013), suggest that country-specific dynamics should be taken into

[2] The International Monetary Fund (IMF), for instance, has recently updated its methodology, the external balance assessment (EBA), to assess the member countries' exchange rates. Although the previous version of the EBA, discussed in IMF (2012), ignores the financial variables for various reasons, the latest version, described in IMF (2013), finds a significant impact of these on the current account (CA) balance dynamics.

[3] IMF (2013) reports results with both private credit growth and deviations from the trend of the private credit stock.

[4] Chinn and Ito (2007) discuss the impact of financial development on saving and investment in detail. Moreover, for a recent comprehensive discussion on this point, see Arcand *et al.* (2012) and the references therein.

[5] Biggs *et al.* (2009) and Ermişoğlu *et al.* (2013) also use new lendings in their analysis and report a significant role in explaining the gross domestic product (GDP) growth.

account while investigating the determinants of the CA balance. In this study, we show that the credit growth has a statistically significant impact on the CA balance for both industrial and developing countries; however, it is much more pronounced for the latter group. The diversion in the results regarding the industrial and developing countries points to a heterogeneity within the sample. Building on the growth literature, which suggests nonlinearities with the level of financial deepening, we document the change of impact of the credit growth on the CA balance due to the degree of financial depth. Using alternative measures of financial excess and financial depth, we observe that the CA balance is more sensitive to the degree of financial excess for those countries with lower levels of financial depth. This finding implies that acceleration in the credit growth might cause a larger deterioration in the CA balance at the early stages of financial development. Therefore, as a policy implication, it can be claimed that monetary policy and macro-prudential measures aimed at preventing financial excess might be effective in reducing the external imbalances particularly at the early stages of financial deepening.

Section II discusses data and methodology of the article. Section III presents empirical evidence on the impact of the credit growth on the CA balance. In Section IV, we examine the role of financial depth in explaining the variation in the impact of the credit growth on the CA balance. Section V provides robustness checks for our results before Section VI concluding the article.

II. Data and Methodology

In this study, we document the dynamics of impact of the credit growth on the CA balance. Our panel data set includes 49 countries including industrial and developing ones. Table 1 gives the list of the countries in the sample[6] and the details of the classification. Following the studies that investigate the impact of financial excess, such as IMF (2013), we use

Table 1. Countries in the sample

Country	Abbreviation	Industrial = 1, 0 otherwise	Country	Abbreviation	Industrial = 1, 0 otherwise
Argentina	ARG	0	Korea	KOR	1
Australia	AUSL	1	Malaysia	MLY	0
Austria	AUS	1	Mexico	MEX	0
Belgium	BEL	1	Morocco	MOR	0
Brazil	BRA	0	Netherlands	NTL	1
Canada	CAN	1	New Zealand	NZ	1
Chile	CHI	0	Norway	NOR	1
China	CHN	0	Pakistan	PAK	0
Colombia	COL	0	Peru	PER	0
Costa Rica	COSR	0	Philippines	PHL	0
Czech Republic	CZE	1	Poland	POL	0
Denmark	DEN	1	Portugal	POR	1
Egypt	EGY	0	Russia	RUS	0
Finland	FIN	1	South Africa	SAFR	0
France	FRA	1	Spain	SPA	1
Germany	GER	1	Sri Lanka	SRL	0
Greece	GRE	1	Sweden	SWE	1
Guatemala	GUA	0	Switzerland	SWZ	1
Hungary	HUN	0	Thailand	THA	0
India	IND	0	Tunisia	TUN	0
Indonesia	IDN	0	Turkey	TUR	0
Ireland	IRE	1	United Kingdom	UK	1
Israel	ISR	1	United States	US	1
Italy	ITA	1	Uruguay	URU	0
Japan	JAP	1			

[6] The distinction between the industrial and developing countries is made according to the IMF classification.

Table 2. Variable description

Variable	Source	Notes
CA to GDP ratio	IMF World Economic Outlook Database (WEO)	
Credit growth	World Bank's World Development Indicators (WDI)	Ratio of new lendings to the private sector within a year to GDP
Financial depth	WEO	The historical average of the ratio of the private credit to GDP
NFA to GDP ratio	Updated Lane and Milesi-Ferretti (2007) data set	Lagged one period
Dummy for high debt		Equals 1 if $\frac{NFA}{GDP} < -60\%$
Relative income	WEO	Own per capita GDP/US per capita GDP (PPP)
Average growth rate	WDI	Five-year average growth rate of GDP at market prices based on constant local currency
Oil trade balance to GDP ratio	WEO	
Fiscal balance	World Bank Global Economic Prospects data set	
Financial centre dummy	IMF (2013)	Equals 1 for Netherlands, Switzerland and Belgium
Exorbitant privilege	WEO	Own currency share in world reserves
Dependency ratio (old)	WDI	Population over 65/working-age population
Dependency ratio (young)	WDI	Population under 15/working-age population
Population growth	WDI	
Terms of trade	WDI	Net barter terms of trade

annual data and the data set spans the period from 1991 to 2011. The credit growth is calculated as the ratio of the new lendings to the private sector within a year to GDP. For the control variables, we consider the determinants of the CA balance identified in the literature.[7] Table 2 collects all variables considered in this study with their sources, and in the following, we briefly discuss how these variables might influence the CA balance.

The ratio of the NFA to GDP is introduced to the estimation by two means. First one is the ratio with one-period lag. Lane and Milesi-Ferretti (2012) argues that the sign should be positive due to the fact that the steady-state CA balance is proportional to the equilibrium NFA position. Second, we include a dummy variable when a country has an NFA to GDP ratio lower than −60%. Catao and Milesi-Ferretti (2013) suggests that this level is a threshold after which the crisis probability substantially increases. Therefore, the dummy is expected to have a positive impact on the CA balance.

Relative income is assumed to be a proxy for the marginal product of capital and expected to have a positive impact on the CA balance. It is calculated as the ratio of the country's per capita GDP to the per capita GDP of the United States where GDP is measured with purchasing power parity. In addition to this, higher growth rate should lead to a lower CA balance; thus, we include 5-year average annual growth rate of GDP to the estimation process.

Oil trade balance is a proxy for the impact of oil price and volume changes on the CA balance. For instance, when oil prices increase, the share of oil balance for an oil-exporting country would be higher and so would the CA balance. Similarly, the share would be lower for an oil-importing country. We should also note that the countries where GDP heavily depends on oil exports are excluded while constructing our data set.

Fiscal balance is expected to affect national savings as long as the private sector does not fully offset the changes in public saving. Lane and Milesi-Ferretti (2012) and IMF (2013) find that the Ricardian equivalence does not hold and a positive impact from the fiscal balance is expected.

Following the literature, we mark Belgium, Netherlands and Switzerland as the financial centres. The rationale behind this is to obtain unbiased

[7] For a detailed discussion on the determinants of the CA balance, see Chinn and Prasad (2003) and IMF (2013).

estimates for the other parameters in the regression. Moreover, we use the reserve currency countries' share in world reserves, which is dubbed as exorbitant privilege.

To capture the dynamics of demographics, we consider three measures. Old-age dependency ratio is measured as the ratio of the population over 65 to the working-age population, where young-age dependency ratio is the ratio of the population under 15 to the working-age population. The third variable is the annual growth rate of the population. A larger dependent population is expected to decrease national savings and hence the CA balance. All the demographic variables are expected to have a negative impact on the CA balance.

Finally, the terms of trade is expected to have a positive sign and aims at capturing the impact of the world prices on exports and imports.

Since the CA data display strong autocorrelation, it is important to address this issue in the estimation process. Therefore, we use pooled generalized least squares with a panel-wide AR(1) correction as it is the case in IMF (2013). We estimate the following equation under alternative specifications:

$$\left(\frac{CA}{GDP}\right)_{it} = \beta_0 + \beta_1 \left(\frac{\Delta Credit}{GDP}\right)_{it} + \beta_2 X_{it} + \varepsilon_{it} \quad (1)$$

Here, the dependent variable is the ratio of the CA balance to GDP, $\left(\frac{CA}{GDP}\right)_{it}$. As explanatory variables, we use the change in the credit stock extended to the private sector, $\left(\frac{\Delta Credit}{GDP}\right)_{it}$, as a ratio to GDP, i.e. credit growth, and the control variables (denoted by X_{it}) explained earlier.

III. Panel Results

We report the results of our benchmark empirical model in Table 3 with an emphasis on the impact of the credit growth on the CA balance.[8] We observe that the credit growth negatively affects the CA balance in an economically and statistically significant way. The results without including the control variables suggest that a 10 percentage point increase in the credit growth leads to a 0.3 percentage point decrease the CA balance.[9]

Our findings up to this point are consistent with the literature. Cheung *et al.* (2013), for instance, finds a strong negative relationship between the private credit to GDP ratio and the CA balance. IMF (2013) also finds a strong negative impact of the demeaned private credit to GDP ratio on the CA balance for a large set of countries.

The literature suggests that the country-specific factors should be taken into account while investigating the determinants of the CA balance. In a broad sense, Chinn and Prasad (2003), Lane and Milesi-Ferretti (2012) and Cheung *et al.* (2013) find that impacts of some of the variables, such as NFA, relative income, expected growth, dependency ratios, fiscal deficit and financial deepening, on the CA balance significantly differ between industrial and developing countries. Atoyan *et al.* (2013), in the meantime, divides the country set into two groups, i.e. industrial and developing countries, and finds significant differences between the parameters estimated for such as real private credit growth and partners' GDP growth among the two. Given these findings, a first natural question to be asked at this point is whether there is a diversion in the relationship between the credit growth and the CA balance among subsamples of our data set.

To be able to test this hypothesis, we re-estimate our model by allowing different slopes for industrial and developing countries and present the results in the third and fourth columns of Table 3. The empirical results clearly indicate that although the credit growth has a negative impact on the CA balance for both groups of countries, the link between the credit growth and the CA balance is stronger in the developing countries than that in the industrial countries.[10]

To deepen our analysis on parameter heterogeneity and materialize the impact of the credit growth on the

[8] We provide the results for fixed-effects estimation in Table 3 as a robustness check.

[9] We observe that this result remains intact after the inclusion of the control variables with all having expected signs. Impact of the credit growth on the CA balance is also estimated by using Newey–West SEs since time dimension of our sample is relatively low. The results of this estimation, which supports our results, are available upon request.

[10] According to the Wald test, coefficients of the credit growth for the industrial and developing countries are significantly different under both specifications, which exclude and include control variables. *p*-values of the tests are provided in Table 3.

Table 3. Panel estimations results: the dependent variable is the ratio of the CA balance to GDP

	(1)	(2)	(3)	(4)
Pooled generalized least squares (GLS) with a panel-wide AR(1)				
Credit growth	−0.030***	−0.027**		
	(0.005)	(0.006)		
Credit growth × IND			−0.013**	−0.012**
			(0.005)	(0.006)
Credit growth × DEV			−0.058***	−0.056***
			(0.011)	(0.013)
Dummy for IND			0.0034	0.035
			(0.004)	(0.029)
Dummy for DEV			−0.009**	0.032
			(0.004)	(0.023)
Average growth		−0.362***		−0.325***
		(0.081)		(0.081)
NFA		0.028***		0.026***
		(0.007)		(0.007)
Dummy for high NFA level		0.001		0.001
		(0.005)		(0.005)
Relative income		0.005		−0.002
		(0.012)		(0.020)
Oil trade balance		0.555***		0.564***
		(0.068)		(0.069)
Fiscal balance		0.067**		0.066***
		(0.032)		(0.032)
Financial centre dummy		0.039***		0.041***
		(0.009)		(0.009)
Exorbitant privilege		−0.027**		−0.027*
		(0.014)		(0.014)
Dependency ratio (old)		−0.158***		−0.157***
		(0.058)		(0.062)
Dependency ratio (young)		−0.053*		−0.054**
		(0.026)		(0.026)
Population growth		−0.416		−0.462
		(0.303)		(0.307)
Terms of trade		0.040***		0.040***
		(0.011)		(0.011)
Constant	−0.003	0.031		
	(0.003)	(0.022)		
No. of observations	1000	967	1000	967
No. of countries	49	49	49	49
R^2	0.01	0.353	0.058	0.351
Root MSE	0.048	0.039	0.048	0.039
Wald Test *p*-values			(0.0001)	(0.0012)
Robustness check: fixed-effects estimation				
Credit growth	−0.040***	−0.034**		
	(0.018)	(0.013)		
Credit growth × IND			−0.058	−0.014
			(0.015)	(0.011)
Credit growth × DEV			−0.096***	−0.094***
			(0.031)	(0.025)
Average growth		−0.576***		−0.504***
		(0.153)		(0.143)
NFA		0.042***		0.040**
		(0.019)		(0.019)

(*continued*)

Table 3. Continued

	(1)	(2)	(3)	(4)
Dummy for high NFA level		0.015		0.012
		(0.010)		(0.009)
Relative income		−0.011		−0.008
		(0.052)		(0.050)
Oil trade balance		0.558***		0.521***
		(0.181)		(0.190)
Fiscal balance		0.196**		0.177***
		(0.078)		(0.077)
Exorbitant privilege		−0.038**		−0.048
		(0.037)		(0.036)
Dependency ratio (old)		0.109		0.133
		(0.155)		(0.155)
Dependency ratio (young)		−0.152**		−0.144**
		(0.069)		(0.066)
Population growth		−1.544**		−1.772
		(0.583)		(0.633)
Terms of trade		0.018		0.0197
		(0.018)		(0.018)
Constant	−0.002	0.082	−0.002	−0.015
	(0.001)	(0.059)	(0.001)	(0.011)
No. of observations	1000	967	1000	967
No. of countries	49	49	49	49
R^2	0.02	0.178	0.054	0.276
Root MSE	0.048	0.056	0.048	0.057
Wald Test *p*-values			(0.011)	(0.003)

Notes: SEs in brackets: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
IND marks the industrial countries and DEV denotes the developing countries.
According to the Wald test, coefficients of the credit growth for industrial and developing countries, respectively, are significantly different for both of the equations that including and not including control variables at 5% significance level.

CA balance, we extract the country-specific parameters by augmenting Equation 1 with country dummies, which is represented by D_i.[11]

$$\left(\frac{CA}{GDP}\right)_{it} = \beta_0 + \beta_1 \left(\frac{\Delta Credit}{GDP}\right)_{it} + \alpha_i \left(\frac{\Delta Credit}{GDP}\right)_{it} D_i + \gamma_i Di + \beta_2 X_{it} + \varepsilon_{it} \quad (2)$$

In this set-up, the slope of the credit growth for country i is given by $\beta_1 + \alpha_i$. Country-specific parameters (α_i) measure the incremental sensitivity of the countries' CA balance to the credit growth relative to the panel average.

To further emphasize the influence of the credit growth on the CA balance, we conduct a simple rebalancing exercise for three countries, Poland, Sri Lanka and Turkey, for the year 2012.[12] The first column of the Table 4 writes panel average coefficient from the estimation of Equation 1 and the second column collects the slope of the credit growth for country i, $\beta_1 + \alpha_i$, for the countries that are estimated with the control variables included. As provided in the table, the adjustment in CA/GDP ranges from 1.30 percentage points to 3.79 percentage points. The calculations show that, in Poland, almost 37% of the adjustment in the CA balance in

[11] A similar empirical strategy is used by Bruno and Shin (2013) to assess the impact of macro-prudential policies for Asian countries, in particular Korea.
[12] The countries are chosen due to the most dramatic adjustments in their CA balances in that year.

Table 4. A rebalancing exercise for three selected countries on adjustment in the CA balance explained by credit growth in 2012 with control variables included

	Parameter values for (ΔK/Y)		Change in the data		Rebalancing due to credit growth estimates	
	Only panel average	With country-specific slope	ΔK/Y	CA/GDP	Only panel average	With country-specific slope
Poland	−0.027	−0.042	−11.46	1.30	0.31	0.49
Sri Lanka	−0.027	−0.044	−7.80	1.78	0.21	0.34
Turkey	−0.027	−0.265	−2.92	3.79	0.08	0.77

2012 is due to the decrease in credit growth. In Turkey and Sri Lanka, the share of external adjustment which could be attributed to credit growth is around 20%.

IV. The Role of Financial Depth

The evidence presented earlier indicates a significant heterogeneity in the impact of the credit growth on the CA balance. Regarding the underlying reasons behind this heterogeneity, we particularly concentrate on the level of the financial depth in this study. When we consider the direct impact of financial deepening on the CA balance, the mechanism relies on the influence of financial depth on economic growth. However, the literature finds that financial deepening contributes to the GDP growth up to a certain threshold,[13] and after this point, the positive contribution of financial deepening on growth disappears. Moreover, Easterly *et al.* (2000) argues that, further deepening after the threshold increases the volatility of output growth. Therefore, these nonlinearities motivate us to develop a different approach and study how the influence of financial excess might change with the level of financial depth.[14] We measure financial depth as the historical average of the ratio of total credit stock to GDP for each country.

To this end, we extract country-specific slopes from the whole sample by using the estimation methodology involving country specific dummies as in Equation 2. Instead of providing all results, we depicted them in Fig. 1, which plots the level of financial depth and the extracted slopes.[15] Panel A of the figure shows the results for the full sample where panel B considers only the developing countries. The figure indicates that there is a significant degree of slope heterogeneity across the sample. Moreover, there is a positive relationship between the depth in the financial markets and influence of the credit growth on the CA balance. The same finding is also valid when only the developing countries are included, where the relationship is more pronounced.

To proceed in a more systematic way, we form interaction variables for the credit growth and financial depth. We estimate the following equation, which allows us to examine the impact of the credit growth on the CA balance conditional on the level of financial depth.

$$\left(\frac{CA}{GDP}\right)_{it} = \beta_0 + \beta_1\left(\frac{\Delta Credit}{GDP}\right)_{it} + \gamma\left(\frac{\Delta Credit}{GDP}\right)_{it} financialdepth_i + \delta\, financialdepth_i + \beta_2 X_{it} + \varepsilon_{it} \quad (3)$$

The results are presented in Table 5, which shows that the impact of the credit growth on the CA

[13] Arcand *et al.* (2012) suggests that when the credit stock to GDP ratio reaches 100%, additional financial development puts a negative effect on output growth.

[14] The direct impact of financial deepening on the CA balance has been studied extensively starting with Chinn and Prasad (2003). Although theoretically one might expect a negative relationship between financial depth and the CA balance, the literature could not establish a clear finding on this issue. For instance, Gruber and Kamin (2007, 2009) fail to report a statistically significant association in empirical terms.

[15] The regressions are run separately for each country and the control variables are included in the estimation processes.

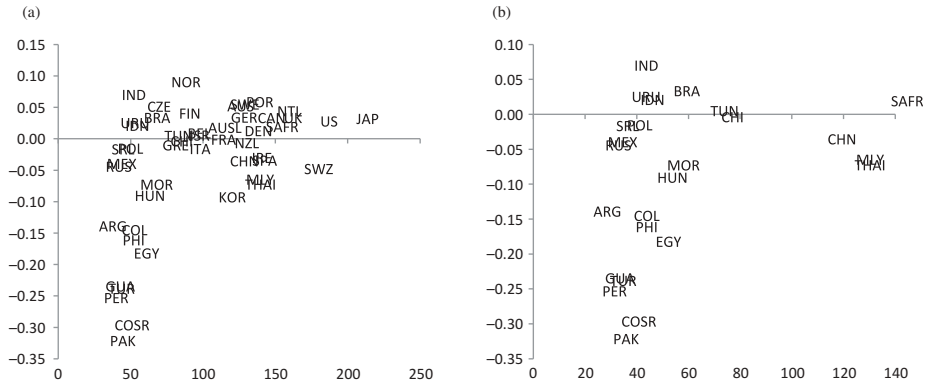

Fig. 1. Country-specific parameters and financial depth. (a) Full sample with control variables. (b) Developing countries with control variables

Notes: This figure is derived from the estimation of Equation 2. It plots the country-specific parameters extracted out of this estimation. The country-specific parameters measure the incremental sensitivity of the countries' CA balance to the credit growth relative to the panel average.

Table 5. Credit levels and the impact of the credit growth on the CA balance

	(1)	(2)	(3)	(4)
Pooled generalized least squares (GLS) with a panel-wide AR(1)				
Credit growth	−0.030***	−0.080***	−0.027**	−0.066***
	(0.005)	(0.012)	(0.006)	(0.013)
Credit growth × financial depth*		0.047***		0.035**
		(0.010)		(0.011)
Financial depth		0.024***		0.027***
		(0.005)		(0.007)
Controls	No	No	Yes	Yes
No. of observations	1000	1000	967	967
No. of countries	49	49	49	49
R^2	0.01	0.06	0.35	0.27
Root MSE	0.048	0.046	0.039	0.039
Robustness check: fixed-effects estimation				
Credit growth	−0.040***	−0.078***	−0.034**	−0.075***
	(0.018)	(0.034)	(0.013)	(0.029)
Credit growth × financial depth*		0.036***		0.036**
		(0.026)		(0.024)
Controls	No	No	Yes	Yes
No. of observations	1000	1000	967	967
No. of countries	49	49	49	49
R^2	0.01	0.02	0.28	0.25
Root MSE	0.048	0.047	0.057	0.057

Notes: SEs in brackets, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
Credit growth × financial depth denotes the interaction variable between the credit growth and the level of financial depth.

balance is getting weaker for higher levels of financial depth.[16] In addition, we run an exercise to examine the implied coefficients[17] for the high 10 percentile and the low 10 percentile financial depth levels. The estimation results (in column 4 where control variables are included) implies that a 10 percentage point increase in the credit growth would worsen CA balance by 0.16 percentage points for a

[16] We provide the results for fixed-effects estimation in Table 5 as a robustness check.
[17] Details of the calculations are available upon request.

country with financial depth level at the high 10 percentile. On the other hand, same level of a credit boom would worsen the CA balance by 0.58 percentage points for a country where financial depth level is at the low 10 percentile.

V. Robustness

To verify our results, we conduct some robustness checks. Our first robustness test is using alternative indicators to measure financial excess and financial depth. Then, we employ a dynamic panel data (DPD) estimation to deal with a potential endogeneity problem.

As for the alternative measures for financial excess and financial depth, we first use the annual growth rate of credit stock (instead of the change in credit stock to GDP ratio). We re-estimate Equation 3 with this new variable and the results are reported in Table 6. The results indicate that the annual credit growth rate has a similar impact on the CA balance. Moreover, the impact is weakened for higher levels of financial depth. Second, to check the results with respect to the choice of financial depth measure, we generate dummies for alternative levels of financial depth, using stock market and bond market capitalizations (both as ratios to GDP). Estimation results with different measures of financial depth levels are reported in Table 7, which supports our main findings. As the bond or stock market capitalization levels increase, the impact of credit growth on the CA balance becomes weaker.

Regarding the empirical strategy, it might be argued that the causal relationship between the domestic credit growth and foreign borrowing may not be clear since the shocks that are deriving the latter might also affect the former.[18] In other words, shocks that are driving the credit growth can also affect the foreign borrowing. The same concern is addressed by IMF (2013) suggesting that the source of financing, whether it is domestic or foreign, is in the secondary importance compared with proxying the lack of policies that could limit excessive credit growth. Moreover, the financial and economic cycles do not necessarily coincide and the credit growth carries information about the CA balance that is not addressed by the latter one. A similar approach to ours is implemented in Atoyan *et al.* (2013), which uses the credit growth as a determinant of the CA balance and identifies it among the most important determinants of the CA balance, which is exacerbated during the post-crisis period.

To control for a potential endogeneity problem, we employ generalized method of moments (GMM) procedure that is developed for DPD models by Arellano and Bond (1991). GMM procedures for DPD models have been widely used in the literature as these models can handle multiple endogenous

Table 6. Alternative determinants for the CA balance and credit levels (pooled generalized least squares (GLS) with a panel-wide AR(1))

	(1)	(2)	(3)	(4)
Annual credit growth	−0.016***	−0.014***	−0.027***	−0.022***
	(0.003)	(0.003)	(0.007)	(0.006)
Annual credit growth × financial depth*			0.016***	0.011
			(0.007)	(0.007)
Financial depth			0.022**	0.0260***
			(0.006)	(0.008)
Controls	No	Yes	No	Yes
No. of observations	1000	967	1000	967
No. of countries	49	49	49	49
R^2	0.01	0.41	0.04	0.26
Root MSE	0.048	0.037	0.047	0.039

Notes: SEs in brackets, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
Credit growth and credit level are used as alternative financial excess measures.
Annual credit growth × financial depth denotes the interaction variable between annual credit growth of credit stock and level of financial depth.

[18] See IMF (2013) for a detailed discussion.

Table 7. Alternative measures for financial depth (pooled generalized least squares (GLS) with a panel-wide AR(1))

	(1)	(2)	(3)	(4)
Credit growth	−0.048***	−0.037***	−0.063***	−0.051***
	(0.011)	(0.013)	(0.011)	(0.012)
Credit growth × stock*	0.020	0.008		
	(0.015)	(0.017)		
Stock*	0.034***	0.023**		
	(0.010)	(0.009)		
Credit growth × bond*			0.042***	0.033***
			(0.009)	(0.010)
Bond*			0.021***	0.020**
			(0.006)	(0.009)
Controls	No	Yes	No	Yes
No. of observations	916	891	752	728
No. of countries	45	45	37	37
R^2	0.02	0.35	0.02	0.30
Root MSE	0.048	0.040	0.049	0.042

Notes: SEs in brackets, ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.
Stock market capitalization ratio to GDP and bond market capitalization ratio to GDP are used as to generate different financial depth levels. Credit growth × stock and credit growth × bond denote the interaction variables between the credit growth and financial depth level as stock market capitalization and bond market capitalization, respectively.

variables by using first-differencing and lagged values of the endogenous variables as instruments. Similar GMM procedures are also used in the studies identifying dynamics of the CA balance such as Calderon *et al.* (2002) and Cheung *et al.* (2013). The results of the DPD models with GMM estimation[19] are reported in Table 8. The results of the GMM estimations indicate that when potential endogeneity problem is taken into consideration, the results remain intact. The credit growth has a statistically significant impact on the CA balance and the impact declines with the level of financial development.

Table 8. Controlling for potential endogeneity problem (difference GMM estimation)

	(1)	(2)
Credit growth	−0.033**	−0.182**
	(0.015)	(0.083)
Credit growth × financial depth		0.136*
		(0.068)
Controls	Yes	Yes
No. of observations	868	868
No. of countries	49	49
Specification tests (*p*-values)		
Hansen Test for overidentification	0.788	0.781
First-order correlation	0.017	0.044
Second-order correlation	0.128	0.100
Number of instruments	61	61

Notes: SEs in brackets, **$p < 0.05$, *$p < 0.1$.
Instruments include second order lag of CA balance and first and second order lags of the credit growth as GMM type instruments and oil trade balance, dependency ratios for young and old are used as IV type instruments.

VI. Conclusion

This study undertakes a challenging task of examining the impact of financial variables on the CA

[19] In this study, we prefer difference GMM estimation, which is proposed by Arellano and Bond (1991). To limit the set of instruments as Roodman (2009) suggests, for the difference equation, instruments include second-order lag of CA balance and first- and second-order lags of the credit growth as GMM type instruments. Oil trade balance and dependency ratios for young and old are used as IV type instruments. To reduce the number of instruments, other control variables are assumed to be exogenous. In addition, as reported in Table 8, Hansen's overidentification test and tests for autocorrelation give expected results. Hansen test statistic indicates that selected instruments are valid and are exogenous as a group. The results for Arellano–Bond's first-order and second-order serial correlation tests suggest that there is serial correlation for the first-order correlation and as expected there is no serial correlation for the second order.

dynamics. When we look at the previous work on the impact of financial variables on the CA balance, we observe that there are two strands of literature focusing on financial excess and financial depth. In this study, we implement a different approach and combine these two views. We first report a significant impact from the degree of financial excess, measured by the ratio of the change in new lendings to the private sector to GDP on the CA balance. Then, we show that there is a large dispersion in the country-specific parameters and argue that the level of financial depth can account for this dispersion. We present strong empirical evidence that the credit growth causes a higher deterioration in the CA balance for lower levels of financial depth. In other words, acceleration in the domestic credit causes a larger deterioration in the CA balance, particularly for the countries that are in the early stages of financial development. Our results imply that low financial-depth countries should be mindful of their domestic credit growth rate and implement appropriate monetary and macro-prudential policies to avoid possible disruptive impact of the credit growth on the CA balance.

This study can be extended in several directions. First of all, the composition of the credit stock is important for CA dynamics. Buyukkarabacak and Krause (2009) shows that lending to the consumers negatively affects the trade balance by increasing the demand for consumption, where the firm loans raise the net exports by increasing the demand for investment goods. Second issue is related with the means by which the credit growth is financed. Credit growth financed by domestic deposits may not alter the CA balance compared with the case where it is financed by foreign borrowing. Future work concerning these issues will enhance our understanding of the CA dynamics and help to implement more effective policies.

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No potential conflict of interest was reported by the authors.

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