Global Research Unit
Working Paper #2021-019

Does household borrowing reduce the trade balance? Evidence from developing and developed countries

Can Xu, University of Groningen
Jan Jacobs, University of Groningen, CAMA and CIRANO
Jakob de Haan, University of Groningen and CESifo, Munich

Does household borrowing reduce the trade balance? Evidence from developing and developed countries

Can Xu
University of Groningen
carl.xu@rug.nl

Jan Jacobs
University of Groningen, CAMA and CIRANO
j.p.a.m.jacobs@rug.nl

Jakob de Haan
University of Groningen and CESifo, Munich
jakob.de.haan@rug.nl

May 4, 2021

Abstract

We examine the dynamic impact of household borrowing on the trade balance using data from 33 developing countries and 36 developed countries over the 1980-2017 period. Our findings suggest that the impact of household borrowing on the trade balance is by and large negative, both in the short and long run. We show that household borrowing's adverse effects on the trade balance are more pronounced but less persistent in developing countries.

JEL classifications: E21; F32; G21

Keywords: household borrowing; trade balance; dynamic effects; panel ARDL model

1 Introduction

The effect of household borrowing on the trade balance (net exports) is important and intriguing at the same time. The earliest known proponents of the notion that household borrowing has an adverse effect on the trade balance are Büyükkarabacak and Krause (2009); their view was later endorsed by Ekinci et al. (2015), Bahadir and Gumus (2016), and Islam (2017). These studies suggest that higher household borrowing raises consumption, which, in turn, increases imports and reduces the trade balance. By contrast, there is another strand of literature on household borrowing and consumption arguing that these two variables might not be positively related (Dynan, 2012; Lombardi et al., 2017). In particular, Lombardi et al. (2017) explore both the short- and long-run effects of household borrowing on consumption and conclude that household borrowing only boosts consumption in the short run, while this effect is not significant in the long run. They argue that excessive indebtedness implies that a growing share of households' income is used for debt repayments, thus having a long-run negative impact on consumption. Seen from this perspective, an increase in household borrowing reduces the consumption of imports in the long run and thereby contributes to an improvement of the trade balance.

Against this backdrop, we contribute to the literature by studying the short- and long-run effect of household borrowing on the trade balance for both developing and developed countries. Using data for 33 developing countries and 36 developed countries over the 1980-2017 period, we find that the negative link between household borrowing and the trade balance holds in both the short and long run.

Our findings have important implications. First, household borrowing and the trade balance are essential in the interaction between financial and business cycles (Mian et al., 2017). Ups and downs in household borrowing reflect fluctuations in financial cycles, and the trade balance is an important factor in driving business cycles. Understanding the causal relationship between household borrowing and the trade balance contributes to this field by providing evidence on whether and how financial factors influence real economic activities. Second, the relationship between household borrowing and the trade balance also helps explain cross-country differences in the relationship between financial

development and the real economy. Studies show that the relationship between financial development and economic growth is non-linear (Cecchetti and Kharroubi, 2012; Arcand et al., 2015; Samargandi et al., 2015). Household borrowing plays a vital role in measuring financial development. In addition, the trade balance is an integral part of GDP. An exploration of the nexus between household borrowing and the trade balance provides evidence regarding how and to what extent financial development contributes to economic growth. Third, studying how household borrowing affects the trade balance helps to better understand finance's role in global imbalances. Multiple studies indicate that besides fluctuations in real activities, finance-related factors also play a non-negligible role in determining trade balances. One such variable is household borrowing. For example, Büyükkarabacak and Krause (2009) show that the two components of financial development, household and firm borrowing, have different economic implications. The former affects domestic demand, and the latter affects domestic supply. Therefore, these authors suggest that household borrowing needs to be treated as a separate determinant of the trade balance. In this study we focus on household borrowing because it is more likely than firm borrowing to have negative effects on the trade balance. Still, we control for the influence of firm borrowing on the trade balance. In contrast to studies explaining the differences between two types of borrowing like Büyükkarabacak and Krause (2009) and Islam (2017), we do not explain why household borrowing and firm borrowing affect the trade balance differently. Instead, we analyze whether and how household borrowing affects the trade balance in the short and long run.

The remainder of the paper is organized as follows. Section 2 summarizes related literature. Sections 3 and 4 present our data and methodology. Section 5 offers the main results. Section 6 presents our sensitivity analyses. Finally, section 7 concludes.

2 Previous research

This paper is directly related to the literature on the effects of household borrowing on consumption and the trade balance. Indeed, the predominant view is that household

borrowing has an adverse influence on trade balances. According to the Life-Cycle or Permanent Income Hypothesis, households borrow to smooth their consumption and invest in high-return assets such as education and housing, which boosts their average lifetime expenditures. This increase in household expenditure is positively linked with imports and negatively linked with the trade balance (Büyükkarabacak and Krause, 2009; Ekinci et al., 2015; Islam, 2017). Moreover, an increase in household borrowing is also associated with a higher level of financial development, which in turn, according to the 'savings glut' theory, accounts for the decline of domestic saving and of the trade balance (Jappelli and Pagano, 1994; Chinn and Ito, 2007). So, an increase in household borrowing tends to reduce the trade balance.

However, there is a contrasting view that household borrowing is not negatively associated with the trade balance. Using data of 30 countries from 1960 to 2012, Mian et al. (2017) find that an increase in household debt relative to GDP predicts a fall in imports which improves the trade balance. Three strands of literature provide arguments for this. First, using micro-level household data, Dynan (2012) and Kukk (2016) show that high household borrowing may contribute to weakness in future consumption, especially when the economy is experiencing a depression. Second, excessive household borrowing can indirectly reduce household consumption by making a country more vulnerable to financial disruptions, potentially even leading to a financial crisis (Jordà et al., 2011; Davis et al., 2016). As average income growth falls during the crisis, the pressure of repayment makes households reduce consumption, causing a decline of demand and lower output growth. Third, given that mortgage loans account for a large part of household borrowing in some countries, the negative wealth effect on consumption associated with declining house prices or other shocks may be amplified (Mian et al., 2013). In these views, household borrowing may slow down consumption and improve the trade balance.

This paper is closely related to studies that investigate the role of credit-related variables in explaining global imbalances. The early literature on the determinants of global imbalances paid much attention to real economic and demographic factors such as excess savings in emerging market countries (Bernanke, 2005), dependency ratio heterogeneity

(Masson et al., 1998), the "twin deficits" theory (Obstfeld and Rogoff, 2009), and the stages of development hypothesis (Roldos, 1996). Recent discussions regarding global imbalances shed light on the effects of financial development, which is usually measured by the level of private borrowing, but the relevant empirical findings are ambiguous. Some studies indicate that financial development negatively affects the trade balance (Chinn and Ito, 2007; Ekinci et al., 2015). This is because private credit expansion stimulates consumption and reduces domestic savings, which further reduces imports and deteriorates the trade balance. In contrast, Beck (2002) finds that countries with a high level of financial development are prone to have a comparative advantage in some sectors and become net exporters. Moreover, Gruber and Kamin (2009) show that financial development fails to explain global imbalances. The disruptive influences of the Global Financial Crisis (GFC) in 2007-2008 highlighted the importance of credit-related factors in affecting international trade. For example, Chor and Manova (2012) argue that private credit serves as a channel for a financial crisis affecting international trade. The credit crunch reduces the availability of external finance, which further inhibits the increase of exporters' production and export capacities. Unger (2017) investigates the nexus between credit growth and the current account balance in the euro area. He distinguishes pull and push channels through which credit could affect the trade balance. The pull channel captures how bank loans to domestic firms raise domestic demand, while the push channel measures how domestic banks' claim on debtors in foreign countries accelerate domestic savings flowing abroad.

Another strand of literature related to this paper differentiates between credit to households and credit to firms. Researchers have paid more attention to firm credit growth because it promotes firms' investments and is less likely than household credit expansion to lead to financial instability (Beck et al., 2012; Mian et al., 2017; Sassi and Gasmi, 2014). For example, Beck et al. (2012), looking at 45 developing and developed countries, find that household borrowing does not have a positive relationship with economic growth, but firm borrowing has. This is because firm borrowing growth leads to faster reductions in income inequality and drives financial development's positive im-

pact on economic growth. In addition, Büyükkarabacak and Valev (2010) find that an increase in household credit without pushing up income levels generates vulnerabilities that can precipitate a banking crisis. The same effects of firm credit expansion are tempered by the accompanying increase in income. Büyükkarabacak and Krause (2009) and Islam (2017) study the different impacts of household credit and firm credit on the trade balance. Their results show that an increase in household credit and firm credit raises domestic demand for consumption and investment, respectively. Although both kinds of credit lead to a deterioration of the trade balance in the long run, the increase in firm credit also has a positive effect on the trade balance because it promotes firms' capacity for production and exports.

Finally, this paper is related to studies that focus on the impact of household borrowing on consumption and economic growth. Theoretically, household borrowing up to some level is believed to be beneficial to the economy because it alleviates budget constraints for households, which therefore promotes consumption. Yet, empirical findings concerning the implications of household borrowing on consumption are ambiguous. For example, Dynan (2012), using household-level data from the U.S., finds that due to debt overhang the high leverage of households appears to be associated with weak consumption growth, even after accounting for wealth effects. Moreover, unsustainable credit growth leads to the build-up of systemic risks and financial instability, thus predicting financial crises (Davis et al., 2016; Jordà et al., 2011; Aikman et al., 2015; Alter et al., 2018). Mian et al. (2017) find that an increase in household borrowing predicts a decline in future output growth and employment, which exacerbates the economic downturns in the cycle's bust phase. Lombardi et al. (2017) differentiate between the short- and long-run effects of household borrowing on consumption and conclude that only in the short run both variables are positively related. Bahadir and Valev (2020) also find that household borrowing has a negative effect on consumption growth, and this effect is stronger in countries with weak institutions.

3 Data

This study is based on an annual panel data-set covering 33 developing countries and 36 developed countries, as classified by the World Bank (WB) in 2010, over the period 1980-2017. The countries in the panel are listed in Appendix B. The choice of countries and time period is mainly driven by data availability. Note that because we are interested in exploring the dynamic effects of household borrowing on the trade balance, we prefer to keep countries with more extended time series data and exclude countries for which available data is too short to estimate regressions. In our sample the shortest period for the trade balance is 16 years, and that of household borrowing is 12 years. Our dependent variable, the trade balance, is measured as the ratio of net exports (exports minus imports) to GDP. We focus on the effect of household borrowing on the trade balance rather than that on the current account balance for two reasons. First, the concept of the current account balance is too broad to investigate the detailed mechanism through which household borrowing affects external balances. The current account records not only exports and imports of goods and services but also international receipts or payments of income. Therefore, the current account balance measures a country's net exports as well as net international capital receipts. Focusing on the trade balance helps us to identify the effects of household borrowing on the real economic activities and avoids mixing the implications on both trade-related and finance-related variables. Second, it is easier to control for reverse causality from external balances to household borrowing. Samarina and Bezemer (2016), for example, show that private credit can be affected by the current account balance. This causality from the current account balance might result in a bias in estimating the trade balance effects from household borrowing.

Our primary explanatory variable, household borrowing, is directly collected from the International Monetary Fund (IMF) database and measured as the ratio of all loans and other debt instruments extended to households to GDP. We include a set of control variables typically used in the literature:

1. Firm borrowing: Büyükkarabacak and Krause (2009) find that firm borrowing is able to boost firm productivity and exports. Meanwhile, together with household

borrowing, firm borrowing is also a component of private credit, which is considered as an important driver of the trade balance.

2. Fiscal balances: Countries with higher government budget surpluses are expected to have higher national saving rates. Some studies (Chinn and Prasad, 2003; Chinn and Ito, 2007) report a positive relationship between fiscal balances and trade balances.

3. Dependency ratio: Masson et al. (1998) find that the dependency ratio plays a crucial role in determining private saving. Older and younger societies are expected to save less. Following the previous literature, we measure the relative dependency ratio as its difference from the GDP weighted means across all countries.

4. Terms-of-trade volatility: We include this variable to account for short- and medium-run fluctuations in the trade balance. Countries with more volatile terms-of-trade may save more for precautionary reasons and reduce their consumption and imports. Therefore, a positive association between the terms-of-trade volatility and trade balance is expected.

5. Growth rate: Following Chinn and Prasad (2003); Chinn and Ito (2007), we include this variable to capture the influence of economic growth or labor productivity growth on the trade balance.

A detailed description of all variables is in the Appendix A. Figure 1 shows the evolution of unweighted average trade balances and household borrowing in developing and developed countries from 1980 to 2017. As is apparent from this figure, developing countries usually have a lower trade balance and household borrowing, and the differences across the two country groups in each series have increased since 2000. Figure 2 displays the change in household borrowing (horizontal axis) against the trade balance (vertical axis) over the sample period in developing and developed countries. The downward fitted lines in both panels of Figure 2 suggest a negative relationship between household borrowing growth and trade balances. Moreover, the negative relation is more apparent in developed counties than in developing countries.

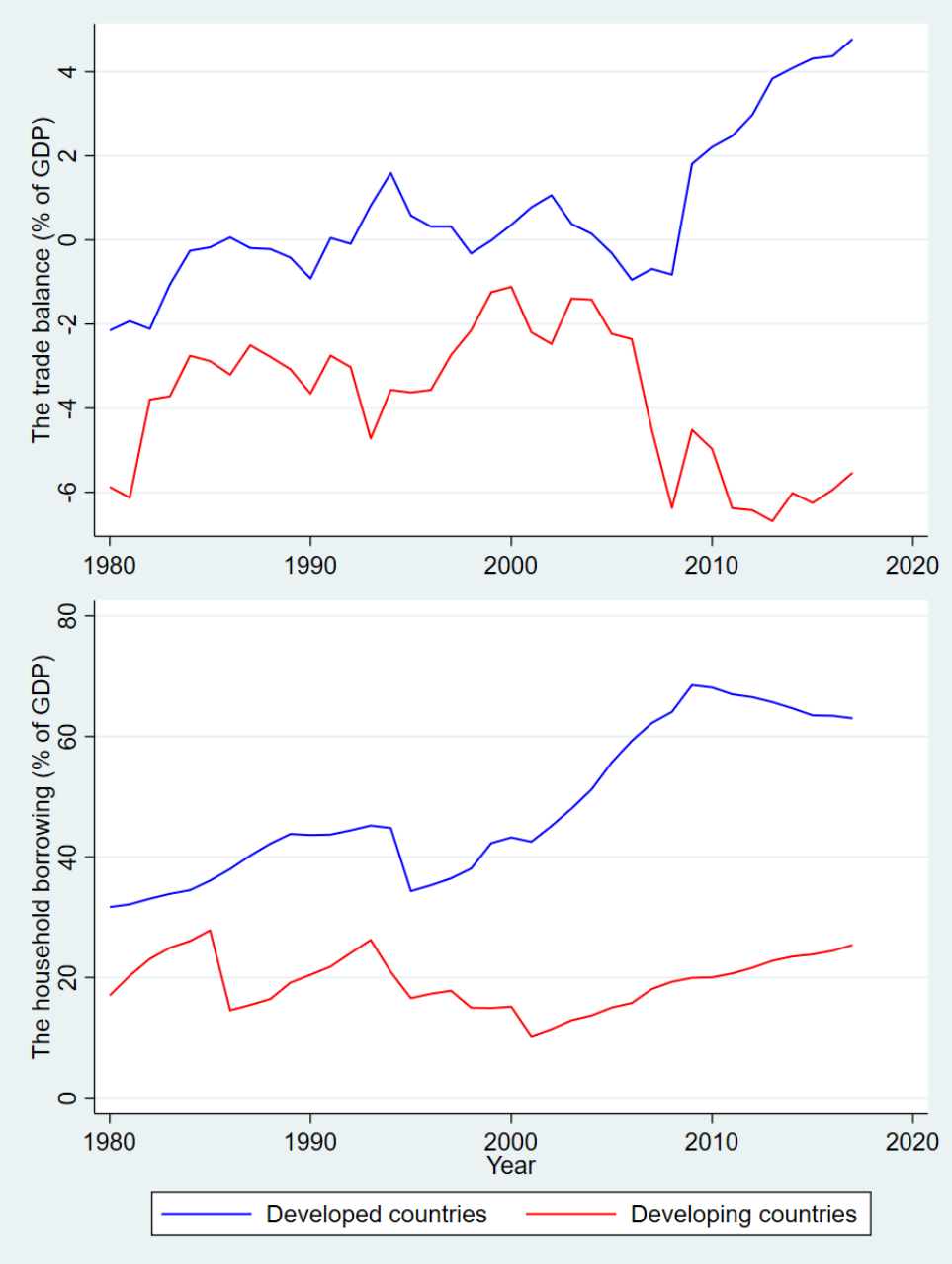

Figure 1: The trade balance and household borrowing

Notes: The upper panel shows (unweighted) average trade balances across developing and developed countries. The lower panel shows (unweighted) average household borrowing across developing and developed countries. In both panels, developing countries and developed countries are represented with red and blue lines, respectively.

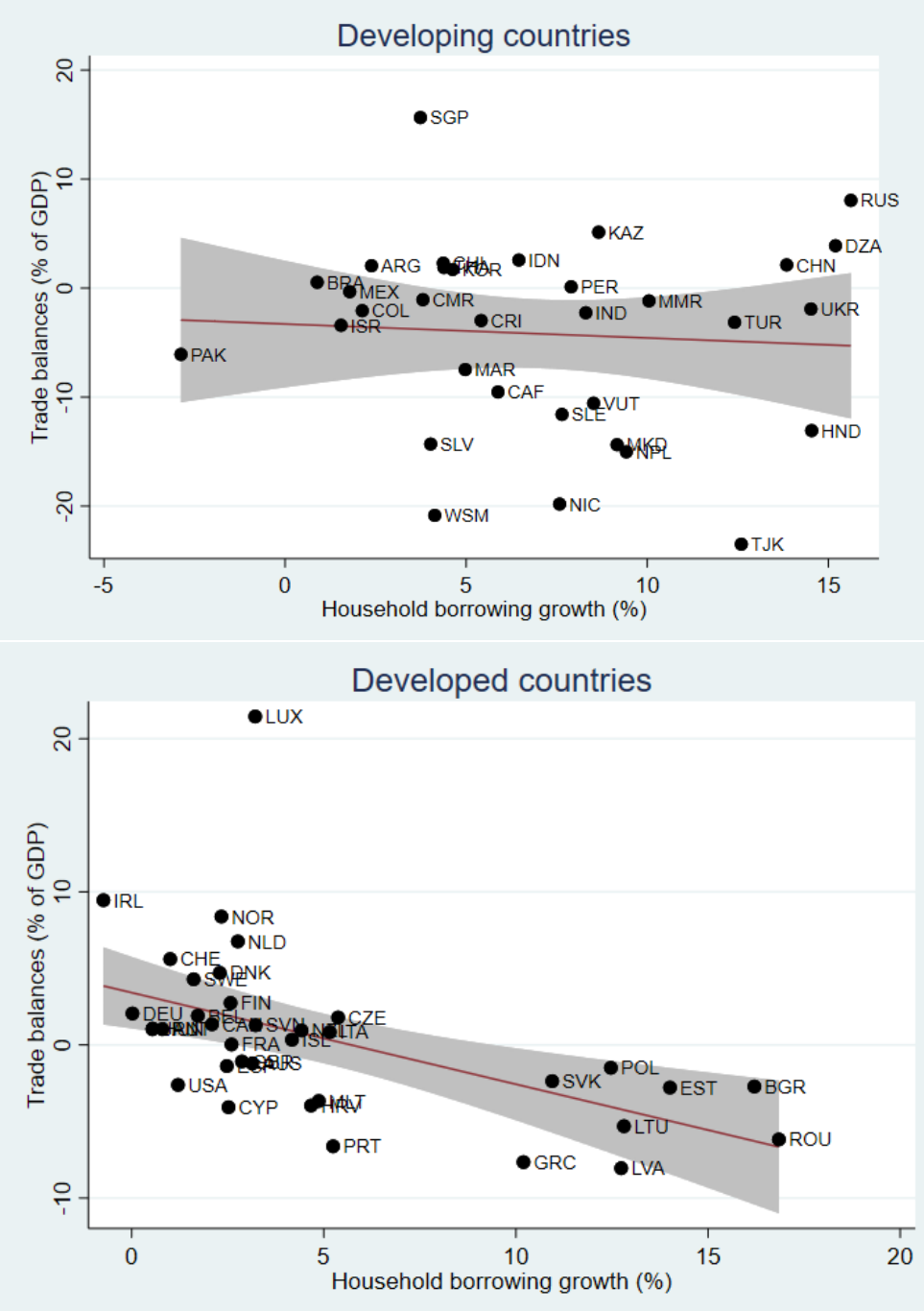

Figure 2: The trade balance and household borrowing

Notes: Both the trade balance and household borrowing are expressed as average values of each country from 1980 to 2017 if data are available. The red line represents the fitted linear relationship between two variables and the shadow area represents the 95% confidence interval.

Table 1 gives descriptive statistics. The variable Trade balance exhibits high cross-sectional variability ranging from -53.81 to 30.78 with an average value of -3.82 and a

standard deviation of 10.32 for developing countries, and from -20.67 to 33.72 with an average value of 0.78 and a standard deviation of 7.08 for developed countries. In general, developing countries' trade balances are relatively lower and spread out over a broader range compared to those of developed countries.

Table 1: Descriptive statistics

All countries	Obs	Mean	Std. Dev.	Min	Max
Trade balance (% of GDP)	2393	−1.44	9.09	−53.81	33.72
Imports (% of GDP)	2393	40.22	28.09	0.06	210.41
Exports (% of GDP)	2393	38.78	31.15	0.10	231.19
Household borrowing (% of GDP)	1687	38.90	30.59	0.08	139.43
Firm borrowing (% of GDP)	1686	69.32	52.67	1.11	569.08
Fiscal balance (% of GDP)	2103	−2.07	4.07	−32.05	30.45
Dependency ratio (%)	2622	−0.48	5.20	−12.80	13.73
Terms-of-trade volatility	2297	0.87	1.12	0.00	10.23
Growth rate (%)	2416	2.09	4.17	−36.83	23.94
Developing countries					
Trade balance (% of GDP)	1156	−3.82	10.32	−53.81	30.78
Imports (% of GDP)	1156	35.83	29.43	0.06	210.41
Exports (% of GDP)	1156	32.01	31.55	0.10	231.19
Household borrowing (% of GDP)	639	18.81	17.69	0.08	94.19
Firm borrowing (% of GDP)	638	37.40	28.89	1.11	157.43
Fiscal balance (% of GDP)	937	−1.61	3.95	−15.27	30.45
Dependency ratio (%)	1254	2.42	5.91	−12.80	13.73
Terms-of-trade volatility	1127	1.17	1.34	0.01	10.23
Growth rate (%)	1205	2.04	5.00	−36.83	20.86
Developed countries					
Trade balance (% of GDP)	1237	0.78	7.08	−20.67	33.72
Imports (% of GDP)	1237	44.33	26.14	6.94	191.55
Exports (% of GDP)	1237	45.11	29.41	6.98	224.84
Household borrowing (% of GDP)	1048	51.14	30.33	0.24	139.43
Firm borrowing (% of GDP)	1048	88.75	54.39	10.74	569.08
Fiscal balance (% of GDP)	1166	−2.45	4.14	−32.05	18.67
Dependency ratio (%)	1368	−3.13	2.28	−8.11	5.32
Terms-of-trade volatility	1170	0.59	0.73	0.00	6.42
Growth rate (%)	1211	2.14	3.13	−14.56	23.94

Prior to the model estimation, we test for unit roots to guarantee that variables are not integrated of order higher than 1. We conduct this test for each variable using a Fisher-type panel unit root test and the Im-Pesaran-Shin (2003) test that allow for unbalanced panels. Table 2 reports the test results. We find that the trade balance is a stationary variable in both country groups, while imports and exports are I(1) variables. Household and firm borrowing are only stationary after first-differencing in both groups. Therefore, this finding confirms a mixture of I(0) and I(1) variables in our sample.

Table 2: Panel unit root test outcomes

	ADF test statistic		IPS statistic		Result
Developing countries	Level	First difference	Level	First difference	
Trade balance	5.53***	61.34***	-4.11***	-22.93***	I(0)
Imports	1.54*	57.33***	-1.51*	-21.85***	I(1)
Exports	2.76***	50.75***	-2.16**	-20.25***	I(1)
Household borrowing	-1.94	12.79***	1.40	-11.43***	I(1)
Firm borrowing	1.26	13.48***	-0.58	-12.24***	I(1)
Fiscal balance	10.08***	48.99***	-6.82***	-19.02***	I(0)
Dependency ratio	9.40***	-0.07	-1.56*	0.83	I(0)
Terms-of-trade volatility	28.88***	88.67***	-13.87***	-29.00***	I(0)
Growth rate	31.67***	102.16***	-14.26***	-32.76***	I(0)
Developed countries					
Trade balance	2.06**	47.19***	-1.46*	-19.32***	I(0)
Imports	-1.46	55.64***	1.52	-21.88***	I(1)
Exports	-3.22	45.02***	4.15	-19.07***	I(1)
Household borrowing	-1.53	3.42***	1.82	-6.00***	I(1)
Firm borrowing	-0.58	15.76***	0.94	-12.96***	I(1)
Fiscal balance	11.68***	45.59***	-7.47***	-19.04***	I(0)
Dependency ratio	11.14***	6.07***	-4.03***	-3.55***	I(0)
Terms-of-trade volatility	41.14***	95.33***	-18.06***	-30.70***	I(0)
Growth rate	23.26***	80.2***	-12.65***	-27.58***	I(0)

Notes: The table presents the results of the Im-Pesaran-Shin (2003) and the Fisher-type ADF (Choi (2001)) panel unit root tests. The null hypothesis for both tests is that all panels have a unit root. The alternative hypothesis of the ADF test is that at least one country is stationary. The alternative hypothesis of the IPS test is that the fraction of the stationary countries is nonzero. Rejection of the null hypothesis implies that the tested variable is stationary. Lags are selected based on the Bayesian information criterion. Standard errors are in parentheses, *,** and*** denotes significance at 1%, 5% and 10% levels, respectively.

4 Methodology

4.1 Panel Auto-Regressive Distributed Lag (Panel ARDL) model

In time series studies, a common way to differentiate short- and long-run effects of one variable on another is to employ the Auto-Regressive Distributed Lag (ARDL) model, which includes lags of both dependent and independent variables. The ARDL model has become extremely popular in time series analysis since its invention. One reason for its popularity is that its error correction form can be used even with variables with different integration orders. Pesaran et al. (1999) first applied the ARDL model in a panel data framework. Based on their work, our dynamic panel regression can be incorporated into an error-correction model using the ARDL(p, q) technique mentioned above, where p is the number of lags of the dependent variable y_{it}, and q is the lag of the independent variables x_{it}. Our baseline specification is as follows:

$$\Delta y_{it} = \phi_i[y_{i,t-1} - (\beta_0^i + \boldsymbol{\beta}_1^i \boldsymbol{X}_{it})] + \sum_{j=1}^{p-1} \gamma_j^i \Delta y_{t-j} + + \sum_{j=0}^{q-1} \boldsymbol{\delta_j^i} \Delta \boldsymbol{X_{t-j}} + c + u_{it}, i = 1, \ldots, n, \quad (1)$$

where y_{it} and $\boldsymbol{X_{it}}$ are the dependent variable and a set of independent variables, respectively, and u_{it} is the error term. γ_j^i and $\boldsymbol{\delta_j^i}$ are the short-run coefficients of the lagged dependent and independent variables, respectively. $\boldsymbol{\beta}_1^i$ is the long-run coefficient, and ϕ_i, the coefficient of the lagged dependent variable, represents the speed of adjustment to the long-run equilibrium. The subscripts i and t represent cross-sectional units and time indexes, respectively. In ARDL models, the long-run effect refers to the equilibrium effects of independent variables on the dependent variable. The short-run effect accounts for short-run fluctuations due to deviations from the long-run equilibrium. One may compute how long it takes for an existing disequilibrium to be reduced by 50% (half-life of disequilibrium) using the error correction run coefficient ϕ_i.[1] The term in square brackets

[1] The half-lives period can be approximated as $-ln2/ln(1+\phi)$.

in Equation (1) defines the long-run regression and it can be written as:[2]

$$y_{i,t-1} = \beta_0^i + \boldsymbol{\beta_1^i X_{it}} + \mu_{it}, \quad \text{where} \quad \mu_i \sim I(0). \tag{2}$$

Conventional panel models assume that all units are homogeneous, suggesting that the coefficients are the same across all units. This is less realistic in macroeconomic studies that use country-level data. In this regard, Pesaran et al. (1999) develop three estimators that differ in the way they deal with possible heterogeneity across units. The first one is the Mean Group (MG) estimator, which assumes that both short- and long-run coefficients are heterogeneous. This estimator calculates the estimated coefficients using the unweighted means of all heterogeneous coefficients. The second is the Dynamic Fixed Effects (DFE) estimator. The DFE estimator assumes both the long- and short-run coefficients to be homogeneous. Therefore, all units have the same long- and short-run coefficients. The last is the Pooled Mean Group (PMG) estimator, which offers a compromise approach in the selection of homogeneous and heterogeneous models. The PMG estimator allows the short-run coefficients, the speed of adjustment, and error variances to be heterogeneous across units, while the long-run slope coefficients are still homogeneous.

To choose between these three estimators, the Hausman test can be used by examining whether there is a significant difference between these estimators. The MG estimator provides consistent estimates of the mean of the long-run coefficients, although these will be inefficient if the homogeneity hypothesis holds. Under long-run slope homogeneity, the pooled estimators are consistent and efficient. Therefore, the effect of heterogeneity on the means of the coefficients can be determined by a Hausman-type test applied to the difference between the MG and the PMG or the DFE estimators. Another issue is that although the MG estimator is consistent for large N and T, for small T the familiar lagged dependent variable bias causes the estimates of short-run coefficients to

[2] Theoretically, we can use the bounds cointegration test by examining the joint significance of the coefficient vector $\boldsymbol{\beta_1^i}$ in Equation (2). However, the STATA routine we use by default normalizes the vector such that the coefficient on the first term in the cointegrating vector is 1, and therefore, the normalized term is omitted from the estimation output. Accordingly, we are unable to perform the bounds cointegration test in Panel ARDL models.

underestimate their true values (Pesaran et al., 1999). In our context, we conduct two Hausman tests. In the first test we compare the DFE and MG estimator. Pesaran et al. (1999) indicate that under the null hypothesis both estimators are consistent but the DFE estimator is asymptotically more efficient. The DFE estimator is preferred over the MG when the null hypothesis is not rejected. In the second test we compare the PMG and MG estimator. Likewise, under the null hypothesis both estimators are consistent but the PMG is asymptotically more efficient. The PMG estimator comes with better performance when the null hypothesis is not rejected. The choice between the DFE and PMG estimator is less difficult and important since both assume long-run homogeneity of parameters. It is equivalent to testing the homogeneity of the error variances and the short-run slope coefficients. Therefore, it can be easily carried out using a Log Likelihood (LogL) ratio test, because the PMG and DFE estimators are restricted versions of the set of individual group equations (Pesaran et al., 1999). Under the null hypothesis that the short-run heterogeneity is insignificant, this log likelihood test statistic has an asymptotic $\chi^2(n)$ distribution where the degrees of freedom n equal the number of restrictions imposed which, in our case, is the difference in the number of estimated parameters in the PMG and DFE estimators. Therefore, a rejection of the null hypothesis implies that the PMG estimator is preferred over the DFE estimator.

4.2 Panel Vector Error Correction model (Panel VECM)

As it is not clear yet to what extent the effects of household borrowing on the trade balance are achieved via boosting imports, our next step is to examine the effects of household borrowing on the dis-aggregated trade balance. We identify the impact on imports and exports instead of the trade balance in order to see to what extent household borrowing reduces the trade balance via affecting imports or exports. For that purpose, we analyse a three variable system which includes household borrowing, imports and exports. Since these variables are non-stationary, we are not allowed to use the conventional Vector Autoregressive models (VAR) unless the non-stationary variables are differenced until they are stationary. However, this approach may cause loss of information. The

cointegration framework solves this problem by modelling non-stationary data through linear combinations of the levels of non-stationary variables that are stationary and called cointegrating relations. In order to analyse the existence of a cointegration (or long-run equilibrium) relationship among the variables, we first use the panel cointegration test developed by Westerlund (2007), which is based on structural rather than residual dynamics. The idea is to test the null hypothesis of no cointegration by inferring whether the error-correction term in a conditional panel error-correction model is equal to zero. If the null hypothesis is rejected, then cointegration is confirmed.

Our aim of the panel cointegration test is to rationalize the use of the following Panel VECM and determine the number of cointegrating equations. We use this test to ensure the reliability of empirical models of integrated variables and to avoid spurious regressions. However, the panel cointegration test does not yield estimates of the long-run parameters. To address this shortcoming, we perform a standard panel regression model with fixed effects to obtain the lagged residuals as the error correction terms (ECTs) in our Panel VECMs. ECTs provide a measure of the extent by which the observed values in time $t-1$ deviate from the long-run equilibrium. Since the variables are cointegrated, any such deviation at time $t-1$ should induce changes in the values of the variables in the next time point, in an attempt to force the variables back to the long-run equilibrium. The Panel VECM we use is as follows:

$$\begin{aligned}
\Delta HB_{it} &= c + \lambda_1 ECT_{i,t-1}^{HB} + \beta_1^{HB}\Delta HB_{i,t-1} + \beta_2^{HB}\Delta IM_{i,t-1} + \beta_3^{HB}\Delta EX_{i,t-1} + \epsilon_{1,it}, \\
\Delta IM_{it} &= c + \lambda_2 ECT_{i,t-1}^{IM} + \beta_1^{IM}\Delta HB_{i,t-1} + \beta_2^{IM}\Delta IM_{i,t-1} + \beta_3^{IM}\Delta EX_{i,t-1} + \epsilon_{2,it}, \\
\Delta EX_{it} &= c + \lambda_3 ECT_{i,t-1}^{EX} + \beta_1^{EX}\Delta HB_{i,t-1} + \beta_2^{EX}\Delta IM_{i,t-1} + \beta_3^{EX}\Delta EX_{i,t-1} + \epsilon_{3,it},
\end{aligned} \tag{3}$$

where HB_{it}, IM_{it}, EX_{it} are household borrowing, imports and exports of country i at time t, respectively. $ECT_{i,t-1}$ is the lagged residuals estimated from the following separate

equations:[3]

$$\begin{aligned} \text{Household borrowing equation: } HB_{it} &= \alpha_i + \beta_1 IM_{it} + \beta_2 EX_{it} + \epsilon_{it}, \\ \text{Imports equation: } IM_{it} &= \alpha_i + \beta_3 HB_{it} + \beta_4 EX_{it} + \epsilon_{it}, \\ \text{Exports equation: } EX_{it} &= \alpha_i + \beta_5 HB_{it} + \beta_6 IM_{it} + \epsilon_{it}. \end{aligned} \tag{4}$$

After $ECTs_{i,t-1}$ are obtained, we can estimate Equation (3) using the Generalized Method of Moments (GMM) technique developed by Arellano and Bond (1991). The GMM technique has been previously adapted to estimate panel VARs through using lags of the endogenous variables as instruments with an attempt to obtain unbiased and consistent estimates of the coefficients.

In order to understand the cause and effect direction among those variables in general, we then test the direction of causality between household borrowing and imports/exports. Conventional approaches to test causality are conducted by estimating VAR models and fail to consider the possibility of non-stationarity or absence of a cointegrating relationship among the variables. In this regard, Toda and Yamamoto (1995) developed a new procedure to test for Granger causality based on an augmented VAR model with a Modified Wald (MWald) test, and this procedure can be applied for series with different orders of integration, i.e. I(0), I(1), and I(2), and for non-cointegrated or co-integrated variables. The causality approach of Toda and Yamamoto (1995) applies a standard VAR model while variables are in levels rather than first differences (unlike the Granger causality test), implying that the risk of wrongly identifying the order of integration of the series is minimized (Mavrotas and Kelly, 2001). This approach consists of four steps: the first step is to determine the maximum order of integration among variables (d_{max}); the next step is to find the optimal lag order (p) of the VAR model in levels using different information

[3] There might be more than one error correction term. The number of ECTs is determined by the number of cointegration relationship that can be inferred by the panel cointegration test.

criteria; the third step is to construct a VAR($p + d_{max}$) model in levels as follows:

$$
\begin{aligned}
HB_{it} &= c_{it}^{HB} + \sum_{j=1}^{p} \alpha_j^{HB} HB_{i,t-j} + \sum_{j=1}^{p} \beta_j^{HB} IM_{i,t-j} + \sum_{j=1}^{p} \gamma_j^{HB} EX_{i,t-j} \\
&\quad + \sum_{k=p+1}^{p+d_{max}} \alpha_k^{HB} HB_{i,t-k} + \sum_{k=p+1}^{p+d_{max}} \beta_k^{HB} IM_{i,t-k} + \sum_{k=p+1}^{p+d_{max}} \gamma_k^{HB} EX_{i,t-k} + e_{it}^{HB}, \\
IM_{it} &= c_{it}^{IM} + \sum_{j=1}^{p} \alpha_j^{IM} HB_{i,t-j} + \sum_{j=1}^{p} \beta_j^{IM} IM_{i,t-j} + \sum_{j=1}^{p} \gamma_j^{IM} EX_{i,t-j} \\
&\quad + \sum_{k=p+1}^{p+d_{max}} \alpha_k^{IM} HB_{i,t-k} + \sum_{k=p+1}^{p+d_{max}} \beta_k^{IM} IM_{i,t-k} + \sum_{k=p+1}^{p+d_{max}} \gamma_k^{IM} EX_{i,t-k} + e_{it}^{HB}, \\
EX_{it} &= c_{it}^{HB} + \sum_{j=1}^{p} \alpha_j^{EX} HB_{i,t-j} + \sum_{j=1}^{p} \beta_j^{EX} IM_{i,t-j} + \sum_{j=1}^{p} \gamma_j^{EX} EX_{i,t-j} \\
&\quad + \sum_{k=p+1}^{p+d_{max}} \alpha_k^{EX} HB_{i,t-k} + \sum_{k=p+1}^{p+d_{max}} \beta_k^{EX} IM_{i,t-k} + \sum_{k=p+1}^{p+d_{max}} \gamma_k^{EX} EX_{i,t-k} + e_{it}^{HB}.
\end{aligned}
\tag{5}
$$

The final step is to use the MWald test to identify the direction of causality. For example, we can test the non-causality from household borrowing (HB_{it}) to imports (IM_{it}) by examining the significance of α_j^{IM}, $j = 1, 2, ..., p$ using the Wald statistic. The MWald statistic asymptotically follows a Chi-square (χ^2) distribution and the degrees of freedom are the number of time lags ($p + d_{max}$). Rejection of the null hypothesis entails the rejection of Granger non-causality. That is, an insignificant α_j^{IM} supports the presence of Granger causality from household borrowing to imports.

5 Results

5.1 Short-run and long-run effects of household borrowing on the trade balance

After performing the panel unit root tests and ensuring all variables are stationary either in levels or in first-differences, we first use the Panel ARDL approach to examine the long- and short-run effects of household borrowing on the trade balance. The lag structure of household borrowing is chosen based on the smallest SBIC (Schwarz Bayesian Information

Criterion). Regarding the control variables, in order to reduce the parameters to be estimated, we only include one lag of first-differenced control variables. Therefore, the framework we use is ARDL(1,1,1,1,1,1,1). The estimated models are displayed in Table 3. The upper and middle panels report the long-run and short-run coefficients of explanatory variables, respectively. Columns 1 to 3 show results for developing countries based on DFE, PMG and MG estimators, respectively. Columns 4 to 6 show results using the same estimators but now for developed countries.

Before explaining the coefficients, we first take a look at some statistics that help us evaluate the models. First, the Hausman test results reported in the bottom of Table 3 indicate that the MG estimators are rejected compared with either the PMG or DFE estimators because the null hypotheses are accepted that the PMG/DFE estimators are more efficient than MG estimators. Therefore, we conclude that heterogeneity between countries in each group is rejected, at least for the long-run coefficients. The other LogL tests that compare PMG and DFE estimators suggest that for developing countries the PMG estimator is supported since the null hypothesis is rejected. However, for developed countries, the DFE estimator is supported. Accordingly, our results imply a homogeneous long-run relationship and a heterogeneous short-run relationship between household borrowing and the trade balance for developing countries, whereas for developed countries both the long-run and short-run relationship are expected to be homogeneous.

With respect to the error correction terms, we find that their coefficients are significantly negative in all specifications, suggesting that there exists a cointegration relationship irrespective of the model or sample selection. Meanwhile, the error correction terms' coefficients in the preferred model are -0.406 and -0.288 for developing and developed countries, respectively, which implies that around 41% and 29% of any movements into disequilibrium are corrected within one year. The half-life period is 1.33 years for developing countries and 2.04 years for developed countries. This suggests that in general it takes one to two years for a disequilibrium in the trade balance caused by an increase in household borrowing to be reduced by 50%, while the effect of household borrowing on the trade balance is more persistent in developed countries.

As regards the long- and short-run coefficients, we find that for both sub-samples the long-run and the short-run coefficients of household borrowing are mostly significantly negative, implying that household borrowing reduces the trade balance. We find no evidence of a positive effect of household borrowing on the trade balance. This result is consistent with the empirical findings of Büyükkarabacak and Krause (2009), even though they only modeled emerging countries. In particular, the magnitude of the negative long-run coefficient of long-run household borrowing in developing countries (-0.482) is stronger than that in developed countries (-0.096), suggesting that the negative long-run impact of household borrowing on the trade balance is stronger in developing countries than in developed countries. Intuitively, a one unit (percent of GDP) increase in household borrowing in developing countries could lead to a reduction in the trade balance by 0.48 percent of GDP, and the same increase in developed countries could lead to a reduction in the trade balance by only 0.1 percent of GDP. This finding also applies to short-run household borrowing, with its coefficient being -0.343 for developing countries and -0.223 for developed countries. Taken together, we confirm the negative effects of household borrowing on the trade balance in both the short and long run, and find that this negative effect is slightly stronger in developing countries but less persistent than in developed countries.

In terms of control variables, the models used in this paper display more or less similar results and most coefficients have the signs consistent with the previous literature. We only focus on the interpretation of the long-run coefficients of our control variables and we do not replicate the discussion for the short-run coefficients for brevity. In both developing and developed countries, firm borrowing has significant and positive long-run coefficients, implying that an increase in firm borrowing will lead to an improvement in the trade balance in the long run. This result is consistent with the findings of Büyükkarabacak and Krause (2009) who argue that firm borrowing boosts investment and productivity and therefore is able to improve exports and the trade balance. The fiscal balance has a positive sign in both groups. The positive sign of the fiscal balance can be explained by the "twin deficit" theory, arguing that external deficits can be driven

Table 3: Panel ARDL results

	Developing countries			Developed countries		
	(1)	(2)	(3)	(4)	(5)	(6)
	DFE	PMG	MG	DFE	PMG	MG
Long-run coefficients						
Household borrowing	-0.173*	-0.482***	3.048	-0.096***	-0.067***	-0.167
	(0.092)	(0.036)	(1.872)	(0.018)	(0.009)	(0.103)
Firm borrowing	-0.045	0.089***	-1.159	0.054***	0.013**	0.042
	(0.051)	(0.026)	(1.044)	(0.009)	(0.005)	(0.063)
Fiscal balance	0.180	0.076	-1.397	0.303***	0.186***	0.229
	(0.178)	(0.046)	(1.055)	(0.083)	(0.047)	(0.173)
Dependency ratio	-0.528	-0.456***	11.430*	-0.119	-0.188**	0.678
	(0.351)	(0.116)	(6.718)	(0.192)	(0.094)	(1.214)
Terms-of-trade volatility	0.390	0.490***	-0.235	0.167	0.656**	0.696
	(0.483)	(0.162)	(3.066)	(0.458)	(0.283)	(0.815)
Growth rate	-0.025	-0.520***	-0.798	-1.182***	-0.860***	-0.659***
	(0.171)	(0.076)	(0.804)	(0.128)	(0.081)	(0.255)
Short-run coefficients						
Δ Household borrowing	-0.415***	-0.343	0.506	-0.220***	-0.223***	-0.186*
	(0.087)	(0.322)	(1.021)	(0.024)	(0.066)	(0.109)
Δ Firm borrowing	-0.104***	-0.301	-0.794*	-0.006	-0.069***	-0.103***
	(0.038)	(0.189)	(0.412)	(0.005)	(0.022)	(0.036)
Δ Fiscal balance	0.166***	0.112	0.904*	0.047	0.004	0.018
	(0.057)	(0.147)	(0.514)	(0.031)	(0.043)	(0.094)
Δ Dependency ratio	-1.548**	3.413	11.740**	0.671*	-0.512	-0.266
	(0.737)	(2.431)	(5.590)	(0.358)	(0.726)	(3.004)
Δ Terms-of-trade volatility	-0.115	-0.251	0.906	-0.231*	-0.563	0.351
	(0.145)	(0.581)	(0.828)	(0.122)	(0.443)	(0.337)
Δ Growth rate	-0.154***	-0.150	-0.401	0.123***	0.055	0.081
	(0.039)	(0.091)	(0.487)	(0.025)	(0.034)	(0.051)
Error correction term	-0.324***	-0.406***	-0.938***	-0.288***	-0.342***	-0.788***
	(0.030)	(0.065)	(0.160)	(0.021)	(0.034)	(0.077)
Constant	-7.821*	-4.417***	54.200	2.761	0.490	-25.790
	(4.521)	(1.243)	(89.650)	(1.842)	(0.572)	(24.850)
Log likelihood	-1540.627	-1031.116		-1811.474	-1181.216	
Hausman test (p-value)	0.37 (0.99)^a		0.18 (0.99)^b	0.67(0.99)^a		0.89 (0.99)^b
LogL test (DFE over PMG)	1019.02, p-value<0.01			0.52, p -value>0.10		
Countries	33			36		
Observations	589			909		

Notes: The dependent variable is ΔTrade balance$_{it}$. The DFE estimates are based on a panel fixed effects model. The MG estimates are based on country-specific regressions. The PMG estimates impose extra restrictions that the long-run coefficients are the same across countries, but are otherwise comparable to the MG estimates. Standard errors are in parentheses. *, **, *** represents the 10%, 5% and 1% significance level. Superscription a denotes that DFE is more efficient than MG under the null hypothesis. Superscription b denotes that PMG is more efficient than MG under the null hypothesis. The STATA routine we use is *xtpmg* which does not provide the log likelihood statistic for the MG estimates.

by government deficits (Abbas et al., 2011). A significant negative coefficient is obtained for the dependency ratio, showing that an economy with relatively high dependency ratio is prone to experience a reduction in the trade balance. This may be due to the fact that the non-working-age population saves less, which is negatively linked to the trade balance. Another significant control variable is the terms-of-trade volatility, which has a positive sign in both groups. As explained in the previous section, the positive signs imply that countries with more volatile terms-of-trade may reduce their consumption and imports, and therefore a positive association between the terms-of-trade gap and trade balances is expected. Finally, consistent with the findings of Chinn and Prasad (2003) and Chinn and Ito (2007), our results show that an increase in GDP per capita reduces the trade balance. Overall, since most control variables have reasonable signs, our empirical results from the Panel ARDL estimation confirm the long-run and short-run negative effects of household borrowing on the trade balance.

5.2 Results from Panel VECMs

Next, we perform the panel cointegration test developed by Westerlund (2007) for household borrowing, imports and exports. Our panel cointegration tests provide two kinds of statistics. The panel statistic tests the null hypothesis that the panel is not cointegrated as a whole. The group statistic tests the null hypothesis that at least one unit in the panel is not cointegrated. Rejection of the null hypothesis suggests that there is a cointegration relationship in the equation. The results are reported in Table 4. We perform the tests for both developing and developed countries and find that there is a cointegration relationship in both groups when imports are the dependent variable. For developing countries, both panel and group statistics suggest that there are two cointegrating equations (Imports equation and Exports equation). For developed countries, there is only one cointegrating equation (Imports equation) since the Panel statistic shows that there is no evidence of cointegration in the Exports equation. Based on the panel cointegration

test results, we estimate the long-run relationship for developing countries as follows:

$$Imports_{it} = \underset{(0.00)}{0.069}\, Household\ borrowing_{it} + \underset{(0.00)}{0.695}\, Export_{it} + \underset{(0.00)}{13.399}, \tag{6}$$

$$Export_{it} = \underset{(0.81)}{0.006}\, Household\ borrowing_{it} + \underset{(0.00)}{0.838}\, Imports_{it} - \underset{(0.03)}{2.574}, \tag{7}$$

and the long-run relationship for developed countries is as follows:

$$Imports_{it} = \underset{(0.00)}{0.034}\, Household\ borrowing_{it} + \underset{(0.00)}{0.746}\, Export_{it} + \underset{(0.00)}{8.578}, \tag{8}$$

where p-values are in parentheses. As illustrated in the above equations, one common finding for both developing and developed countries is that household borrowing is positively related to imports, which supports our findings from the Panel ARDL model that household borrowing reduces the trade balance via boosting imports. Interestingly, it is shown that imports and exports are also positively related, which might indicate the importance of global value chains.

Table 4: Panel cointegration results

Dependent variable	Developing countries		Developed countries	
	Panel statistics	Group statistics	Panel statistics	Group statistics
Imports	-9.608 (0.01)	-3.347 (0.00)	-14.245 (0.02)	-2.805 (0.00)
Exports	-9.164 (0.01)	-3.447 (0.00)	-11.870 (0.07)	-2.481 (0.01)
Household borrowing	-3.499 (0.80)	-1.735 (0.49)	-6.404 (0.63)	-1.288 (0.88)

Notes: The p-values in parentheses are obtained through 200 bootstraps. The null hypothesis is that there is no cointegration relationship.

The existence of at least one cointegration relationship rationalizes the use of the Panel VECM as the next step. The lagged residuals from the above equations (Equation(6), (7), and (8)) are included in the Panel VECMs as the error correction terms denoted by ECT_1^{IM}, ECT^{EX} and ECT_2^{IM}, respectively. The estimated results of Panel VECMs are reported in Table 5. The statistics in the lower part of Table 5 present strong evidence against the null hypothesis of zero auto correlation in the first-differenced errors at order 1, and presents no significant evidence of serial correlation in the differenced errors at

order 2. This suggests that the first-differenced errors are first-order serially correlated, implying that idiosyncratic errors are independent and identically distributed (i.i.d.). The Sargan and Hansen statistics show that the instruments we use in all equations are valid. Therefore, these tests presents no evidence of model misspecification.

Columns 2 and 5 of Table 5 show that household borrowing has a significant positive effect on imports in both developing and developed countries (coefficients are 0.364 and 0.194, respectively), with the positive association between household borrowing and imports being stronger in developing countries. For developing countries, household borrowing is significant in the imports equation, which validates the link that household borrowing negatively affects the trade balance via boosting imports. Columns 5 and 6 of Table 5 show that for developed countries, household borrowing has a significant positive coefficient in both the import and export equations (0.194 and 0.101, respectively), implying that household borrowing increases both imports and exports, while the relatively higher coefficient in the imports equation suggests that the impact on imports is larger than that on exports.

Finally, we perform panel Granger causality tests to examine the causality among variables. We find that both the optimal lag of the VAR model in levels and the maximum integration order of variables is one, therefore a VAR(2) model is defined from which we can get the results for the Granger causality test. Table 6 reports the Wald statistics for both developing and developed countries in which the arrows represent the direction of causality. The first row shows that the causality from household borrowing to imports is confirmed for both developing and developed countries, since the null hypothesis of insignificance is rejected. The second row indicates that there is causality from household borrowing to exports for developed countries but this is not significant for developing countries. The third and fourth row show no evidence for causality from imports or exports to household borrowing, since the null hypothesis of no causality is not rejected. The results indicate that the causality between household borrowing and the trade balance (imports and/or exports) is unidirectional. An increase in household borrowing affects imports and/or exports, but not vice versa. This evidence further validates the effect of

Table 5: Panel VECM results

	Developing countries			Developed countries		
	(1)	(2)	(3)	(4)	(5)	(6)
	Δ HB	Δ Imports	Δ Exports	Δ HB	Δ Imports	Δ Exports
Δ HB (-1)	0.331***	0.364***	0.105	0.665***	0.194***	0.101***
	(0.061)	(0.131)	(0.072)	(0.029)	(0.035)	(0.028)
Δ Imports (-1)	0.011	0.055	-0.002	0.176**	-0.070	-0.263***
	(0.013)	(0.057)	(0.029)	(0.076)	(0.044)	(0.070)
Δ Exports (-1)	-0.012	0.077	0.046	-0.159*	0.263***	0.426***
	(0.017)	(0.131)	(0.042)	(0.083)	(0.044)	(0.084)
ECT^{IM} (-1)	-0.001	-0.620***	-0.386***	-0.027	-0.403***	-0.044
	(0.014)	(0.053)	(0.059)	(0.043)	(0.081)	(0.040)
ECT^{EX} (-1)	0.056***	-0.316***	-0.428***			
	(0.014)	(0.054)	(0.040)			
Constant	0.489***	-0.655	0.102	0.327***	0.192***	0.367***
	(0.070)	(0.688)	(0.206)	(0.089)	(0.074)	(0.063)
AR(1)	0.01	0.11	0.05	0.00	0.00	0.00
AR(2)	0.29	0.92	0.54	0.82	0.31	0.61
Sargan statistic	571.15	544.07	555.01	942.03	967.54	987.43
Sargan p-value	0.36	0.67	0.54	0.48	0.27	0.14
Hansen statistic	27.49	27.66	24.70	32.16	33.22	31.81
Hansen p-value	1.00	1.00	1.00	1.00	1.00	1.00
Observations		576			967	
Countries		33			36	

Notes: Standard errors are in parentheses. *, **, *** represents the 10%, 5% and 1% significance level. The dependent variable in column 1 and column 4 is the first-differenced household borrowing. Column 2 and column 5 use the first-differenced imports as the dependent variable. Column 3 and column 6 show the results for the first-differenced exports. AR(1) and AR(2) calculate the p-values from the Arellano–Bond test for first- and second-order auto-correlation in the first-differenced errors. Sargan and Hansen statistics test he validity of instrument subsets, and the null hypothesis is that the instruments are valid.

household borrowing on the trade balance.

Table 6: Panel Granger causality results

Causality order	Developing countries ($p = 1$, $d_{max} = 1$)	Developed countries ($p = 1$, $d_{max} = 1$)
Household borrowing → Imports	7.45 (0.01)	24.72 (0.00)
Household borrowing → Exports	0.09 (0.76)	19.09 (0.04)
Imports → Household borrowing	3.25 (0.07)	0.01 (0.92)
Exports → Household borrowing	1.46 (0.23)	1.17 (0.28)
Imports → Exports	3.77 (0.05)	13.94 (0.00)
Exports → Imports	9.47 (0.00)	9.41 (0.00)

Notes: The causality directions are indicated by the arrows. The p-values are in parentheses. The null hypothesis is that there is no Granger causal relationship. The lag length (p) selection was based on three consistent moment and model selection criterion (MMSC) proposed by Andrews and Lu (2001).

6 Sensitivity Analysis

In order to reduce the bias due to country-specific factors, we re-estimate Equation (1) N times (N is the number of countries) but we drop one country each time to check to what extent household borrowing's negative effect on the trade balance remains the same. The full results are shown in Appendix C. We find that the long-run and short-run coefficients of household borrowing are again significantly negative, although the estimates differ somewhat. This finding confirms our results that a rise in household borrowing causes a decline in the trade balance and this effect is not country-specific. We obtained the same findings for developed countries. Our results show that the adverse long-run and short-run effects of household borrowing on the trade balance are valid no matter which country is dropped from our sample.

7 Conclusion

This paper investigates the relationship between household borrowing and the trade balance, with a particular interest in the differences between the short- and long-run effects. Using data from 36 developed countries and 33 developing countries over the 1980-2017

period, we find strong evidence for a negative relation between household borrowing and the trade balance, both in the short and long run. Our analyses show that the negative effect of household borrowing on the trade balance is stronger but less persistent in developing countries than in developed countries. Moreover, we find that for developing countries the negative effect of household borrowing on the trade balance is achieved via boosting imports. For developed countries, the negative effect of household borrowing on the trade balance is driven by the positive effects of household borrowing on both imports and exports, where the effect on imports is larger.

More research is needed to discern the role of mortgage loans and other household borrowing in affecting trade balances. Households with a mortgage may have lower uncertainty with respect to the amount of saving and spending (Fan and Yavas, 2018). Therefore, their consumption may display different responses to borrowing shocks, which may also complicate the effect on imports and the trade balance. Unfortunately, due to data limitations, we are unable to differentiate the effects of mortgage loans and other borrowing such as consumption loans on the trade balance at a country level. Hence, the empirical regularities documented in this paper point to some directions for further work, if data are available, towards understanding the effects of different types of household borrowing on the trade balance.

References

Abbas, Ali, Jacques Bouhga-Hagbe, Antonio J. Fatàs, Paolo Mauro, and Ricardo C. Velloso (2011), "Fiscal policy and the current account." *IMF Economic Review*, 59, 603–629.

Aikman, David, Andrew G. Haldane, and Benjamin D. Nelson (2015), "Curbing the credit cycle." *The Economic Journal*, 125, 1072–1109.

Alter, Adrian, Alan Feng, and Nico Valckx (2018), "Understanding the macro-financial effects of household debt: A global perspective." IMF Working Papers 76, International Monetary Fund, URL `https://www.elibrary.imf.org/doc/IMF001/25050-9781484349861/25050-9781484349861/Other_formats/Source_PDF/25050-9781484351888.pdf`.

Andrews, Donald WK and Biao Lu (2001), "Consistent model and moment selection procedures for gmm estimation with application to dynamic panel data models." *Journal of Econometrics*, 101, 123–164.

Arcand, Jean Louis, Enrico Berkes, and Ugo Panizza (2015), "Too much finance?" *Journal of Economic Growth*, 20, 105–148.

Arellano, Manuel and Stephen Bond (1991), "Some tests of specification for panel data: Monte carlo evidence and an application to employment equations." *The Review of Economic Studies*, 58, 277–297.

Bahadir, Berrak and Inci Gumus (2016), "Credit decomposition and business cycles in emerging market economies." *Journal of International Economics*, 103, 250–262.

Bahadir, Berrak and Neven Valev (2020), "Institutions, household credit composition, and the business cycle." *Economic Inquiry*, 58, 1401–1413.

Beck, Thorsten (2002), "Financial development and international trade: Is there a link?" *Journal of International Economics*, 57, 107–131.

Beck, Thorsten, Berrak Büyükkarabacak, Felix K. Rioja, and Neven T. Valev (2012), "Who gets the credit? And does it matter? Household vs. firm lending across countries." *The BE Journal of Macroeconomics*, 12, 1–46.

Bernanke, Ben S. (2005), "The global saving glut and the US current account deficit." URL `https://www.federalreserve.gov/boarddocs/speeches/2005/200503102/`.

Büyükkarabacak, Berrak and Stefan Krause (2009), "Studying the effects of household and firm credit on the trade balance: The composition of funds matters." *Economic Inquiry*, 47, 653–666.

Büyükkarabacak, Berrak and Neven T. Valev (2010), "The role of household and business credit in banking crises." *Journal of Banking & Finance*, 34, 1247–1256.

Cecchetti, Stephen and Enisse Kharroubi (2012), "Reassessing the impact of finance on growth." BIS Working Papers 381, Bank for International Settlements, URL `https://ideas.repec.org/p/bis/biswps/381.html`.

Chinn, Menzie and Eswar Prasad (2003), "Medium-term determinants of current accounts in industrial and developing countries: An empirical exploration." *Journal of International Economics*, 59, 47–76.

Chinn, Menzie D. and Hiro Ito (2007), "Current account balances, financial development and institutions: Assaying the world 'saving glut'." *Journal of International Money and Finance*, 26, 546–569.

Choi, In (2001), "Unit root tests for panel data." *Journal of International Money and Finance*, 20, 249–272.

Chor, Davin and Kalina Manova (2012), "Off the cliff and back? Credit conditions and international trade during the global financial crisis." *Journal of International Economics*, 87, 117–133.

Davis, J. Scott, Adrienne Mack, Wesley Phoa, and Anne Vandenabeele (2016), "Credit

booms, banking crises, and the current account." *Journal of International Money and Finance*, 60, 360–377.

Dynan, Karen (2012), "Is a household debt overhang holding back consumption?" *Brookings Papers on Economic Activity*, Spring 2012, 299–344.

Ekinci, M. Fatih, F. Pinar Erdem, and Zubeyir Kilinc (2015), "Credit growth, current account and financial depth." *Applied Economics*, 47, 1809–1821.

Fan, Ying and Abdullah Yavas (2018), "How does mortgage debt affect household consumption? Micro evidence from China." *Real Estate Economics*, 48, 1–46.

Gruber, Joseph and Steven Kamin (2009), "Do differences in financial development explain the global pattern of current account imbalances?" *Review of International Economics*, 17, 667–688.

Im, Kyung So, M. Hashem Pesaran, and Yongcheol Shin (2003), "Testing for unit roots in heterogeneous panels." *Journal of Econometrics*, 115, 53–74.

Islam, Roumeen (2017), "Credit composition, output composition, and external balances." Policy Research Working Paper Series 8082, The World Bank, URL `https://ideas.repec.org/p/wbk/wbrwps/8082.html`.

Jappelli, Tullio and Marco Pagano (1994), "Saving, growth, and liquidity constraints." *Quarterly Journal of Economics*, 109, 83–109.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor (2011), "Financial crises, credit booms, and external imbalances: 140 years of lessons." *IMF Economic Review*, 59, 340–378.

Kukk, Merike (2016), "How did household indebtedness hamper consumption during the recession? Evidence from micro data." *Journal of Comparative Economics*, 44, 764–786.

Lombardi, Marco Jacopo, Madhusudan Mohanty, and Ilhyock Shim (2017), "The real effects of household debt in the short and long run." BIS Working Papers 607, Bank for International Settlements, URL https://www.bis.org/publ/work607.htm.

Masson, Paul R, Tamim Bayoumi, and Hossein Samiei (1998), "International evidence on the determinants of private saving." *The World Bank Economic Review*, 12, 483–501.

Mavrotas, George and Roger Kelly (2001), "Old wine in new bottles: Testing causality between savings and growth." *The Manchester School*, 69, 97–105.

Mian, Atif, Kamalesh Rao, and Amir Sufi (2013), "Household balance sheets, consumption, and the economic slump." *The Quarterly Journal of Economics*, 128, 1687–1726.

Mian, Atif, Amir Sufi, and Emil Verner (2017), "Household debt and business cycles worldwide." *Quarterly Journal of Economics*, 132, 1755–1817.

Obstfeld, Maurice and Kenneth Rogoff (2009), "Global imbalances and the financial crisis: Products of common causes." CEPR Discussion Papers 7606, The Centre for Economic Policy Research, URL https://ideas.repec.org/p/cpr/ceprdp/7606.html.

Pesaran, M. Hashem, Yongcheol Shin, and Ron P. Smith (1999), "Pooled mean group estimation of dynamic heterogeneous panels." *Journal of the American Statistical Association*, 94, 621–634.

Roldos, Jorge (1996), "Human capital, borrowing constraints, and the stages of the balance of payments." *Manuscript, IMF*.

Samargandi, Nahla, Jan Fidrmuc, and Sugata Ghosh (2015), "Is the relationship between financial development and economic growth monotonic? Evidence from a sample of middle-income countries." *World Development*, 68, 66–81.

Samarina, Anna and Dirk Bezemer (2016), "Do capital flows change domestic credit allocation?" *Journal of International Money and Finance*, 62, 98–121.

Sassi, Seifallah and Amira Gasmi (2014), "The effect of enterprise and household credit on economic growth: New evidence from European union countries." *Journal of Macroeconomics*, 39, 226–231.

Toda, Hiro Y and Taku Yamamoto (1995), "Statistical inference in vector autoregressions with possibly integrated processes." *Journal of Econometrics*, 66, 225–250.

Unger, Robert (2017), "Asymmetric credit growth and current account imbalances in the euro area." *Journal of International Money and Finance*, 73, 435–451.

Westerlund, Joakim (2007), "Testing for error correction in panel data." *Oxford Bulletin of Economics and Statistics*, 69, 709–748.

A Variable description

1. Trade balance: The ratio of net exports (exports minus imports) to GDP. Data is obtained from the World Integrated Trade Solution (WITS) database of the World Bank.

2. Household borrowing: All loans and other debt instruments borrowed by households to GDP. Data is obtained from the Global Debt Database of the International Monetary Fund.

3. Firm borrowing: All loans and other debt instruments borrowed by non-financial firms to GDP. Data is obtained from the Global Debt Database of the International Monetary Fund.

4. Fiscal balance: The general government net lending/borrowing as a ratio of GDP. Data is taken from the World Bank national accounts data series.

5. Relative dependency ratio: The ratio of the population older than 65 years and younger than 14 to the population between 14 and 65. We calculated the difference from the GDP-weighted average for each period for all economies in each country group. Data is taken from the World Bank national accounts data series.

6. Terms of trade volatility: The three-year rolling standard deviation series of the ratio of an index of export prices to an index of import prices. Data is taken from the IMF database.

7. Growth rate: The year-on-year growth rate of GDP per capita. Data is taken from the World Bank national accounts data series.

B Sample description

Developing countries (33): Algeria, Argentina, Brazil, Cameroon, Central African Republic, Chile, China, Colombia, Costa Rica, El Salvador, Honduras, India, Indonesia, Israel, Kazakhstan, Korea, Mexico, Morocco, Myanmar, Nepal, Nicaragua, North Macedonia,

Pakistan, Peru, Russia, Samoa, Sierra Leone, Singapore, Tajikistan, Thailand, Turkey, Ukraine, and Vanuatu.

Developed countries (36): Australia, Austria, Belgium, Bulgaria, Canada, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

C Sensitivity analysis

The following tables provide the sensitivity analysis results for developing and developed countries, respectively.

Table 7: Sensitivity test for developing countries

Excluded country	Long-run HB		Short-run HB		Error correction term	
	Coefficient	Std.Dev.	Coefficient	Std.Dev.	Coefficient	Std.Dev.
Argentina	-0.131***	0.041	-0.771*	0.399	-0.259***	0.064
Brazil	-0.141***	0.044	-0.834**	0.389	-0.256***	0.062
Central African Republic	-0.150***	0.045	-0.872**	0.382	-0.260***	0.061
Chile	-0.164***	0.048	-0.802**	0.394	-0.230***	0.061
China	-0.152***	0.045	-0.866**	0.392	-0.242***	0.063
Cameroon	-0.154***	0.044	-0.795**	0.394	-0.258***	0.063
Colombia	-0.164***	0.048	-0.837**	0.39	-0.245***	0.063
Costa Rica	-0.149***	0.044	-0.788**	0.393	-0.261***	0.062
Algeria	-0.134***	0.041	-0.681*	0.384	-0.251***	0.064
Honduras	-0.157***	0.045	-0.811**	0.394	-0.255***	0.063
Indonesia	-0.125***	0.043	-0.850**	0.389	-0.236***	0.059
India	-0.147***	0.044	-0.846**	0.39	-0.249***	0.062
Israel	-0.435***	0.075	-0.765***	0.275	-0.218***	0.063
Kazakhstan	-0.099***	0.029	-0.796*	0.427	-0.243***	0.037
South Korea	-0.441***	0.075	-0.758***	0.276	-0.220***	0.063
Morocco	-0.154***	0.044	-0.825**	0.395	-0.250***	0.063
Mexico	-0.132***	0.042	-0.850**	0.392	-0.255***	0.063
North Macedonia	-0.157***	0.045	-0.802**	0.394	-0.245***	0.063
Myanmar	-0.147***	0.043	-0.906**	0.383	-0.263***	0.062
Nicaragua	-0.154***	0.044	-0.815**	0.395	-0.259***	0.063
Nepal	-0.152***	0.044	-0.832**	0.394	-0.257***	0.063
Pakistan	-0.154***	0.044	-0.763*	0.395	-0.255***	0.063
Peru	-0.155***	0.046	-0.842**	0.39	-0.249***	0.063
Russian	-0.157***	0.045	-0.840**	0.393	-0.251***	0.063
Singapore	-0.154***	0.045	-0.849**	0.393	-0.257***	0.063
Sierra Leone	-0.155***	0.044	-0.482**	0.205	-0.251***	0.063
El Salvador	-0.156***	0.044	-0.812**	0.399	-0.264***	0.062
Thailand	-0.162***	0.046	-0.834**	0.394	-0.254***	0.063
Tajikistan	-0.154***	0.044	-0.776**	0.395	-0.248***	0.063
Turkey	-0.156***	0.045	-0.819**	0.393	-0.254***	0.063
Ukraine	-0.385***	0.073	-0.785**	0.317	-0.225***	0.063
Vanuatu	-0.411***	0.074	-0.762***	0.284	-0.218***	0.063
Samoa	-0.152***	0.044	-0.814**	0.396	-0.251***	0.063

Notes: The dependent variable is ΔTrade balance$_{it}$. HB refers to household borrowing. Standard errors are in parentheses. *, **, *** represents the 10%, 5% and 1% significance level. Estimation are done with PMG estimations. Each row represents a model that excludes one country.

Table 8: Sensitivity test for developed countries

Excluded country	Long-run HB		Short-run HB		Error correction term	
	Coefficient	Std.Dev.	Coefficient	Std.Dev.	Coefficient	Std.Dev.
Australia	-0.119***	0.021	-0.225***	0.025	-0.293***	0.022
Austria	-0.097***	0.019	-0.221***	0.024	-0.288***	0.022
Belgium	-0.096***	0.019	-0.219***	0.024	-0.289***	0.022
Bulgaria	-0.094***	0.019	-0.226***	0.024	-0.268***	0.022
Canada	-0.094***	0.019	-0.215***	0.025	-0.293***	0.022
Croatia	-0.097***	0.019	-0.220***	0.025	-0.286***	0.022
Cyprus	-0.091***	0.018	-0.259***	0.025	-0.295***	0.021
Czech Republic	-0.097***	0.019	-0.223***	0.024	-0.290***	0.022
Denmark	-0.096***	0.019	-0.222***	0.025	-0.294***	0.022
Estonia	-0.093***	0.019	-0.224***	0.025	-0.288***	0.022
Finland	-0.094***	0.019	-0.217***	0.025	-0.291***	0.022
France	-0.096***	0.019	-0.222***	0.025	-0.284***	0.022
Germany	-0.094***	0.017	-0.216***	0.025	-0.312***	0.022
Greece	-0.095***	0.019	-0.217***	0.025	-0.290***	0.022
Hungary	-0.094***	0.019	-0.223***	0.025	-0.289***	0.022
Iceland	-0.101***	0.019	-0.221***	0.025	-0.289***	0.022
Ireland	-0.096***	0.019	-0.218***	0.024	-0.287***	0.022
Italy	-0.098***	0.019	-0.221***	0.025	-0.289***	0.022
Japan	-0.094***	0.020	-0.194***	0.024	-0.254***	0.020
Latvia	-0.089***	0.019	-0.212***	0.025	-0.283***	0.021
Lithuania	-0.094***	0.019	-0.220***	0.025	-0.295***	0.022
Luxembourg	-0.099***	0.019	-0.217***	0.025	-0.296***	0.022
Malta	-0.096***	0.019	-0.216***	0.024	-0.291***	0.022
Netherlands	-0.100***	0.019	-0.216***	0.024	-0.287***	0.022
New Zealand	-0.094***	0.019	-0.223***	0.025	-0.282***	0.022
Norway	-0.091***	0.018	-0.217***	0.024	-0.288***	0.021
Poland	-0.104***	0.020	-0.223***	0.025	-0.290***	0.022
Portugal	-0.093***	0.019	-0.188***	0.024	-0.275***	0.022
Romania	-0.095***	0.020	-0.221***	0.025	-0.287***	0.022
Slovak Republic	-0.096***	0.019	-0.219***	0.024	-0.287***	0.022
Slovenia	-0.102***	0.020	-0.216***	0.025	-0.287***	0.022
Spain	-0.097***	0.019	-0.216***	0.024	-0.289***	0.022
Sweden	-0.095***	0.019	-0.221***	0.024	-0.282***	0.021
Switzerland	-0.095***	0.018	-0.224***	0.025	-0.294***	0.022
United Kingdom	-0.098***	0.018	-0.229***	0.025	-0.298***	0.022
United States	-0.094***	0.019	-0.227***	0.025	-0.289***	0.022

Notes: The dependent variable is ΔTrade balance$_{it}$. HB refers to household borrowing. Standard errors are in parentheses. *, **, *** represents the 10%, 5% and 1% significance level. Estimation are done with DFE estimations. Each row represents a model that excludes one country.