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RESEARCH ARTICLE

Does Household Borrowing Reduce the Trade Balance? Evidence from Developing and Developed Countries

Can Xu[1] · **Jan P. A. M. Jacobs**[2] · **Jakob de Haan**[3]

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Abstract
We examine the dynamic impact of household borrowing on the trade balance using data from 32 developing countries and 36 developed countries over the 1980-2020 period. Our findings suggest that the impact of household borrowing on the trade balance is negative, both in the short and long run, but the effects are more pronounced in developing countries. Moreover, we find that for developing countries the negative effect of household borrowing on the trade balance is achieved via boosting imports. In developed countries, household borrowing stimulates both imports and exports, where the effect on imports is larger.

Keywords Household borrowing · Trade balance · Dynamic effects · Panel ARDL · Panel VECM

JEL classification: E21 · F32 · G21

1 Introduction

Recent studies suggest that household borrowing plays an important role in global current account imbalances. However, the results of these studies are inconclusive. Some studies report a negative effect of household borrowing on the trade

✉ Can Xu
carl.xu@rug.nl

Jan P. A. M. Jacobs
j.p.a.m.jacobs@rug.nl

Jakob de Haan
jakob.de.haan@rug.nl

[1] Department of Global Economics and Management, Faculty of Economics and Business, University of Groningen, PO Box 800, Groningen 9700 AV, The Netherlands

[2] University of Groningen, CAMA and CIRANO, Groningen, The Netherlands

[3] University of Groningen and CESifo, Munich, Germany

balance, arguing that household borrowing stimulates consumption, which, in turn, leads to higher imports and a deterioration of the trade balance (Büyükkarabacak and Krause 2009; Ekinci et al. 2015). By contrast, another strand of literature casts doubts on this view, arguing that household borrowing and consumption might not be positively related (Lombardi et al. 2017; Tunc and Kilinc 2022). Several reasons have been suggested for this finding, such as higher debt servicing reducing consumption (see Section 2 for a more elaborate discussion). Furthermore, financial development (which is often proxied by credit to the non-financial private sector) may enhance comparative advantages in exporting industries and promote exports (Beck 2002). Therefore, household borrowing's negative impact on consumption and imports and the positive effect of financial development on exports may lead to an improvement of the trade balance (Mian et al. 2013).

Against this background, this paper contributes to the literature on the role of household borrowing in determining the trade balance in three ways. First, we distinguish between the short- and long-run effects by employing time-series econometric techniques in a panel framework to study the impact of household borrowing on the trade balance. Most previous research on this topic only accounts for equilibrium effects and ignores the time dimension of these effects. Our paper considers a dynamic framework and yields a more convincing analysis. Second, we investigate the response of the trade balance to household borrowing shocks in developing and developed countries given that these two countries groups differ in terms of financial development and trade liberalization. Third, we distinguish the channels through which household borrowing affects the trade balance. Prior studies pay much attention to the effect of household borrowing on imports and less attention to its effect on exports. We complement the literature by taking the export channel through which household borrowing may have a less negative effect on the trade balance into account.

Given that our panel unit root test results indicate that the trade balance is stationary in levels while household borrowing is only stationary in first-differences, we adopt two methods to model the nexus between these I(0) and I(1) variables. First, we use the Panel Auto-Regressive Distributed Lag (Panel ARDL) model, which allows a mixture of I(0) and I(1) variables, to disentangle short- and long-run effects of household borrowing on the trade balance directly. Second, we use a panel cointegration test and Panel Vector Error Correction Model (Panel VECM) to estimate the effects of household borrowing on the dis-aggregated trade balance (imports and exports). This allows us to examine the channels through which household borrowing affects the trade balance. In addition, we use the panel Granger causality test developed by Toda and Yamamoto (1995) to investigate potential reverse causality from the trade balance to household borrowing.

Using data from 32 developing countries and 36 developed countries over the 1980-2020 period, we find a significant negative effect of household borrowing on the trade balance in both the short and long run. The negative effect of household borrowing on the trade balance is more pronounced in developing countries than in developed countries. To be specific, an increase in household borrowing by 1 percent of GDP in developing countries is associated with a reduction of the trade balance by approximately 0.1 percent of GDP, while the same increase in household

borrowing in developed countries only reduces the trade balance by 0.07 percent of GDP. Closer inspection of this nexus shows that although household borrowing has a negative effect on the trade balance in both developing and developed countries, the channels differ. The negative effect of household borrowing on the trade balance in developing countries mostly runs through stimulating imports. However, the negative effect of household borrowing on the trade balance in developed countries is driven by increasing both imports and exports, where the positive effect on imports is larger.

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

2 Previous Research

Previous research suggests that household borrowing affects a country's trade balance. However, there is no consensus about the direction and the mechanisms involved. The most intuitive and straightforward logic is that household borrowing increases consumption and imports, which contributes to a deterioration of the trade balance (Büyükkarabacak and Krause 2009; Ekinci et al. 2015; Islam 2017).

Yet, several studies question this logic. For example, Mian et al. (2017) use data of 30 countries from 1960 to 2012 and find that an increase in household debt relative to GDP predicts a fall in imports and improves the trade balance. Some other studies find that household borrowing is not positively associated with consumption. 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. Likewise, Tunc and Kilinc (2022) show that an increase in household borrowing initially promotes consumption growth but reduces it in the medium run.

Several arguments for a negative impact of household borrowing on consumption have been put forward. First, some empirical studies show that the debt service burden due to household borrowing depresses household consumption, especially when the economy is experiencing a depression (Kukk 2016; Tunc and Kilinc 2022). Second, excessive household borrowing can indirectly reduce household consumption by making the economy more vulnerable to financial disruptions, potentially even leading to a financial crisis (Davis et al. 2016; Jordà et al. 2011). As average income growth falls during the crisis, so does consumption. 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). So these mechanisms imply that household borrowing may slow down consumption, thereby reducing imports and improving the trade balance.

The early literature on external imbalances refers to real economic and demographic factors such as excess savings in emerging market countries (Bernanke 2005), dependency ratio heterogeneity (Masson et al. 1998), and the "twin deficits" theory

(Obstfeld and Rogoff 2009; Furceri and Zdzienicka 2020) in explaining these imbalances. Recent discussions on external imbalances zoom in on the effect of the level of indebtedness of the private sector (households and firms), which is usually employed as a proxy for financial development, but the empirical findings are ambiguous. Some studies indicate that financial development negatively affects the trade balance because private credit expansion stimulates consumption and reduces domestic savings, which further increases imports and deteriorates the trade balance (Chinn and Ito 2007; Ekinci et al. 2015). In contrast, other studies, such as Beck (2002), find that financially developed countries are prone to have a comparative advantage in some sectors and become net exporters.

It is important to distinguish between credit to firms and credit to households. Credit to firms promotes investments and is less likely to lead to financial instability than credit to households (Beck et al. 2012; Mian et al. 2017; Sassi and Gasmi 2014). For example, looking at 45 developing and developed countries, Beck et al. (2012) find that household borrowing does not have a positive relationship with economic growth, but firm borrowing has. In addition, Büyükkarabacak and Valev (2010) find that an increase in household credit generates vulnerabilities that can precipitate a banking crisis, whereas similar 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 credit to households and firms raises 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' production capacity and their exports.

3 Data

We use an unbalanced annual panel data set covering 32 developing countries and 36 developed countries, as classified by the 2022 World Economic Situation and Prospects Report by the United Nations, over the period 1980-2020. The countries in the panel are listed in Appendix A. 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 are too short to estimate meaningful regressions. In our sample, the shortest period for the trade balance is 19 years, and that of household borrowing is 15 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. Focusing on the trade balance

helps us to identify the effects of household borrowing on real economic activity 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. Verma and Sengupta (2021) also show that domestic credit conditions can be influenced by external conditions. In the meantime, there is little evidence indicating that the trade balance could affect domestic credit conditions.

Our primary explanatory variable, household borrowing, is collected from the Global Debt database compiled by the International Monetary Fund (IMF) 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.
2. Fiscal balances: Countries with higher government budget surpluses are expected to have higher national saving rates. Some studies (Hohberger et al. 2014; Furceri and Zdzienicka 2020; Obstfeld and Rogoff 2009) report a positive relationship between fiscal balances and trade balances.
3. Relative dependency ratio: Masson et al. (1998) find that the dependency ratio plays a crucial role in determining private saving. Following previous studies, we measure the relative dependency ratio as its difference from the world average.
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) and Chinn and Ito (2007), we include this variable to capture the influence of economic growth on the trade balance.

A detailed description of all variables is in Appendix B. Figure 1 shows the evolution of average trade balances and household borrowing in developing and developed countries from 1980 to 2020. As is apparent from this figure, the evolution of household borrowing and the trade balance has little similarity in the two country groups. Developing countries usually have a lower trade balance and lower household borrowing, and the differences across the two country groups in each series have increased since 2000.

Table 1 gives descriptive statistics. The most striking finding is that the trade balance exhibits high cross-sectional variability ranging from -53.81 to 31.71 with an average value of -3.99 and a standard deviation of 10.39 for developing countries, and from -20.64 to 33.76 with an average value of 0.90 and a standard deviation of 7.04 for developed countries. In general, developing countries' trade balances are lower and spread out over a broader range compared to those of developed countries.

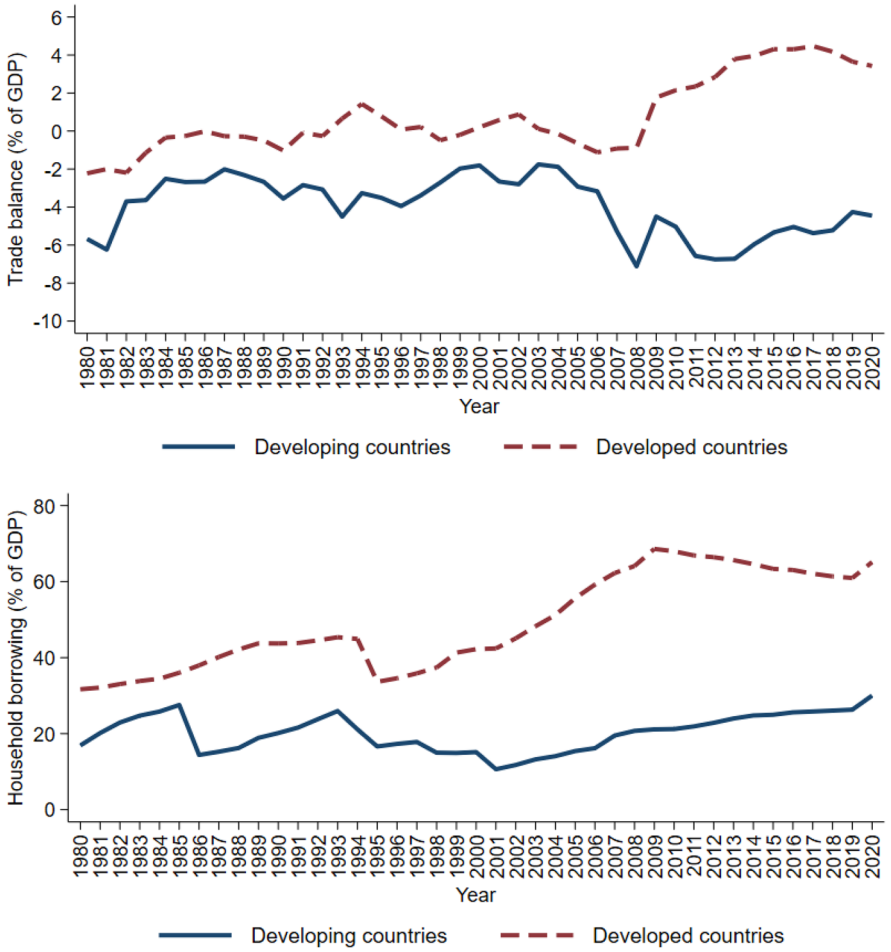

Fig. 1 The trade balance and household borrowing. *Notes*: The upper panel shows average trade balances across developing and developed countries. The lower panel shows average household borrowing across developing and developed countries. In both panels, developing countries and developed countries are represented by red and blue lines, respectively

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 import, exports, household and firm borrowing are I(1) variables because they are only stationary after first-differencing in both groups. All other control variables are stationary in levels. Therefore, this finding suggests a mixture of I(0) and I(1) variables in our sample.

Table 1 Descriptive statistics

All countries (N=68)	Obs	Mean	SD	Min	Max
Trade balances (% of GDP)	2545	-1.41	9.11	-53.81	33.76
Imports (% of GDP)	2545	40.82	28.22	0.06	208.93
Exports (% of GDP)	2545	39.42	31.47	0.10	228.99
Household borrowing (% of GDP)	1888	40.01	30.49	0.08	137.94
Firm borrowing (% of GDP)	1884	71.46	52.84	1.11	566.65
Fiscal balances (% of GDP)	2354	-2.28	4.06	-34.24	28.21
Relative dependency ratio (%)	2788	0.00	4.18	-13.08	14.19
Terms-of-trade volatility	2201	4.76	7.98	0.00	172.61
Growth rate (%)	2549	1.95	4.28	-36.56	24.00
Developing countries (N=32)					
Trade balances (% of GDP)	1200	-3.99	10.39	-53.81	31.71
Imports (% of GDP)	1200	36.07	29.53	0.06	208.93
Exports (% of GDP)	1200	32.09	31.85	0.10	228.99
Household borrowing (% of GDP)	717	20.60	18.27	0.08	103.37
Firm borrowing (% of GDP)	713	39.65	29.59	1.11	144.85
Fiscal balances (% of GDP)	1033	-2.00	3.78	-34.24	28.21
Relative dependency ratio (%)	1312	0.00	5.81	-13.08	14.19
Terms-of-trade volatility	1039	7.58	10.58	0.00	172.61
Growth rate (%)	1247	1.91	5.07	-36.56	21.03
Developed countries (N=36)					
Trade balances (% of GDP)	1345	0.90	7.04	-20.64	33.76
Imports (% of GDP)	1345	45.06	26.31	6.94	174.62
Exports (% of GDP)	1345	45.96	29.64	6.99	205.48
Household borrowing (% of GDP)	1171	51.89	30.39	0.18	137.94
Firm borrowing (% of GDP)	1171	90.84	54.48	9.99	566.65
Fiscal balances (% of GDP)	1321	-2.50	4.26	-32.12	18.64
Relative dependency ratio (%)	1476	0.00	1.75	-6.95	5.54
Terms-of-trade volatility	1162	2.24	2.66	0.02	21.67
Growth rate (%)	1302	1.98	3.36	-14.46	24.00

4 Methodology

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

In time series studies, a common approach to differentiate short- and long-run effects of one variable on another is to employ the Auto-Regressive Distributed Lag (ARDL) model, in which the dependent variable is regressed on its lags and lags of independent variables. One reason for the popularity of the ARDL model is that its error correction form can be used even with variables with different integration orders. Pesaran et al. (1999) first introduced the ARDL model into a panel data framework. Based on their work, we apply the Panel ARDL(p, q) technique, where

Table 2 Panel unit root test outcomes

	ADF test statistic		IPS test statistic		Result
	Level	First difference	Level	First difference	
All countries					
Trade balance	2.87***	40.50***	-3.10***	-20.30***	I(0)
Import	-1.22	49.63***	0.96	-23.26***	I(1)
Export	-1.78	38.44***	1.80	-19.12***	I(1)
Household borrowing	1.59	5.57***	2.42	-5.86***	I(1)
Firm borrowing	1.52*	14.19***	0.72	-9.06***	I(1)
Fiscal balance	7.97***	29.65***	-6.47***	-16.30***	I(0)
Relative dependency ratio	8.44***	2.53***	-4.79***	-2.75***	I(0)
Terms-of-trade volatility	12.21***	70.76***	-8.90***	-27.67***	I(0)
Growth rate	14.42***	55.36***	-10.29***	-24.05***	I(0)
Developing countries					
Trade balance	2.75***	34.50***	-3.08***	-15.99***	I(0)
Import	0.72	32.21***	-0.91	-15.38***	I(1)
Export	0.80	26.90***	-0.43	-13.10***	I(1)
Household borrowing	-2.56	13.58***	4.43	-8.99***	I(1)
Firm borrowing	1.36*	9.64***	0.52	-5.87***	I(1)
Fiscal balance	3.28***	22.48***	-2.80***	-11.84***	I(0)
Relative dependency ratio	24.76***	2.73***	-11.09***	-2.21**	I(0)
Terms-of-trade volatility	6.42***	48369***	-5.32***	-18.90***	I(0)
Growth rate	13.07***	43.76***	-8.35***	-18.09***	I(0)
Developed countries					
Trade balance	1.92**	49.67***	-1.96**	-20.19***	I(0)
Import	-2.36	37.84***	2.18	-17.47***	I(1)
Export	-3.2	27.48***	2.88	-13.93***	I(1)
Household borrowing	-1.66	1.32*	2.26	-2.81***	I(1)
Firm borrowing	0.81	10.41***	0.50	-6.95***	I(1)
Fiscal balance	7.85***	19.54***	-6.27***	-11.23***	I(0)
Relative dependency ratio	10.68***	3.58***	-6.52***	-3.55***	I(0)
Terms-of-trade volatility	10.72***	51.35***	-7.22***	-20.21***	I(0)
Growth rate	7.50***	34.83***	-6.27***	-16.01***	I(0)

The table presents the results of the Im-Pesaran-Shin (IPS) (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. *,** and*** denote significance at the 10%, 5% and 1% level, respectively

p is the number of lags of the dependent variable y in country i at time t, and q is the number of lags of the independent variables x_{it}. Our baseline specification is as follows:

$$\begin{aligned}\Delta y_{it} =& \phi_i[y_{it-1} - (\beta_0^i + \boldsymbol{\beta}_1^i \boldsymbol{X}_{it-1})] + \sum_{j=1}^{p-1} \gamma_j^i \Delta y_{it-j} \\ &+ \sum_{j=0}^{q-1} \boldsymbol{\delta}_j^i \Delta \boldsymbol{X}_{it-j} + c + u_{it}, i = 1, \ldots, N, t = 1, \ldots, T\end{aligned} \tag{1}$$

where y_{it} and $\boldsymbol{X}_{it}$ are the dependent variable and a set of independent variables, respectively, c is the constant, and u_{it} is the error term. ϕ_i is the coefficient of the lagged dependent variable, representing the speed of adjustment to the long-run equilibrium. β_0^i is the constant in the long-run equation and $\boldsymbol{\beta}_1^i$ is the vector of long-run coefficients of independent variables. γ_j^i and $\boldsymbol{\delta}_j^i$ are the short-run coefficients of the lagged dependent and independent variables, respectively. 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 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] Under the assumption that $\phi_i < 0$, the term in square brackets in Eq. (1) defines the long-run regression and it can be written as:[2]

$$y_{it} = \beta_0^i + \boldsymbol{\beta}_1^i \boldsymbol{X}_{it} + \mu_{it}, \quad \text{where} \quad \mu_{it} \sim I(0). \tag{2}$$

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, which 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 that offers a compromise in the selection of homogeneous and heterogeneous models. To be more specific, 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.

We use the Hausman test and Log Likelihood ratio test to determine the appropriate estimator, as suggested by Pesaran et al. (1999). First, the Hausman test is

[1] The half-life period can be approximated as $-\ln 2 / \ln(1 + \phi_i)$.

[2] Theoretically, we can use the bounds cointegration test by examining the joint significance of the coefficient vector $\boldsymbol{\beta}_1^i$ in Eq. (2). However, the STATA routine we use by default normalizes the vector such that the coefficient of 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 our Panel ARDL models.

employed to examine the appropriateness of the MG estimator that provides consistent estimates of the mean of coefficients. One issue of using the MG estimator is that although it is consistent for large N and T, for small T it could introduce the familiar lagged dependent variable bias that causes the short-run coefficient estimates to underestimate their true values (Pesaran et al. 1999). Another issue is that the MG estimator is inefficient if the homogeneity hypothesis holds, under which the pooled estimators (the DFE and PMG) 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. We thus conduct two Hausman tests. In the first test, we compare the DFE and MG estimator as Pesaran et al. (1999) indicate that under the null hypothesis both estimators are consistent but the DFE estimator is asymptotically more efficient, implying that 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 second test we use is the Log Likelihood ratio test, the aim of which is to determine between the DFE and PMG estimator. This is less difficult and important since both estimators assume long-run homogeneity of parameters. Accordingly, this test is equivalent to testing only the homogeneity of the error variances and the short-run slope coefficients, which can be easily carried out using a Log Likelihood 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 from the panel ARDL estimations how household borrowing affects the trade balance, our next step is to identify the impact on imports and exports in order to see to what extent household borrowing reduces the trade balance via affecting imports or exports. To examine the impact of household borrowing on imports and exports, we use a Panel VECM that consists of these three variables. The use of Panel VECM is motivated by two facts. First, the Panel VECM allows for interrelation among variables. This is useful because imports and exports might be not independently determined and these two variables mutually affect each other. Second, the use of Panel VECM is motivated by the fact that the three variables we use are all I(1) variables. In light of this, the cointegration framework implied by Panel VECM could better capture the possible cointegration relationship in the non-stationary data through linear combinations of the levels of non-stationary variables that are stationary and called cointegrating relations.

Before we establish the Panel VECM, the existence of cointegration among variables needs to be tested. For this we use three types of panel cointegration tests: Kao's test, Pedroni's test, and Westerlund's test (Kao 1999; Pedroni 1999; Westerlund 2007). The null hypothesis is that there is no cointegration. If the null hypothesis is rejected, then cointegration is confirmed. Our aim of the panel cointegration test is to rationalize the use of our 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:

$$\begin{aligned}
\Delta \mathrm{HB}_{it} &= c_1 + \lambda_1 ECT^{HB}_{i,t-1} + \gamma_1^{HB}\Delta \mathrm{HB}_{i,t-1} + \gamma_2^{HB}\Delta \mathrm{IM}_{i,t-1} + \gamma_3^{HB}\Delta \mathrm{EX}_{i,t-1} + \epsilon_{it}^{HB},\\
\Delta \mathrm{IM}_{it} &= c_2 + \lambda_2 ECT^{IM}_{i,t-1} + \gamma_1^{IM}\Delta \mathrm{HB}_{i,t-1} + \gamma_2^{IM}\Delta \mathrm{IM}_{i,t-1} + \gamma_3^{IM}\Delta \mathrm{EX}_{i,t-1} + \epsilon_{it}^{IM},\\
\Delta \mathrm{EX}_{it} &= c_3 + \lambda_3 ECT^{EX}_{i,t-1} + \gamma_1^{EX}\Delta \mathrm{HB}_{i,t-1} + \gamma_2^{EX}\Delta \mathrm{IM}_{i,t-1} + \gamma_3^{EX}\Delta \mathrm{EX}_{i,t-1} + \epsilon_{it}^{EX},
\end{aligned} \tag{3}$$

where HB_{it}, IM_{it}, EX_{it} represent 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]

$$\begin{aligned}
&\text{Household borrowing equation:} && \mathrm{HB}_{it} = \alpha^{HB} + \beta_1^{HB}\mathrm{IM}_{it} + \beta_2^{HB}\mathrm{EX}_{it} + \epsilon_{it}^{HB},\\
&\text{Imports equation:} && \mathrm{IM}_{it} = \alpha^{IM} + \beta_1^{IM}\mathrm{IM}_{it} + \beta_2^{IM}\mathrm{EX}_{it} + \epsilon_{it}^{IM},\\
&\text{Exports equation:} && \mathrm{EX}_{it} = \alpha^{EX} + \beta_1^{EX}\,\mathrm{EX}_{it} + \beta_2^{EX}\mathrm{IM}_{it} + \epsilon_{it}^{EX}.
\end{aligned} \tag{4}$$

After ECTs are obtained, we can estimate Eq. (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 to obtain unbiased and consistent estimates of the coefficients. The classic one-step estimator in GMM settings assumes that the error term is independent and homoskedastic across units and time. To relax this assumption, we use the two-step estimator in which the residuals of the first step are used to obtain consistent estimates of the variance–covariance matrix of the residuals. Moreover, to avoid employing too many instruments, we restrict the maximum lag of included instruments to three and collapse the instrument set.

The Panel VECM we estimate is a system containing endogenous variables, therefore providing limited information of the direction of the effect. We use

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

a modified version of the Granger causality test to validate this direction (from household borrowing to imports/exports, not vice versa). Conventional approaches to test Granger causality by estimating VAR models fail to consider the possibility of non-stationarity or absence of a cointegrating relationship among the variables. Therefore, we follow Toda and Yamamoto (1995) who develop a new procedure to test for Granger causality based on an augmented VAR model with a modified Wald test, and this procedure can be applied for series with different orders of integration, and for non-cointegrated or co-integrated variables. This approach 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 second step is to find the optimal lag order (p) of the VAR model in levels using different information criteria; the third step is to construct a VAR($p + d_{max}$) model in levels as follows:

$$\begin{aligned}
\mathrm{HB}_{it} &= c^{HB} + \sum_{k=1}^{p+d_{max}} \alpha_k^{HB} \mathrm{HB}_{i,t-k} + \sum_{k=1}^{p+d_{max}} \beta_k^{HB} \mathrm{IM}_{i,t-k} + \sum_{k=1}^{p+d_{max}} \gamma_k^{HB} \mathrm{EX}_{i,t-k} + e_{it}^{HB}, \\
\mathrm{IM}_{it} &= c^{IM} + \sum_{k=1}^{p+d_{max}} \alpha_k^{IM} \mathrm{HB}_{i,t-k} + \sum_{k=1}^{p+d_{max}} \beta_k^{IM} \mathrm{IM}_{i,t-k} + \sum_{k=1}^{p+d_{max}} \gamma_k^{IM} \mathrm{EX}_{i,t-k} + e_{it}^{IM}, \quad (5) \\
\mathrm{EX}_{it} &= c^{EX} + \sum_{k=1}^{p+d_{max}} \alpha_k^{EX} \mathrm{HB}_{i,t-k} + \sum_{k=1}^{p+d_{max}} \beta_k^{EX} \mathrm{IM}_{i,t-k} + \sum_{k=1}^{p+d_{max}} \gamma_k^{EX} \mathrm{EX}_{i,t-k} + e_{it}^{EX}.
\end{aligned}$$

The final step is to use the modified Wald test to identify the direction of Granger causality. The null hypothesis is that there is no Granger causality. So, we can test for non-Granger-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 modified Wald 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.

The estimated models are displayed in Table 3. The panels in the upper and middle part of the table report the long-run and short-run coefficients of the explanatory variables, respectively. Columns 1 to 3 show results for developing countries based on the DFE, PMG and MG estimators, respectively. Columns 4 to 6 report results using the same estimators but now for developed countries. We also estimate the model using the full country sample and report the results in Table 8 in Appendix C.

Before explaining the coefficients, we first take a look at some statistics that help us evaluate the models. First, the Hausman test results reported at the bottom of Table 3 indicate that the MG estimator is rejected compared with either the PMG or DFE estimators because the null hypotheses are not rejected that the PMG/DFE estimators are more efficient than the MG estimator. Therefore, we conclude that heterogeneity between countries in each group is rejected at least for the long run and proceed with the DFE and PMG estimator. The other Log L tests that compare the PMG and DFE estimators suggest that for both developing and developed countries the PMG estimator is supported since the null hypothesis is rejected. Accordingly, our results imply a homogeneous long-run relationship and a heterogeneous short-run relationship between household borrowing and the trade balance for both country groups.

With respect to the error correction terms, we find that their coefficients are significantly negative in all specifications, suggesting that a cointegration relationship exists irrespective of the model or sample selection. The error correction terms' coefficients in the preferred PMG model are -0.335 and -0.360 for developing and developed countries, respectively, which implies that around 34% and 36% of any movements into disequilibrium are corrected within one year. The half-life period is 1.69 years for developing countries and 1.55 years for developed countries. This suggests that, in general, it takes one and half years for a disequilibrium in the trade balance caused by an increase in household borrowing to be reduced by 50%.

For both sub-samples we find that the long-run and the short-run coefficients of household borrowing are mostly significantly negative, implying that household borrowing reduces the trade balance in both periods. 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) for emerging countries. In particular, the magnitude of the negative long-run coefficient of long-run household borrowing in developing countries (-0.098) is stronger than that in developed countries (-0.065), suggesting that the negative long-run impact of household borrowing on the trade balance is stronger in developing countries than in developed countries. A one-unit (percent of GDP) increase in household borrowing in developing countries leads to a reduction in the trade balance by 0.1 percent of GDP, and the same increase in developed countries to a reduction in the trade balance by only 0.06 percent of GDP. This finding also applies to the short-run case, with household borrowing's coefficient being -0.629 for developing countries and -0.211 for developed countries. Taken together, the negative

Table 3 Panel ARDL results

	Developing countries			Developed countries		
	(1)	(2)	(3)	(4)	(5)	(6)
	DFE	PMG	MG	DFE	PMG	MG
Long-run effects						
Household borrowing	0.022	-0.098***	-3.211	-0.064***	-0.065***	-0.014
	(0.052)	(0.028)	(2.558)	(0.018)	(0.009)	(0.134)
Firm borrowing	-0.050	-0.014	0.412	0.037***	0.010	0.027
	(0.044)	(0.023)	(0.421)	(0.008)	(0.006)	(0.039)
Fiscal balance	-0.038	0.437***	-0.505	0.268***	0.156***	0.057
	(0.175)	(0.119)	(1.284)	(0.088)	(0.040)	(0.095)
Relative dependency ratio	0.615*	-0.983***	7.868	0.289	0.090	-0.535
	(0.341)	(0.174)	(6.921)	(0.206)	(0.114)	(1.408)
Terms-of-Trade volatility	-0.124	-0.096*	-1.470	-0.027	-0.263***	-0.301*
	(0.091)	(0.050)	(1.808)	(0.130)	(0.070)	(0.166)
Growth rate	-0.142	-1.186***	0.512	-1.159***	-0.759***	-0.294
	(0.151)	(0.134)	(0.773)	(0.131)	(0.068)	(0.205)
Short-run effects						
Δ Household borrowing	-0.292***	-0.629**	0.774	-0.230***	-0.211***	-0.008
	(0.066)	(0.268)	(0.817)	(0.023)	(0.052)	(0.080)
Δ Firm borrowing	-0.117***	-0.203*	-0.484*	-0.005	-0.083***	-0.104***
	(0.033)	(0.115)	(0.258)	(0.005)	(0.019)	(0.032)
Δ Fiscal balance	0.147**	0.060	-0.014	0.022	0.010	0.005
	(0.060)	(0.091)	(0.214)	(0.030)	(0.036)	(0.053)
Δ Relative dependency ratio	-1.970**	-0.992	-8.362	-1.048**	-0.606	-3.478*
	(0.790)	(1.843)	(5.232)	(0.420)	(1.062)	(1.802)
Δ Terms-of-Trade volatility	0.012	0.046	0.384	-0.018	0.078	0.237
	(0.030)	(0.089)	(0.315)	(0.037)	(0.109)	(0.149)
Δ Growth rate	-0.123***	0.002	0.063	0.130***	0.069**	0.118**
	(0.042)	(0.125)	(0.111)	(0.027)	(0.035)	(0.049)
Error correction term	-0.374***	-0.335***	-1.020***	-0.274***	-0.360***	-0.777***

Table 3 (continued)

	Developing countries			Developed countries		
	(1)	(2)	(3)	(4)	(5)	(6)
	DFE	PMG	MG	DFE	PMG	MG
	(0.030)	(0.049)	(0.119)	(0.019)	(0.044)	(0.072)
Constant	-0.320	1.854	27.920***	1.628***	3.309***	5.337
	(0.750)	(1.393)	(10.550)	(0.337)	(0.906)	(4.106)
Log likelihood	-1680.64	-1204.37		-2062.55	-1342.54	
Hausman test (p-value)	1.54 (0.96)^b	2.04 (0.92)^b		6.53 (0.37)^a	2.76 (0.84)^b	
Log L test (p-value)	952.54 (0.00)			1440.02 (0.00)		
Countries		32			36	
Observations		644			994	

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 that the long-run coefficients are the same across countries, but are otherwise comparable to the MG estimates. Standard errors are in parentheses. *, **, *** represent the 10%, 5% and 1% significance level, respectively. Superscripts a (or b) denote that DFE (or PMG) is more efficient than MG under the null hypothesis

effects of household borrowing on the trade balance are confirmed both in the short and long run, and we find that this negative effect is stronger in developing countries than in developed countries. To test whether the difference in household borrowing's effect in developing and developed country samples is significant, we compare the coefficients of household borrowing in two bootstrapped country samples.[4] The results indicate that the coefficients of household borrowing is significantly smaller in developing countries than in developed countries, therefore indicating a stronger negative effect on the trade balance in developing countries.

Most coefficients of the control variables have signs consistent with those reported in previous studies. We only focus on the interpretation of the long-run coefficients of our control variables to reduce complexity. First, firm borrowing has a significant and positive long-run coefficient in developed countries, 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. Second, we find that the coefficient of the fiscal balance has a positive sign in both developing and developed countries, which can be explained by the ''twin deficit'' theory, according to which external deficits can be driven by government deficits (Abbas et al. 2011). Third, a significant negative coefficient is obtained for the relative dependency ratio in

[4] Results are available upon request.

Table 4 Panel cointegration results

Dependent variable	Kao's test	Pedroni's test	Westerlund's test		Cointegration
			Group statistics	Panel statistics	
Developing countries					
Imports	-2.47 (0.00)	-4.52 (0.00)	-5.53 (0.00)	-3.81 (0.00)	YES
Exports	-2.99 (0.00)	-2.43 (0.00)	-5.34 (0.00)	-3.81 (0.00)	YES
Household borrowing	1.42 (0.08)	1.23 (0.11)	-3.27 (0.00)	-0.98 (0.16)	NO
Developed countries					
Imports	-6.55 (0.00)	2.52 (0.00)	-4.87 (0.00)	-3.74 (0.00)	YES
Exports	-1.22 (0.11)	-1.03 (0.15)	-7.68 (0.92)	-6.82 (0.15)	NO
Household borrowing	-0.85 (0.20)	1.49 (0.07)	-0.91 (0.18)	-0.48 (0.32)	NO

The null hypothesis is that there is no cointegration relationship. The *p*-values in parentheses for Westerlund's test are obtained through 200 bootstraps

developing countries, showing that an economy with a 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. Fourth, the coefficient of the terms-of-trade volatility variable has a positive sign in both country groups. This is possibly because countries with more volatile terms-of-trade have lower consumption and imports, and therefore a positive association between the terms-of-trade volatility and the trade balance is expected. Finally, consistent with the findings of Chinn and Prasad (2003) and Chinn and Ito (2007), our results show that GDP per capita growth has a negative effect on the trade balance. Overall, 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 for household borrowing, imports and exports. The results are reported in Table 4. We perform the cointegration tests for both developing and developed countries. It is shown that all *p*-values of the tested statistics are below 0.05 when imports are the dependent variable, implying a significant cointegration relationship in the equation for both groups. The *p*-value is larger than 0.05 when the dependent variable is household borrowing for both groups, implying that there is no cointegration in the household borrowing equation. The result differs between developing and developed countries when the dependent variable is exports as cointegration only exists in developing countries. Therefore, to be specific, for developing countries, the statistics suggest that there are two cointegrating equations (Imports equation and Exports equation). For developed countries, there is only one cointegrating equation (Imports equation). Taken together, based on the panel cointegration test results, we estimate the long-run relationship for developing countries as follows:

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
ΔHB_{t-1}	0.232**	0.235**	-0.534	0.602***	0.212***	0.085**
	(0.105)	(0.111)	(0.574)	(0.193)	(0.049)	(0.038)
$\Delta \text{Imports}_{t-1}$	0.026	-0.035	0.538	0.025	-0.114	-0.145*
	(0.044)	(0.124)	(0.357)	(0.055)	(0.084)	(0.075)
$\Delta \text{Exports}_{t-1}$	-0.042	0.036	-0.735	0.003	0.302***	0.353***
	(0.045)	(0.079)	(0.513)	(0.060)	(0.093)	(0.065)
ECT^{IM}_{t-1}	-0.004	-0.310**	-0.074	0.071	-0.295***	-0.098
	(0.021)	(0.122)	(0.151)	(0.061)	(0.090)	(0.080)
ECT^{EX}_{t-1}	0.031	-0.073	-0.428***			
	(0.025)	(0.082)	(0.147)			
Constant	0.518***	-0.086	0.511	0.547**	0.036	0.302***
	(0.174)	(0.175)	(0.531)	(0.236)	(0.092)	(0.082)
AR(1)	0.00	0.07	0.26	0.00	0.00	0.00
AR(2)	0.83	0.28	0.19	0.79	0.05	0.83
No. of IVs	16	12	13	7	10	16
Hansen statistic	17.66	12.37	8.72	3.40	9.03	17.66
Hansen p-value	0.09	0.05	0.27	0.18	0.11	0.09
Observations		640			1088	
Countries		32			36	

Robust standard errors are in parentheses. *, **, *** represent the 10%, 5% and 1% significance level, respectively. The dependent variable in columns 1 and 4 is the first-differenced household borrowing. Columns 2 and 5 use the first-differenced imports as the dependent variable. Columns 3 and 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. Hansen statistics test the validity of instrument subsets, and the null hypothesis is that the instruments are valid

$$\underset{}{\text{Imports}_{it}} = \underset{(0.03)}{0.041}\,\text{HB}_{it} + \underset{(0.00)}{0.751}\,\text{Exports}_{it} + \underset{(0.00)}{11.994}, \tag{6}$$

$$\underset{}{\text{Exports}_{it}} = \underset{(0.91)}{0.002}\,\text{HB}_{it} + \underset{(0.00)}{0.841}\,\text{Imports}_{it} - \underset{(0.03)}{2.275}, \tag{7}$$

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

$$\underset{}{\text{Imports}_{it}} = \underset{(0.00)}{0.031}\,\text{HB}_{it} + \underset{(0.00)}{0.736}\,\text{Exports}_{it} + \underset{(0.00)}{9.270}, \tag{8}$$

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 indicates the importance of global value chains.

Table 6 Panel Granger causality test results

Granger Causality order	Developing countries ($p = 1$, $d_{max} = 1$)	Developed countries ($p = 1$, $d_{max} = 1$)
Household borrowing → Imports	4.63 (0.03)	9.32 (0.00)
Household borrowing → Exports	0.82 (0.37)	5.82 (0.02)
Imports → Household borrowing	0.02 (0.88)	0.32 (0.57)
Exports → Household borrowing	0.01 (0.92)	0.04 (0.84)
Imports → Exports	0.01 (0.92)	14.88 (0.00)
Exports → Imports	1.95 (0.16)	7.00 (0.01)

The Granger 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)

The existence of at least one cointegration relationship rationalizes the use of the Panel VECM as the next step. In this regard, the lagged residuals from Eqs. (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 indicate 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. The Hansen statistics show that the instruments we use in all equations are valid. Therefore, these tests presents no evidence of model misspecification.

Turning to the estimation results reported in Table 5, we find that the coefficients of household borrowing are significant and positive (0.235 and 0.212) in the regression of imports for both developing and developed countries, with the positive association being stronger in the former group. For developing countries, columns 2 and 3 show that the coefficient of household borrowing is significantly positive in the imports equation but not in the exports equation, which indicates that household borrowing negatively affects the trade balance via boosting imports. However, columns 5 and 6 show that for developed countries, the coefficient of household borrowing is significantly positive in both the import and export equations (0.212 and 0.085, respectively), implying that household borrowing promotes both imports and exports, while the relatively larger coefficient in the imports equation suggests that the impact on imports is stronger than that on exports.

Finally, we perform panel Granger causality tests to examine the Granger 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 Toda-Yamamoto test. Table 6 reports the modified Wald statistics for both developing and developed countries in which the arrows represent the direction of Granger causality. The first row shows that the Granger 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 Granger 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 Granger causality from imports or exports to household borrowing, since the null hypothesis of no Granger causality is not rejected. To summarize, the results indicate that the Granger 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 household borrowing on the trade balance.

Taken together, we find that the negative effect of household borrowing on the trade balance is achieved in different ways in developing versus developed countries. The common finding for both groups of countries is that household borrowing has a positive impact on imports. Interestingly, our results also indicate that the positive effect of household borrowing on exports only holds in developed countries, therefore, underlining the importance to differentiate between developing and developed countries.

6 Robustness Check

As a first robustness check, we consider two alternative measures of the trade balance. First, we follow Frankel and Romer (2017) and Pritchett (1996) and use the structural-adjusted imports and exports to obtain a more accurate measure of trade intensity. More specifically, we consider the residual of regressions of imports and exports against structural country characteristics such as the population size, area, being landlocked, and oil resources. Second, given the existence of a tradables and non-tradables sector, we use the trade balance with adjustment for purchasing power parity (PPP) (Alcalá and Ciccone 2004; Kim et al. 2016).

Table 7 provides the estimated results for the first robustness check. Panel A reports the results for the Panel ARDL model with the PMG estimator and Panel B shows the results for the Panel VECM. We find that in panel A both short- and long-run coefficients of household borrowing are significant positive in all columns, which validates the negative effect of household borrowing on the trade balance after taking into account structural country characteristics and trade/non-trade sectors. Moreover, the results suggest that the magnitude of the negative coefficients, whether short- or long-run, is stronger in developing countries than that in developed countries. This finding is consistent with our results for the Panel VECM model as reported in Panel B. We find that household borrowing has a significant positive effect on imports in both developing and developed countries whereas its effect on exports is only significantly positive in developed countries.

Second, we check whether our results are sensitive to a particular country. We re-estimate Eq. (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 results are shown in Tables 9 and 10 in Appendix D. We find that the long-run and short-run coefficients of household borrowing are still significantly negative, although the estimates differ somewhat. This finding confirms

Table 7 Robustness check: alternative measures of trade balances

	Structural-adjusted trade balances		PPP-adjusted trade balances	
	(1)	(2)	(3)	(4)
	Developing countries	Developed countries	Developing countries	Developed countries
Panel A: Panel ARDL (Dependent variable: Δ Trade balance, PMG estimator)				
Long-run effects				
Household borrowing	-0.099***	-0.047***	-0.064***	-0.047***
	(0.028)	(0.009)	(0.018)	(0.009)
Short-run effects				
Δ Household borrowing	-0.630**	-0.183***	-0.239**	-0.183***
	(0.268)	(0.044)	(0.105)	(0.044)
Error correction term	-0.335***	-0.356***	-0.283***	-0.356***
	(0.050)	(0.045)	(0.055)	(0.045)
Observations	644	994	644	994
Panel B: Panel VECM				
Dependent variable: Δ Imports				
Δ Household borrowing	0.240***	0.211***	0.224**	0.390***
	(0.115)	(0.049)	(0.101)	(0.076)
Dependent variable: Δ Exports				
Δ Household borrowing	-0.557	0.081**	-0.314	0.281***
	(0.579)	(0.037)	(0.413)	(0.072)
Observations	641	1088	641	1088

Standard errors are in parentheses. *, **, *** represent the 10%, 5% and 1% significance level, respectively

our results that a rise in household borrowing causes a decline in the trade balance and this effect is not country-specific. We obtain 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 excluded from our sample.

Finally, we consider some specific time shocks. We first control for time fixed effects to take into account the impact of economic shocks in specific years. The results indicate that most time dummies are insignificant. The exceptions are time dummies for 2008, 2019, and 2020, which are significantly negative. Reassuringly, our findings show that the coefficients of household borrowing are significantly negative in the short and long run for both developing and developed countries.

7 Conclusion

This paper investigates the impact of household borrowing on the trade balance, with a particular interest in the differences between the short- and long-run effects. Using data from 32 developing countries and 36 developed countries over the 1980-2020 period, we find strong evidence for a negative effect of household borrowing on 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 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.

Our method deviates from the methodology applied in previous studies. First, we apply dynamic econometric models to estimate the impact of household borrowing and the trade balance, and differentiate between short- and long-run effects. We find that, even accounting for different orders of integration of variables, the negative impact of household borrowing on the trade balance is valid. Second, we distinguish the effect of household borrowing on imports and exports. Unlike previous literature that pays much attention to imports, we show that household borrowing also affects exports in developed countries.

Our results are relevant in several ways. First, this study confirms that household borrowing is negatively associated with imports and the trade balance, both in the short and long run, both for developing and developed countries. This result sheds light on the important macroeconomic implications of household borrowing. Therefore, policymakers should be aware of the ramifications of increasing indebtedness of the household sector. Second, this study shows that household borrowing works differently in developing and developed countries, especially in the determination of exports. A number of studies have noted the importance of financial development in the international trade, yet few have focused on the differences in developing and developed countries. This study shows that household borrowing only promotes exports in developed countries. This result has important policy implications for less developed countries, many of which rely heavily on international trade for economic growth but have lower levels of financial development.

More research is needed to discern the role of mortgage loans, consumption loans, and other household borrowing in affecting the trade balance. Households with a mortgage may have lower uncertainty with respect to the amount of saving and spending. 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.

Appendix A: Sample Description

Developing countries (32): 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.

Appendix B: Variable Description

1. Trade balance: The ratio of net exports (exports minus imports) to GDP. Data are obtained from the World Integrated Trade Solution (WITS) database of the World Bank.
2. Household borrowing: The ratio of all loans and other debt instruments borrowed by households to GDP. Data are obtained from the Global Debt Database of the International Monetary Fund.
3. Firm borrowing: The ratio of all loans and other debt instruments borrowed by non-financial firms to GDP. Data are 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 are taken from the World Bank national accounts data series and World Economic Outlook database (April 2022).
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 average value for each period for all economies in each country group. Data are 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 are taken from the World Development Indicators database of World Bank and OECD database.

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

Appendix C: Full Sample Results

Table 8 Panel ARDL with full sample

	(1) DFE	(2) PMG	(3) MG
Long-run effects			
Household borrowing	-0.027	-0.063***	-1.519
	(0.018)	(0.009)	(1.211)
Firm borrowing	0.032***	0.005	0.209
	(0.009)	(0.006)	(0.199)
Fiscal balance	0.137	0.125***	-0.207
	(0.086)	(0.037)	(0.602)
Relative dependency ratio	0.349*	-0.264**	3.419
	(0.186)	(0.105)	(3.353)
Terms-of-Trade volatility	-0.095	-0.176***	-0.851
	(0.073)	(0.037)	(0.851)
Growth rate	-0.569***	-0.752***	0.085
	(0.098)	(0.059)	(0.380)
Short-run effects			
Δ Household borrowing	-0.237***	-0.386***	0.360
	(0.025)	(0.101)	(0.386)
Δ Firm borrowing	-0.020***	-0.153***	-0.283**
	(0.007)	(0.053)	(0.124)
Δ Fiscal balance	0.078***	0.033	-0.004
	(0.030)	(0.047)	(0.104)
Δ Relative dependency ratio	-1.032***	-1.188	-5.777**
	(0.396)	(0.960)	(2.636)
Δ Terms-of-Trade volatility	0.007	0.051	0.306*
	(0.021)	(0.067)	(0.167)
Δ Growth rate	0.001	-0.001	0.092
	(0.024)	(0.059)	(0.058)
Error corection term	-0.317***	-0.351***	-0.892***
	(0.017)	(0.030)	(0.068)
Constant	0.344	1.916**	15.960***
	(0.315)	(0.764)	(5.548)
Observations		1,638	

The dependent variable is ΔTrade balance$_{it}$.Standard errors are in parentheses. *, **, *** represent the 10%, 5% and 1% significance level, respectively

Appendix D: Sensitivity Analysis

Table 9 Sensitivity test for developing countries

Excluded country	Short-run effect of HB		Long-run effect of HB		Error Correction Term		Observations
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	
Argentina	-0.572**	0.272	-0.099***	0.028	-0.343***	0.051	618
Brazil	-0.648**	0.279	-0.105***	0.029	-0.342***	0.052	620
Cameroon	-0.646**	0.277	-0.100***	0.028	-0.345***	0.050	626
Central African Republic	-0.606***	0.228	-0.062**	0.026	-0.366***	0.045	626
Chile	-0.601***	0.232	-0.064**	0.026	-0.349***	0.047	626
China	-0.672**	0.283	-0.108***	0.030	-0.330***	0.052	630
Colombia	-0.646***	0.234	-0.047*	0.025	-0.343***	0.046	620
Costa Rica	-0.623**	0.282	-0.108***	0.029	-0.329***	0.052	625
El Salvador	-0.653**	0.276	-0.099***	0.028	-0.350***	0.049	625
Honduras	-0.632**	0.275	-0.094***	0.028	-0.338***	0.051	625
India	-0.640***	0.219	-0.039	0.026	-0.357***	0.047	622
Indonesia	-0.650***	0.230	-0.059**	0.026	-0.350***	0.047	625
Israel	-0.651**	0.286	-0.116***	0.030	-0.331***	0.053	620
Kazakhstan	-0.638**	0.284	-0.108***	0.029	-0.327***	0.051	627
Korea	-0.606**	0.280	-0.270***	0.047	-0.346***	0.056	607
Mexico	-0.668**	0.283	-0.115***	0.030	-0.339***	0.053	618
Morocco	-0.639***	0.232	-0.062**	0.026	-0.353***	0.047	625
Myanmar	-0.628**	0.278	-0.100***	0.028	-0.337***	0.052	625
Nepal	-0.635***	0.209	-0.045*	0.025	-0.347***	0.046	627
Nicaragua	-0.634**	0.278	-0.100***	0.028	-0.345***	0.051	625
Pakistan	-0.583**	0.274	-0.098***	0.028	-0.338***	0.051	630
Peru	-0.627**	0.277	-0.099***	0.028	-0.345***	0.050	629

Table 9 (continued)

Excluded country	Short-run effect of HB		Long-run effect of HB		Error Correction Term		Observations
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	
Russia	-0.658***	0.241	-0.075***	0.027	-0.336***	0.045	622
Samoa	-0.636**	0.280	-0.102***	0.028	-0.341***	0.051	627
Sierra Leone	-0.392***	0.130	-0.100***	0.028	-0.341***	0.051	627
Singapore	-0.657**	0.280	-0.105***	0.029	-0.341***	0.051	615
Tajikistan	-0.639**	0.277	-0.099***	0.028	-0.332***	0.052	630
Thailand	-0.626**	0.283	-0.120***	0.030	-0.327***	0.051	627
Turkey	-0.624**	0.293	-0.119***	0.030	-0.328***	0.052	612
Ukraine	-0.638**	0.276	-0.098***	0.028	-0.344***	0.051	627
Vanuatu	-0.640**	0.276	-0.096***	0.028	-0.327***	0.050	627
North Macedonia	-0.650***	0.210	-0.050*	0.025	-0.330***	0.040	629

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

Table 10 Sensitivity test for developed countries

Excluded country	Short-run effect of HB		Long-run effect of HB		Error Correction Term		Observations
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	
Australia	-0.214***	0.054	-0.068***	0.009	-0.369***	0.045	957
Austria	-0.219***	0.053	-0.066***	0.009	-0.365***	0.045	969
Belgium	-0.213***	0.053	-0.065***	0.009	-0.360***	0.046	957
Bulgaria	-0.191***	0.050	-0.066***	0.009	-0.359***	0.046	977
Canada	-0.207***	0.053	-0.066***	0.009	-0.371***	0.045	972
Croatia	-0.196***	0.051	-0.066***	0.009	-0.352***	0.045	977
Cyprus	-0.222***	0.052	-0.067***	0.010	-0.350***	0.045	977
Czech Republic	-0.210***	0.054	-0.065***	0.009	-0.361***	0.045	977
Denmark	-0.213***	0.054	-0.069***	0.010	-0.360***	0.046	968
Estonia	-0.211***	0.054	-0.068***	0.009	-0.363***	0.047	970
Finland	-0.208***	0.053	-0.065***	0.009	-0.368***	0.045	957
France	-0.210***	0.054	-0.065***	0.010	-0.363***	0.045	957
Germany	-0.215***	0.054	-0.066***	0.009	-0.368***	0.045	957
Greece	-0.208***	0.054	-0.070***	0.009	-0.366***	0.046	968
Hungary	-0.216***	0.053	-0.066***	0.009	-0.370***	0.045	969
Iceland	-0.207***	0.054	-0.059***	0.010	-0.347***	0.044	970
Ireland	-0.194***	0.051	-0.064***	0.010	-0.325***	0.034	976
Italy	-0.212***	0.054	-0.065***	0.009	-0.367***	0.046	960
Japan	-0.214***	0.053	-0.066***	0.009	-0.368***	0.046	957
Latvia	-0.215***	0.054	-0.066***	0.009	-0.367***	0.047	972
Lithuania	-0.221***	0.053	-0.067***	0.009	-0.364***	0.047	972
Luxembourg	-0.225***	0.051	-0.067***	0.010	-0.354***	0.045	969
Malta	-0.198***	0.052	-0.066***	0.009	-0.362***	0.046	977
Netherlands	-0.213***	0.054	-0.068***	0.009	-0.367***	0.045	964

Table 10 (continued)

Excluded country	Short-run effect of HB		Long-run effect of HB		Error Correction Term		Observations
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	
New Zealand	-0.222***	0.056	-0.019	0.012	-0.327***	0.040	964
Norway	-0.208***	0.054	-0.065***	0.009	-0.367***	0.046	957
Poland	-0.217***	0.053	-0.070***	0.009	-0.358***	0.046	969
Portugal	-0.205***	0.053	-0.070***	0.009	-0.364***	0.047	957
Romania	-0.202***	0.053	-0.066***	0.01	-0.355***	0.045	977
Slovak Republic	-0.239***	0.045	-0.067***	0.009	-0.357***	0.046	969
Slovenia	-0.215***	0.054	-0.066***	0.009	-0.361***	0.046	970
Spain	-0.212***	0.054	-0.062***	0.009	-0.360***	0.046	957
Sweden	-0.217***	0.054	-0.064***	0.009	-0.366***	0.045	957
Switzerland	-0.206***	0.053	-0.067***	0.009	-0.363***	0.046	973
United Kingdom	-0.213***	0.054	-0.064***	0.010	-0.360***	0.046	957
United States	-0.214***	0.054	-0.065***	0.010	-0.361***	0.046	957

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

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

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Declarations

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