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# IMF Working Paper

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## Trade Finance and Trade Flows: Panel Data Evidence from 10 Crises

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## IMF Working Paper

Policy Development and Review Department

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#### Abstract

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This paper assesses the effect of constrained trade finance on trade flows in countries undergoing financial and balance of payments crises. Most of the countries that had a major crisis had a significant trade contraction, while trade-related finance declined sharply. However, trade may also be affected by other variables such as world demand, domestic demand, banking crises, changes in export and import prices, and real exchange rate depreciation. To estimate the effect of constrained trade finance on trade flows, we estimate import and export volume equations including explicitly trade financing as an explanatory variable in addition to the usual variables such as relative prices and income. We conclude that constrained trade finance is a factor in explaining both export and import volumes in the short-run. A fall in external trade finance explains a relatively small part of the trade loss during crises, while a fall in trade financing in connection with domestic banking crisis can lead to a substantial loss of trade.

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## I. INTRODUCTION

The paper assesses the effect of constrained trade finance on trade flows in countries undergoing financial and balance of payments crises. Most of the countries that had a major external crisis had a significant trade contraction, while trade-related finance declined sharply (Figure 1).

Despite anecdotal evidence that the contraction of trade financing may have affected trade,<sup>2</sup> there has been to date only a few empirical studies assessing the effect of constrained trade finance on trade flows. In addition, trade may have also been affected by other variables such as world demand, domestic demand, banking crises, changes in export and import prices, and real exchange rate depreciation.<sup>3</sup>

A closer look at the data does not provide a clear-cut relationship between trade and trade financing. Table 1 summarizes trade indicators, external short-term credit (as proxy for trade financing, see Section II on data), and real exchange rates for 10 crisis countries. Although overall export and import values in U.S. dollars fell, only import volumes contracted sharply by 20 percent on average, while export volumes have increased by 10 percent on average (albeit slightly below its three-year trend growth of 11.7 percent preceding their crisis).

Some observers argue that the sharp decline in import volumes and slowdown in export volume growth are closely related to the collapse of trade financing as external outstanding short-term credit to crisis countries fell by 20 percent in real terms compared to pre-crisis levels. However, the decline in trade financing seems to have had little effect on export volumes, while the fall in import volumes could have been caused by the sharp real devaluation and fall in domestic demand that followed each crisis (Table 1 and Figure 2).

In addition to trade finance, other factors may have affected trade volumes, including exchange rates, relative prices, and domestic and external demand. To control for the various factors that may have affected trade flows during crises, we estimate export and import volume equations including trade financing as an explanatory variable.

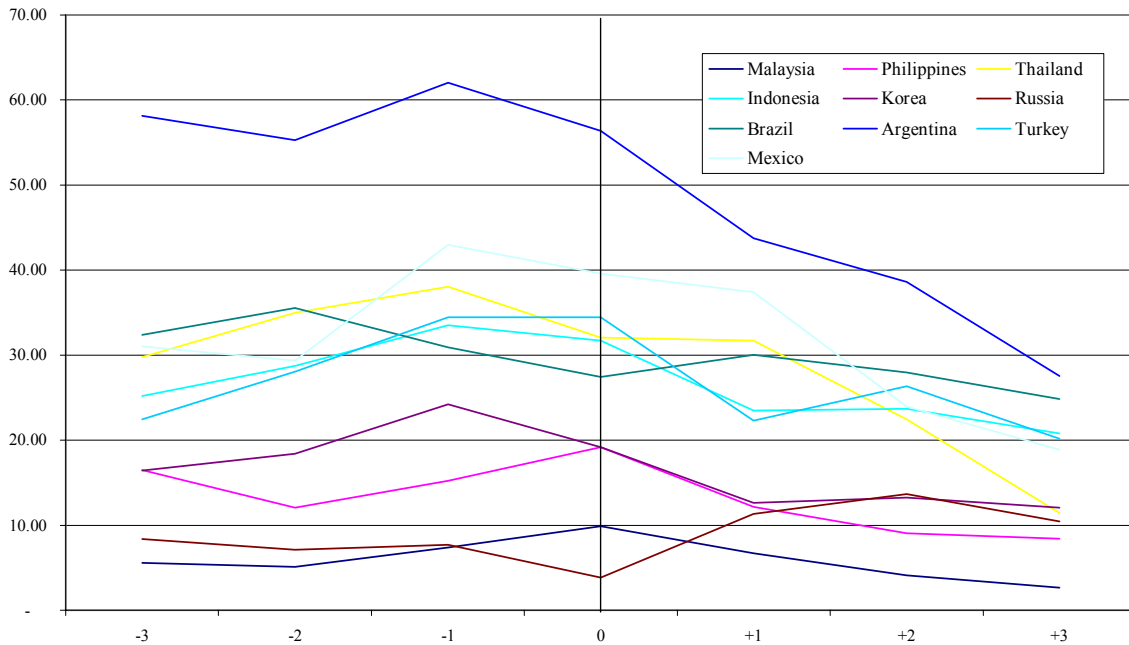
This paper is divided into five sections. After this brief introduction, Section II describes the data used and its limitations. Section III discusses model specification and econometric estimation. Section IV presents the estimation of the export and import volume equations and the trade volume-to-trade finance elasticities. The last section summarizes the results and conclusions.

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<sup>2</sup> This view was shared by various market participants and authorities in a seminar on trade financing organized by the IMF on March 27, 2003 (see IMF, 2003).

<sup>3</sup> There is evidence that foreign bank lending to emerging countries is procyclical (see Jeanneau and Micu, 2002). The present paper will not address this issue.

Figure 1. Outstanding External Short-term Credit  
(Observations centered around the crisis year, in percent of trade)



Sources: *Global Development Finance*, World Bank, and *World Economic Outlook*, IMF.

Table 1. Trade, External Short-term Credit, and Real Exchange Rate in 10 Crises

	Values in U.S. dollars		Volume indexes		Outstanding External Short-term credit (in U.S. Dollars) 1/	Real Exch. Rate
	Exports	Imports	Exports	Imports		
(Annual percentage change)						
<b>1997-1998</b>						
Malaysia	-7.3	-26.6	4.5	-17.8	-41.9	-20.6
Philippines	16.9	-18.6	19.4	-19.0	-37.5	-18.5
Thailand	-6.8	-33.8	8.5	-27.5	-19.6	-15.6
Indonesia	-8.5	-27.4	3.1	-11.2	-37.2	-51.7
Korea	-4.7	-36.2	19.6	-23.1	-46.4	-25.7
Russia	-14.3	-19.4	3.9	-18.0	72.5	2/
<b>1998-1999</b>						
Brazil	-6.1	-14.7	7.7	-4.9	-3.0	-33.6
<b>2000-2001</b>						
Argentina	0.8	-19.8	4.6	-17.3	-30.1	1.9
Turkey	11.9	-26.8	15.6	-23.0	-44.1	-17.8
<b>1994-1995</b>						
Mexico	14.0	-21.4	8.3	-25.5	-8.4	-33.1
<b>Weighed average 3/</b>	<b>-4.3</b>	<b>-29.1</b>	<b>10.6</b>	<b>-21.3</b>	<b>-19.9</b>	<b>-25.6</b>

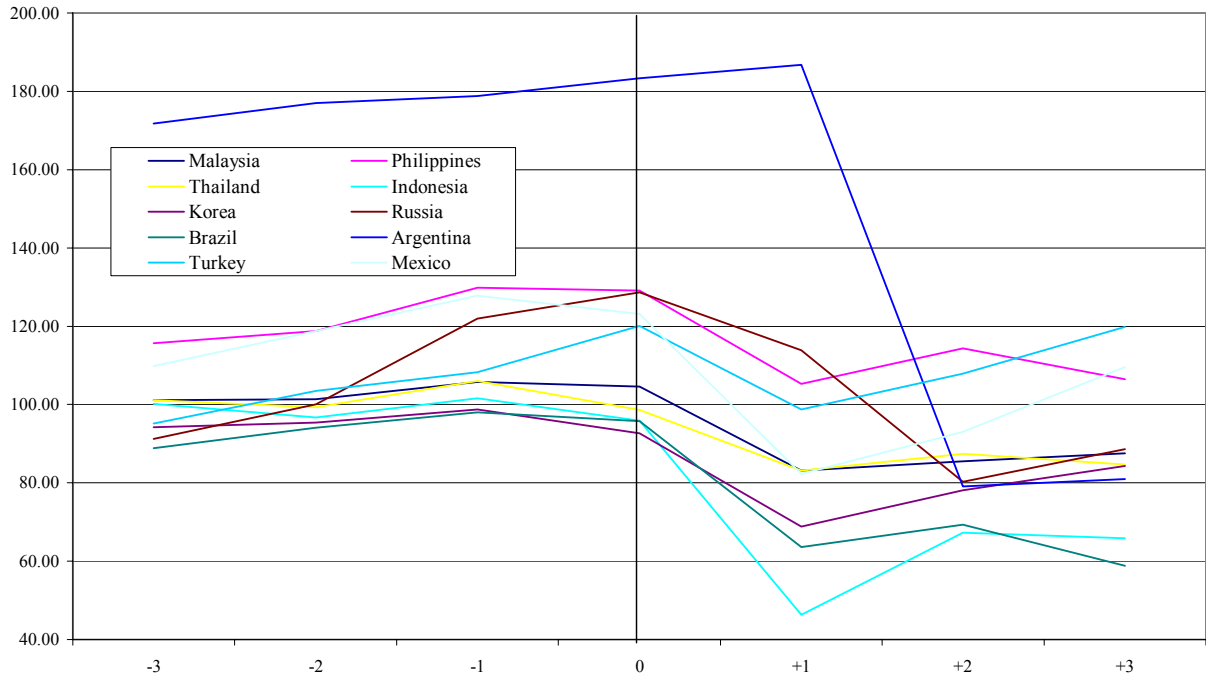
Sources: *World Economic Outlook*, IMF, *International Financial Statistics*, IMF, and *Global Development Finance*, World Bank.

1/ Deflated by U.S. whole industrial price.

2/ The increase in short-term credit during the crisis was largely due to a gas pipeline project under the Black Sea.

3/ Volume changes were weighed using exports (imports) share in the total exports (imports).

Figure 2. Real Effective Exchange Rates  
(Observations centered around the crisis year)



Source: *International Financial Statistics*, IMF.

## II. DATA

Table 2 presents the definitions of variables used in the present study. We used as a proxy for trade financing flows the change in outstanding short-term credit in U.S. dollars as reported in the *Global Development Finance* (GDF),<sup>4</sup> which includes short-term credit for trade as reported by the Organization for Economic Cooperation and Development (OECD) and the international banks' short-term claims as reported by the Bank for International Settlements (BIS). However, using GDF short-term credit as a proxy for trade financing has limitations: It excludes trade financing associated with intra-firm trade by multinational corporations (including most processing trade), and trade related to foreign direct investment.<sup>5</sup> Also, trade financed by domestic banking sources may not be responsive to external trade financing reported in the BIS statistics. We used a dummy variable for domestic banking crisis as trade

<sup>4</sup> Note that the trade financing flow  $F_{j,t}$  is defined as the first difference of the logarithm of the outstanding short-term credit  $D_{j,t}$ :  $FIN_{j,t} = \log D_{j,t} - \log D_{j,t-1}$ , which is approximately equal to the change of  $D_{j,t}$  in percent as  $\log D_{j,t} - \log D_{j,t-1} = \log(\Delta D_{j,t}/D_{j,t-1} + 1) \approx \Delta D_{j,t}/D_{j,t-1}$  according to the well known result  $\log(1+x) \approx x$  if  $x < 1$ .

<sup>5</sup> Some market participants estimate that about half of all trade is financed outside the banking system.

financing supply is also related with the ability of domestic banks to intermediate foreign trade financing.

Table. 2. Summary of the Variables 1/

Variables	Description
$\log X_{j,t}$	Logarithm of Export volumes of country $j$ at time $t$
$\log M_{j,t}$	Logarithm of Import volumes of country $j$ at time $t$
$\log XW_{j,t}$	Logarithm of World trade volume index
$\log YW_{j,t}$	Logarithm of World GDP index
$\log Y_{j,t}$	Logarithm of GDP of country $j$ at time $t$
$\log RELPX_{j,t}$	Logarithm of Relative price index of exports
$\log RELPM_{j,t}$	Logarithm of Relative price index for imports
$FIN_{j,t}$	First difference of logarithm of outstanding short-term credit to country $j$ at time $t$ , $D_{j,t}$
$DUMMY_{j,t}$	"1" for domestic banking crisis, and "0" otherwise for Argentina, Indonesia, Mexico and Russia.

1/ See Annex for sources and definition of variables.

The panel data consists of 10 countries over 10 years which yields a sample of 100 observations. We were constrained to use annual data as most of the variables have annual frequency. Also, we did not include more annual observations as we are interested on the trade finance effects on trade around the crisis year, and we would expect that observations far away from the crisis year would add little information on trade finance on trade flows during crisis.

We tested all variables for each country (Table 3) for unit roots and we found a fair amount of disagreement among the different tests, which may be partly due to the sample period being relatively short.<sup>6</sup> There is some evidence that most variables are nonstationary in levels but for  $FIN$ .<sup>7</sup>

<sup>6</sup> For an explanation of the methods used, see Kim and Maddala (p. 134-137, 2001), Maddala and Wu (1999) and Im, Pesaran and Shin (2003).

<sup>7</sup> In addition to testing presented in Table 3, we also tested for common unit root process among countries (Levin, Lin and Chu, and Breitung t-statistics) and the results were also mixed.

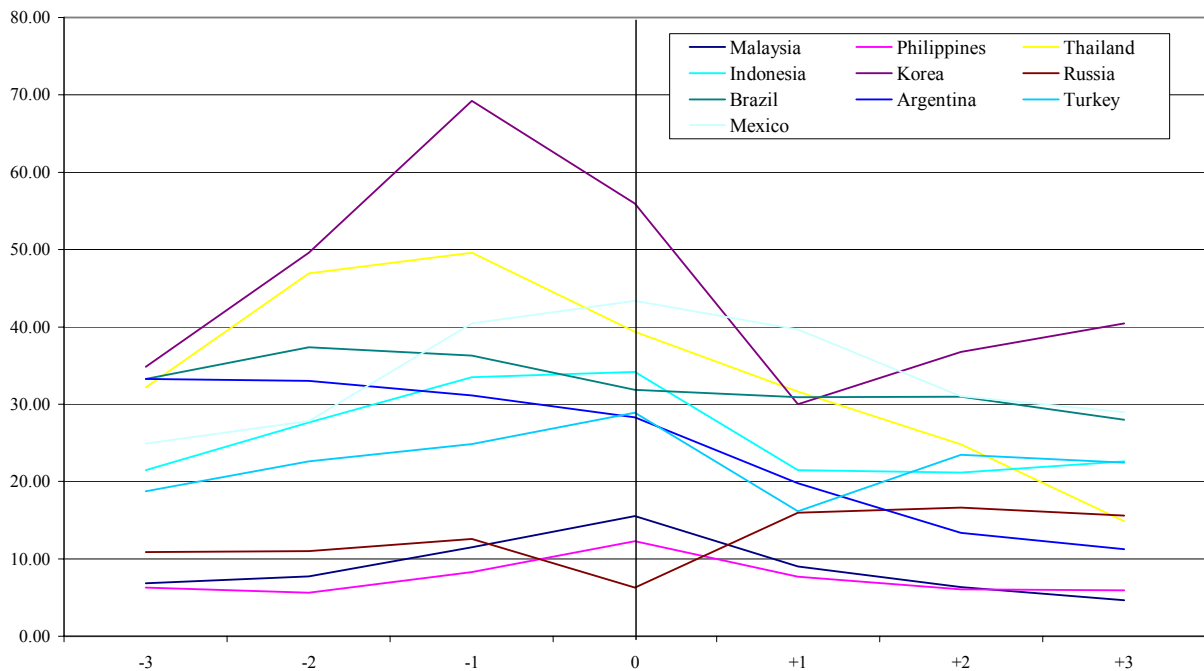
Table 3. Unit Root Tests 1/

Variables	Levels				First difference			
	Im, Pesaran and Shin	Prob.	PP - Fisher Chi-square	Prob.	Im, Pesaran and Shin	Prob.	PP - Fisher Chi-square	Prob.
$\log X_{j,t}$	-0.6272	0.2653	22.8877	0.2943	-0.0735	0.4707	34.8396	0.0210
$\log M_{j,t}$	0.5313	0.7024	11.3702	0.9361	0.2563	0.6012	39.5170	0.0057
$\log XW_{j,t}$	0.1605	0.5637	28.6842	0.0942	-0.7309	0.2324	58.4648	0.0000
$\log YW_{j,t}$	0.0023	0.5009	81.3817	0.0000	-0.7570	0.2245	34.2304	0.0246
$\log Y_{j,t}$	0.7378	0.7697	14.9383	0.7799	-0.1349	0.4463	54.1483	0.0001
$\log RELPX_{j,t}$	0.1355	0.5539	23.6117	0.2598	-1.2254	0.1102	55.9434	0.0000
$\log RELPM_{j,t}$	0.0549	0.5219	24.2112	0.2333	-0.8112	0.2086	49.2845	0.0003
$FIN_{j,t}$	-0.9160	0.1798	91.9535	0.0000	-0.5337	0.2968	111.073	0.0000

1/ Null hypothesis: Unit root assuming individual unit root process (see Kim and Maddala, 2001, pp. 134-137).

An overview of the data shows that in most countries external short-term credit fell significantly in real terms following the crises year (Figure 3), while export volumes continued to growth (Figure 4) and import volumes fell (Figure 5).

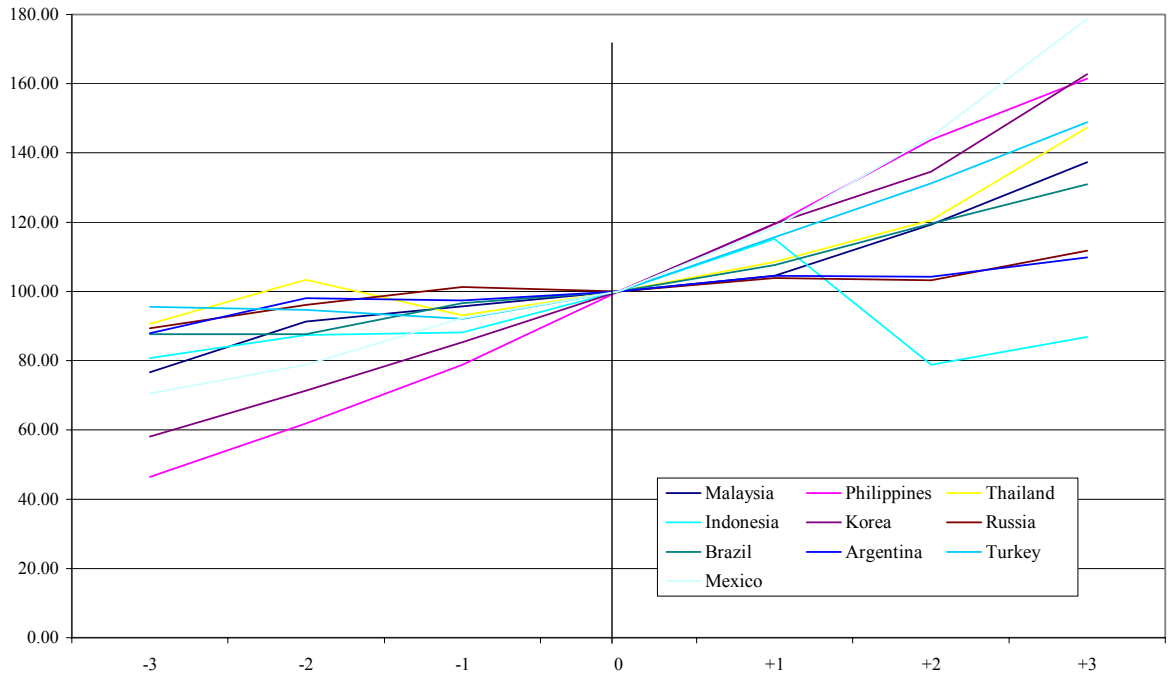
Figure 3. Real Outstanding External Short-term Credit  
(Observations centered around the crisis year, in U.S. billions of 2000) 1/



Source: *World Economic Outlook*, IMF.  
1/ Deflated by U.S. whole industrial price.

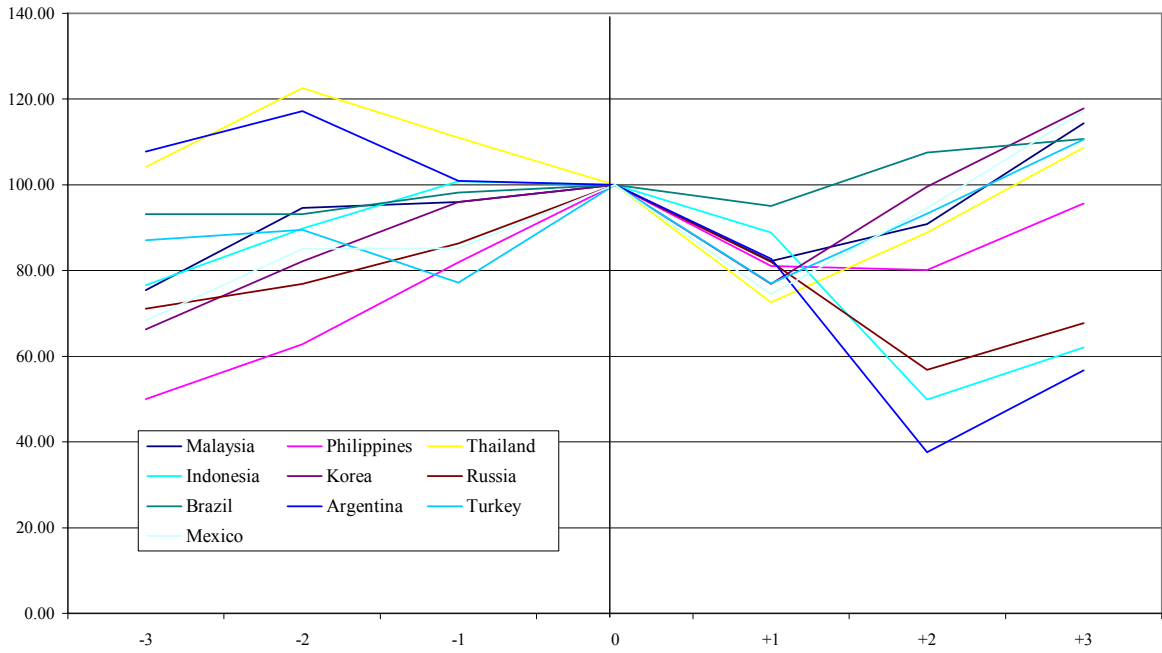


Figure 4. Export Volume Indexes  
(Observations centered around the crisis year=100)



Source: *World Economic Outlook*, IMF

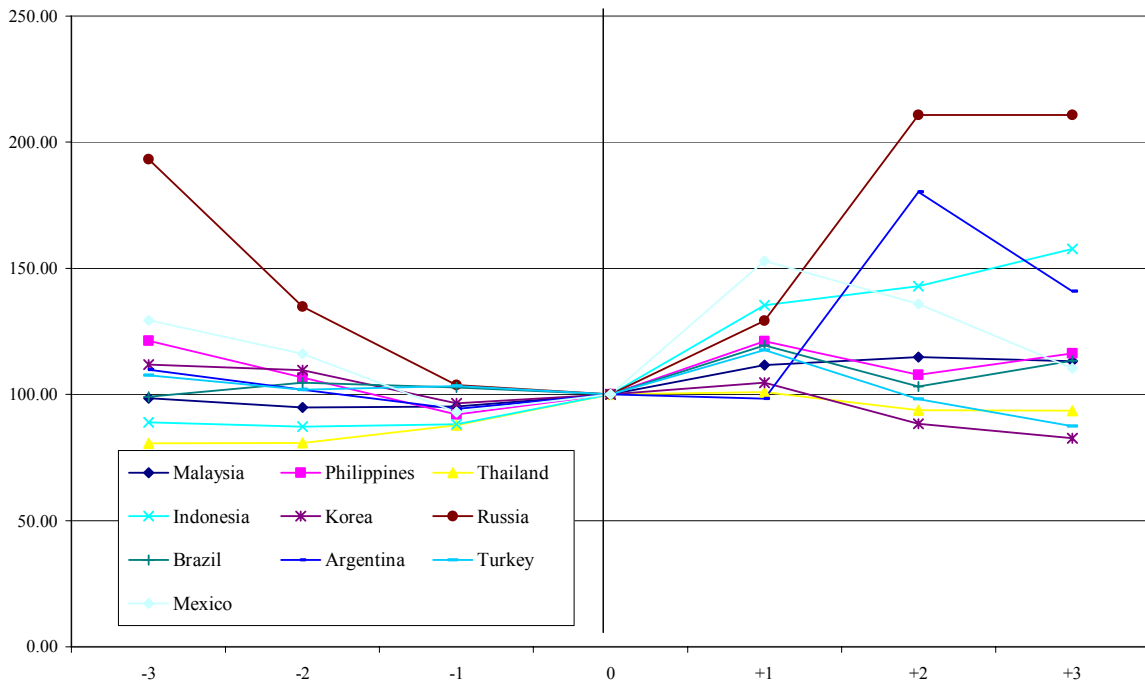
Figure 5. Import Volume Indexes  
(Observations centered around the crisis year=100)



Source: *World Economic Outlook*, IMF.

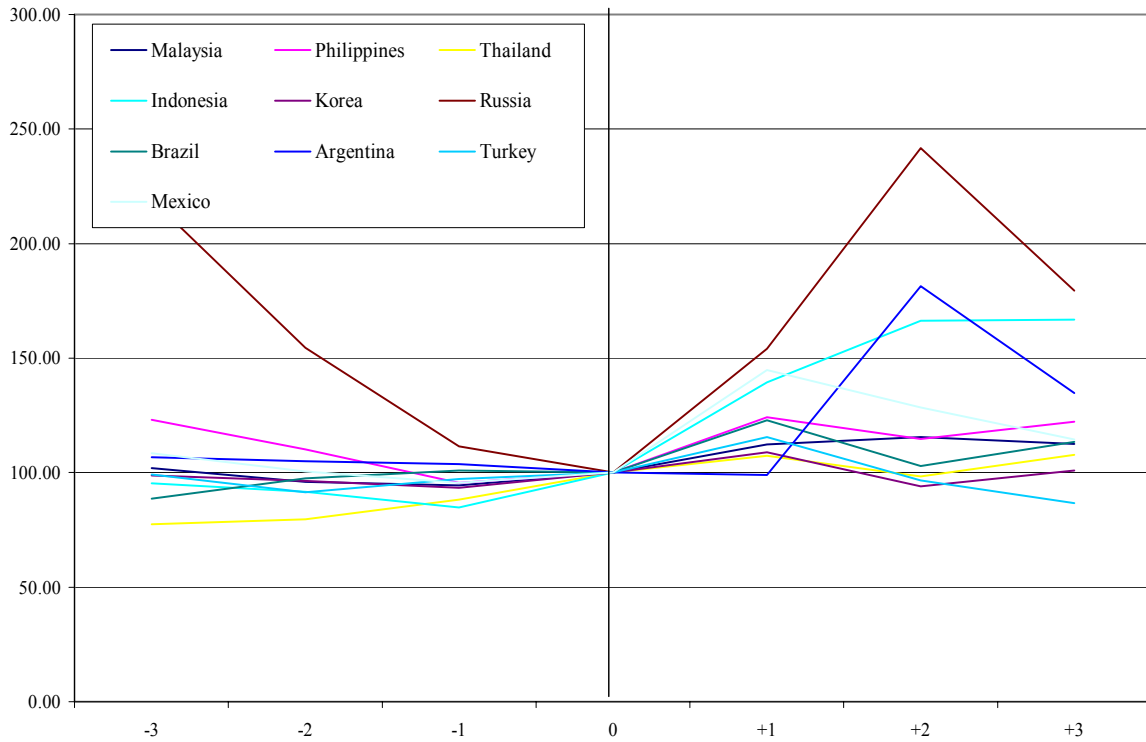
However, the sharp depreciation of national currency increased export and import relative prices (Figures 6 and 7), which may have boosted export and weakened imports.

Fig. 6. Relative Export Price Indexes  
(Observations centered around the crisis year =100)



Source: *World Economic Outlook*, IMF.

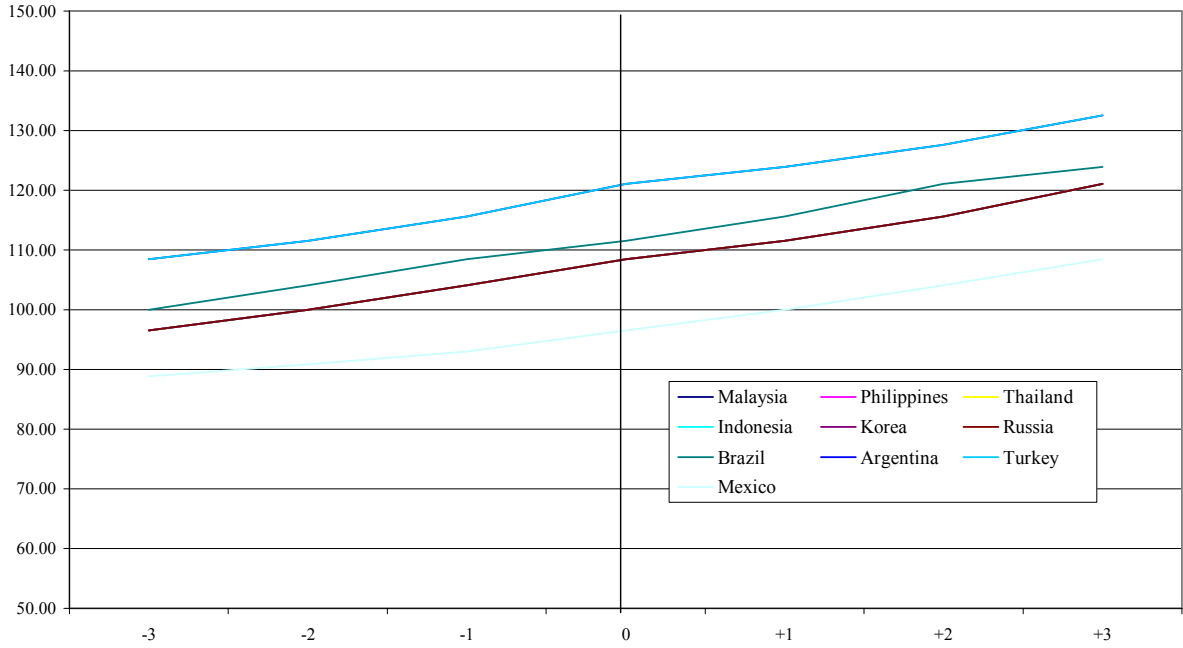
Figure 7. Relative Import Price Indexes  
(Observations centered around crisis year = 100)



Source: *World Economic Outlook*, IMF.

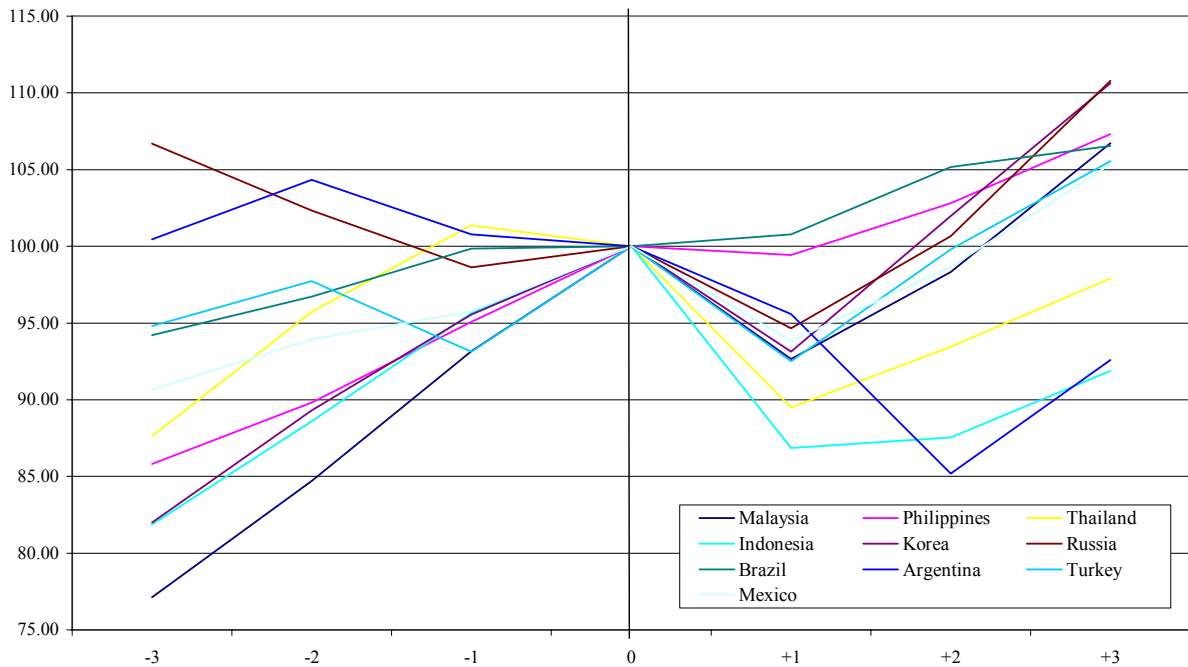
Also, at the time of the crisis, the countries did not face a fall in world demand as world gross product continued increase (Figure 8) which certainly contributed to support exports, while most of the sample countries faced sharp contraction of their GDP leading possibly to lower demand for imports (Figure 9).

Figure 8. World Real Gross Domestic Product Index for each Country at the Time of Their Crises  
(Observations centered around the crisis year)



Source: *World Economic Outlook*, IMF

Figure 9. Countries' Real Gross Domestic Product Index  
(Observations centered around the crisis year = 100)



Source: *World Economic Outlook*, IMF.

### III. MODEL SPECIFICATION AND ECONOMETRIC ESTIMATION METHODOLOGY

The data presented in the previous section suggest that other factors may have affected export and import volumes during crisis in addition to trade finance. To control for the various factors that may have affect trade flows during crisis, we estimate export and import volume equations including trade financing as an explanatory variable, using panel data with observations for each variable centered around the crisis year.

Our basic equations have the following simple specifications:

$$\log X_{t,j} = a_0 + a_1 \log XW_{t,j} + a_2 \log RELPX_{t,j} + a_3 FIN_{t,j} + a_4 DUMMY_{t,j} + v_{t,j} \quad (1)$$

$$\log M_{t,j} = b_0 + b_1 \log Y_{t,j} + b_2 \log RELPM_{t,j} + b_3 FIN_{t,j} + b_4 DUMMY_{t,j} + u_{t,j} \quad (2)$$

$t$  – time annual observations centered around the crisis year ( $t = -4, -3, -2, -1, 0, +1, +2$ ) and  $t=0$  year in which crisis began

$j$  – country (Argentina, Brazil, Indonesia, Malaysia, Philippines, Russia, South Korea, Thailand, Turkey, and Mexico)

where  $M$  and  $X$  are import and export volumes,  $RELPX$  and  $RELPM$  are the export and import relative price indexes,  $FIN$  is trade-related finance,  $Y$  domestic demand,  $XW$  world trade volume index, and  $DUMMY$  is a dummy for domestic banking crisis (equal 1 for banking crisis and 0 if is not the case).<sup>8</sup>

The error terms  $u$  and  $v$  are assumed to have zero mean and constant variance and not autocorrelated.

The expected coefficient signs for the export equation are:

$$a_1 > 0, \quad a_2 > 0, \quad a_3 > 0 \quad \text{and} \quad a_4 < 0$$

The expected coefficient signs for the import equation are:

$$b_1 > 0, \quad b_2 < 0, \quad b_3 > 0 \quad \text{and} \quad b_4 < 0$$

As the unit root tests suggest that most of variables are non-stationary in levels (Table 3), we estimated the first difference of equations (1) and (2), including two lags for each first differenced variable.

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<sup>8</sup> Our selection of explanatory variables was guided by two survey studies: Goldestein and Khan (1985) and Fullerton (1999). For an example of import equation specification including an external financing variable see Resende (1997 and 2001)

We estimated equations (1) and (2) using generalized least squares (GLS), instrumental variables (IV) both with fixed effects, and generalized method of moments (GMM). The GLS recognizes the nonsphericalness of the error terms  $u$  and  $v$  and is more efficient than LS, particularly in the case of heteroskedasticity. The IV and GMM estimation addresses simultaneity and errors in variable measurement. In particular, measurement error in the trade finance variable may be serious as there is no reliable data source. Finally, we tested all restrictions on the coefficients of equations (1) and (2) by means of Wald tests to determine a more parsimonious model specification, including the fixed effects assumption.

#### IV. ESTIMATION RESULTS

Estimation of equations (1) and (2) suggests that trade finance affects both export and import volumes in addition to relative prices and income. Trade financing explains a relatively small part of the fall of trade flows in recent crisis as trade volumes elasticities to trade financing are small, while a fall in trade financing in connection with domestic banking crisis can lead to a substantial loss of trade.

Tables 4 and 5 summarizes the estimation results.<sup>9</sup> Overall, all variables have the expected signs and most of the coefficients are significant at 1 and 5 percent levels. IV and GMM estimates do not differ significantly from GLS estimates, indicating that the results are relatively robust. The statistic *Durbin-Watson* suggests there is no autocorrelation, and the common intercept hypothesis is rejected at 5 percent.

Trade financing affects both export and import volumes positively as expected, but its coefficients are relatively small. The elasticity of export volume with respect to trade financing is estimated at about 0.03 and statistically significantly different from zero, while the elasticity of import volume with respect to trade financing is about 0.08, and statistically significantly different from zero in two out of the four regressions (Table 6). The coefficient of the dummy variables for domestic banking crises are relatively large and significant in both equations. The dummy variable explains about 6 percent and 10 percent fall in export and import volumes respectively compared with pre-crisis volumes on those countries affected by domestic banking crisis (Table 6).

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<sup>9</sup> Equations (1) and (2) were also estimated using the real effective exchange rate index as an alternative to relative prices and the results were broadly the same.

Table 4. Export Volume Equations  
( Dependent Variable:  $\Delta \log X_{j,t}$  )

Explanatory variables	GLS	IV 1/	GMM 1/	GMM 1/
	Fixed effects (1)	Fixed effects (2)	Fixed effects (3)	Fixed effects (4)
$\Delta \log XW_{j,t}$	0.2731 ***	...	...	...
$\Delta \log XW_{j,t-1}$	...	0.2892 *	0.4133 ***	0.2953 ***
$\Delta \log RELPX_{j,t}$	0.0377 ***	0.0420 **	0.0180 ***	0.0638 ***
$\Delta FIN_{j,t}$	0.0177 ***	0.0135 ***	...	...
$\Delta FIN_{j,t-1}$	...	...	0.0387 **	...
Dummy	-0.0666 ***	-0.0752 ***	-0.0170	-0.0550 ***
AR(1)	0.1167 ***	0.1170 ***	...	...
Number of observations	80	80	80	80
R-squared	0.75	0.75	0.31	0.30
Durbin-Watson stat.	2.031	2.324	2.334	2.072
Common intercept F-test 2/	4.020 **	3.000 **	...	...

Notes: (\*) significant at 10 percent level, (\*\*) significant at 5 percent level, and (\*\*\*) significant at 1 percent level.

We defined  $\Delta \log Z_t = \log Z_t - \log Z_{t-1}$ .

1/ Instruments: lagged world demand, real domestic credit and real exchange rate, and dummy for banking crisis.

2/ The common intercept restriction rejected at (\*\*) 5 percent level.

Table 5. Import Volume Equations  
( Dependent Variable:  $\Delta \log M_{j,t}$  )

Explanatory variables	GLS	IV 1/	GMM	GMM 2/
	Fixed effects (5)	Fixed effects (6)	Fixed effects (7)	Dynamic (8)
$\Delta \log M_{j,t-1}$	...	...	...	-0.0489 *
$\Delta \log Y_{j,t}$	2.4571 ***	1.7757 ***	1.9086 ***	1.8337 ***
$\Delta \log RELPM_{j,t}$	-0.2024 ***	-0.1782 **	-0.1453 *	-0.1267 ***
$\Delta FIN_{j,t}$	0.1420	0.1213 *	0.1026	0.0798 ***
Dummy	-0.0891 *	-0.1141 **	-0.1106 **	-0.1138 ***
Number of observations	90	90	90	80
R-squared	0.77	0.69	0.69	0.5300
Durbin-Watson stat	1.998	2.244	2.251	2.9690
Common intercept F-test 3/	4.500 **	3.0600 **	...	...

Notes: (\*) significant at 10 percent level, (\*\*) significant at 5 percent level, and (\*\*\*) significant at 1 percent level.

We defined  $\Delta \log Z_t = \log Z_t - \log Z_{t-1}$ .

1/ Instruments: lagged world demand, real gross domestic product, real domestic credit, real exchange rate, trade finance, and dummy for banking crisis.

2/ Linear dynamic panel data estimation (Arellano-Bond, 1991).

3/ The common intercept restriction rejected at (\*\*) 5 percent level.



## V. CONCLUSIONS

Our results suggest that trade finance affects positively both export and import volumes in addition to relative prices and income in the short run. Trade financing explains a relatively small part of the fall of trade flows in recent crises as elasticities of trade volumes with respect to trade financing are small, while a fall in trade financing in connection with domestic banking crisis can lead to a substantial loss of trade..

Table 6 summarizes trade financing effects on export and import volumes. The estimated elasticities are small and a fall of 20 percent in trade finance — as the one in Table 1 — explains only a decline of 0.6 percent in exports and 1.6 percent in imports. The low elasticities of trade volumes with respect to trade financing may reflect partly the fact that a large part of exports is financed outside the banking system; and, as a result, export volumes are not very sensitive to changes in bank-financed trade credit. In contrast, a domestic banking crisis has a large effect on exports and imports possibly as domestic bankings are not able to intermediate foreign trade financing. The domestic banking crisis dummy explains a fall in exports of about 6 percent and in imports of about 10 percent compared with pre-crisis levels.

These results provide some justification to policies aimed at supporting trade financing during crisis, particularly when domestic banks are in distress and are not able to intermediate foreign trade financing. At same, they indicate that trade financing explains a relatively small part of the total fall of trade flows in recent crises, and other policies are needed to address each country's external vulnerabilities, in particular large macroeconomic imbalances, banking system distress, low external reserves, and unsustainable external debt.

Table 6. Summary of Trade Financing Effects on Trade

	Export volumes	Import volumes
Elasticity of trade volumes with respect to trade financing (centered at the crisis year) 1/	0.03	0.08
Dummy variable for domestic banking crisis (change in percent compared with pre-crisis volumes)	-5.5	-11.0

Sources: Tables 4 and 5.

1/  $\varepsilon_{t=0} \approx \alpha [1 - (\Delta D_t / D_{t-1}) / (\Delta D_{t+1} / D_t)]$ , where  $\alpha$  is the coefficient of *FIN* in the regressions, *D* is the outstanding stock of short-term debt, and  $t=0$  is the crisis year.

### ANNEX: VARIABLES AND DATA SOURCES

Import and export in U.S. dollars as reported in the *International Financial Statistics* (IMF)

Import and export volume indexes ( $M_{j,t}$  and  $X_{j,t}$ ) as reported in the *World Economic Outlook* (IMF).

Real effective exchange rates ( $ER$ ) and Nominal Exchange rate ( $E$ ) national currency per U.S. Dollar as reported in the *International Financial Statistics* (IMF).

Export price indexes ( $PX$ ) - Price deflator for exports of goods as reported in the *World Economic Outlook* (IMF) for each country  $j$ .

Import price indexes ( $PM$ ) - Price deflator for exports of goods as reported in the *World Economic Outlook* (IMF) for each country  $j$

Wholesale price index ( $WPI$ ) as reported in the *International Financial Statistics* (IMF).

External short-term credit ( $FIN$ ) as reported in the *Global Development Finance* (World Bank). This variable was used as proxy for trade finance. The stock of short-term credit in the GDF is calculated adding information on banks' short-term claims by country from the Bank of International Settlements (BIS) and the short-term credit for exports from the Organisation for Economic Co-operation and Development (OECD). As the BIS data is reported in terms of remaining maturity, the GDF adjusts the BIS data to obtain an estimate of banks' claims of one year maturity. Both institutions report short-term claims/credit in U.S. dollars.

Domestic Demand ( $Y$ ) - Gross domestic product, constant prices as reported in the *World Economic Outlook* (IMF) for each country  $j$

World Demand ( $YW$ ) - trade weighed demand as reported in the *World Economic Outlook* (IMF) for each country  $j$ . This variable was used as an instrument in the IV estimation of the paper's equations.

World trade index ( $XW$ ) – Volume of exports of goods & services as reported in the *World Economic Outlook* (IMF) for each country  $j$

Relative export price index ( $REL PX$ ) is defined as export price index divided by wholesale price index and multiplied by the exchange rate:  $REL PX = (PX/WPI) * E$

Relative import price ( $REL PM$ ) is defined as import price index divided by wholesale index and multiplied by the exchange rate:  $REL PM = (PM/WPI) * E$

Real domestic credit ( $DC$ ) is defined as the nominal domestic credit as reported in the *International Financial Statistics* (IMF) deflated by the consumer price index. This variable was used as an instrument in the IV estimation of the paper's equations.

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