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CONTENTS

ARTICLES

A perspective on leading and managing organizational change

Stanley J. Smits, Dawn E. Bowden

Alternative configurations of firm-level employment systems: evidence from American companies

Bruce E. Kaufman, Benjamin I. Miller

How team leaders can improve virtual team collaboration through trust and ICT: A conceptual model proposition

David Kauffmann

International trade in differentiated goods, financial crisis and the gravity equation

Udo Broll, Julia Jauer

Tax revenues and aging in ex-communist EU countries

Mihai Mutascu, Maciej Cieślukowski

The analytics of the New Keynesian 3-equation Model

Jean-Christophe Poutineau, Karolina Sobczak, Gauthier Vermandel

Investments and long-term real interest rate in Poland. Study of investment structure, current account and their correlation with long-term real interest rates

Jakub Krawczyk, Szymon Filipczak

BOOK REVIEWS

Paweł Marszałek, *Systemy pieniężne wolnej bankowości. Koncepcje cechy, zastosowanie* [Free Banking Monetary Systems. Concepts, Characteristics, Application], Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu, Poznań 2014 (Bogusław Pietrzak)

Ewa Mińska-Struzik, *Od eksportu do innowacji. Uczenie się przez eksport polskich przedsiębiorców* [From Export to Innovation – Learning by Exporting in Polish Enterprises], Difin, Warszawa 2014 (Jan Rymarczyk)

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ul. Powstańców Wielkopolskich 16, 61-895 Poznań, Poland
phone +48 61 854 31 54, +48 61 854 31 55, fax +48 61 854 31 59
www.wydawnictwo-ue.pl, e-mail: wydawnictwo@ue.poznan.pl
postal address: al. Niepodległości 10, 61-875 Poznań, Poland

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International trade in differentiated goods, financial crisis and the gravity equation¹

*Udo Broll, Julia Jauer*²

Abstract: The study examines the effect of financial crises on international trade with a gravity equation approach. We use a large data set covering almost 70 importing and 200 exporting countries from 1950 to 2009. Thus it is possible to put the ‘Great Trade Collapse’ witnessed during the financial crisis 2008–2009 into a historical perspective. Both the period for which the crisis is observed, and the level of the trading partners’ economic development constitute important factors in explaining the negative effects of a banking crisis on international trade. As the analysis indicates financial crises have a stronger negative effect on differentiated goods compared to overall export flows. In addition the negative effects of financial crises persist even after the income effect is accounted for. The study therefore suggests that the increasing share of differentiated goods in international trade might be one possible reason for the comparatively large effect of the recent financial crisis on international trade relative to previous financial turmoil in post-war economic history.

Keywords: international trade, differentiated goods, globalization, financial crisis, gravity equation.

JEL codes: F13, F14, F33, G15.

Introduction

In the first quarter of 2009 international trade declined nearly 30 per cent compared to the same period one year before. From the 1950’s onwards, both global economic capacity and complexity were growing with expanding international trade and as complex global interdependencies developed. As a consequence national economies became interlinked globally. This interde-

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² School of International Studies (ZIS), Technische Universität Dresden, Faculty of Business and Economics, Helmholtzstrasse 10, 01062 Dresden, Germany, corresponding author: udo.broll@tu-dresden.de.

pendence did not result in positive gains only; it can also lead the entire world economy into turmoil if one economy malfunctions. This happened when the initial US housing market crisis in 2007 became a world financial crisis in 2008/2009 with effects in the real economy [Didier, Hevia, and Schmukler 2010; Admati and Hellwig 2013]. The world economy experienced one of the broadest, deepest, and most complex crises since the Great Depression and it led to a severe decline in trade relative to gross domestic product (around twenty per cent) unobserved since 1929, that came to be called “the great trade collapse” [Baldwin 2009].

The link between the economic crisis and the decline in international trade is a complex one. Previous studies suggest a negative relationship between the financial crisis and international trade, but some contradictions remain [Baldwin 2009]. Whilst some studies emphasize the role that declining overall demand had on decreasing trade flows downplaying or rejecting the effect trade finance might have had other contributors point out the particular importance that trade finance has for international trade especially in times of financial turmoil. And yet other studies bring forth a compositional argument highlighting the fact that trade is composed of very different commodities and sectors, which might react differently to a financial crisis. The internationalisation of production chains, so called vertical linkages, was mentioned as one key factor in the massive trade decline.

Our study tries to provide additional insight into the question of the impact of the financial crisis on international trade. However, it treats a financial crisis as an exogenous event. The paper is related to the empirical so-called gravity approach trade literature. It sets out to examine the underlying factors driving the trade slump in 2008–2009 using a gravity type trade flow model incorporating country specific characteristics and including external shocks. The analytical framework is based on a recent study by Berman et al. [2012] and by adding the element of disaggregated trade flows. The study provides new evidence on the way the financial crisis affected trade this time around.

There are other approaches in the literature to investigate the question why trade collapsed during the crisis. A prominent example is, Eaton et al. 2013. They use a framework that includes recent development in general equilibrium models of bilateral international trade into a multi-country real business cycle model. The goal of this approach is to provide a mapping between observables and an underlying set of shocks in order to separate the shocks from observables and counterfactual shocks.

In the following Section 1, the related literature is reviewed. In Section 2 the effects of financial crises on international trade are discussed and causes and causalities are addressed leading to some testable hypotheses. Section 3 describes the theoretical approach of the standard gravity model, the estimation method applied and the data used. Section 4 presents and evaluates the empirical results. The next Section concludes.

1. Related literature: trade and financial crises

The financial crisis inspired a series of studies on financial, banking and economic crises [see, for example, Admati and Hellwig 2013]. An extraordinary example of providing empirical research on cycles of debt, financial, currency and sovereign debt crises was done by Reinhart and Rogoff [2011], who also provide a publicly accessible data set dating back to the 19th century. Before the economic and financial crisis in 2008–2009 the examination of the relationship between financial crises and trade as a whole was sparse. A collection of essays, edited by Baldwin [2009], offers a good overview on the subject of trade decline in the recent financial crisis. According to Baldwin's calculations the decrease in trading volume for the second quarter of 2008 to second quarter of 2009 was 20 percent and for some countries even 30 percent.

Frictions in trade finance and the drying up of trade credit during the financial crisis are expected to have an effect on trade [see Chor and Manova 2012]. Studies that focus particularly on trade finance during financial crises usually have a strong regional focus on global banking centres or are country specific [see Amiti and Weinstein 2011].

Bricongne et al. [2012] also examine the compositional effect of external finance on trade with French firm level data and find that the firms that are more dependent on external finance are more affected by the crisis. In general, all studies find strong support that vertical linkages are quantitatively important in understanding the global trade collapse. Global production patterns can thus be expected to explain part of the massive decline in international trade this time around, because the international supply chain has intensified over the last couple of decades. The sensitivity of trade towards output has increased over time and an underlying reason for this could be the growing share of certain goods which react in a more volatile way to economic frictions than total output [Engel and Wang 2011]. International production sharing or vertical specialisation means that trade reactions are increasingly sensitive to changes in trade costs. Furthermore, empirical studies distinguish between differentiated and non-differentiated goods and find that this distinction is crucial for understanding the extent to which price declines contributed to the decline in trade values.

Only very few studies applied the gravity approach to examine the trade collapse during 2008–2009. An exceptional study Berman et al. [2012] analyzes the effect of the recent financial crisis on international trade covering the whole post-war era on a global scale and using a gravity-based approach. The fall in trade caused by financial crises is magnified by the time-to-ship goods between the origin and the destination country. The authors strongly suggest that financial crises affect trade not only through demand but also through financial frictions that are specific to international trade.

Globalisation and the internationalisation of production patterns, however, have not been fully addressed by this study although previous studies suggest

an important role for these in trade. A study of Eaton et al. [2013] includes also an element of the gravity model to calculate an indicator of trade frictions between individual countries. They conclude that the bulk of the decline in trade relative to GDP may be explained by shocks in the industrial demand for goods and it is only in some countries like China and Japan that trade decline can be explained to a large extent by increased trade frictions.

2. The effects of the financial crisis on trade

The years directly after World War II were remarkably tranquil and marked by the quasi-absence of banking crises. If financial crises emerged at all, they were strictly currency crises. The Bretton Woods Agreements and the gold exchange standard stabilized global economic frictions. The fixing of countries exchange rates relative to the US-dollar was abandoned in 1971. Since then banking crises were more frequent and the share of countries experiencing banking crises was rapidly increasing until recently (see Figure 1 below).

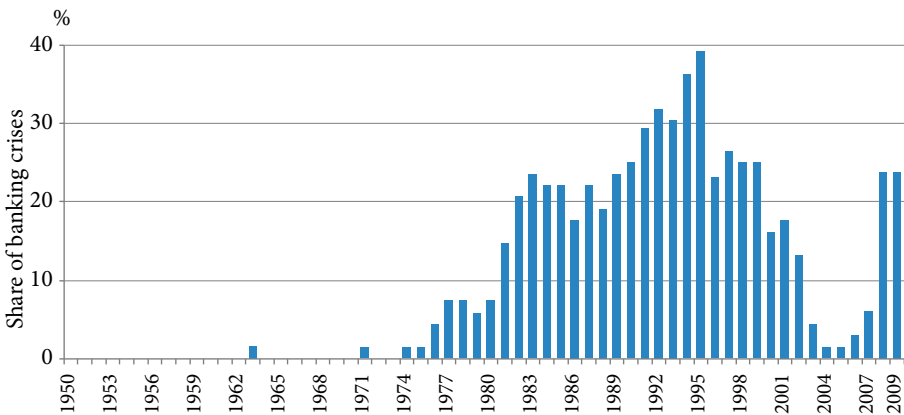


Figure 1. Share of banking crisis in the post-war period (1950–2009)

Source: Authors calculation [based on: Reinhart and Rogoff 2011]

The crisis in Latin America of the 1970's and 1980's, the Japanese banking crisis in the early 1990's, the European and the Asian financial crises are well visible as peaks. The impetus of the share of countries experiencing banking crises in 2008/2009 came after a period that was relatively calm compared to the last ten years. The crisis had a tremendous effect on international trade. Even though the global economy has seen financial crises before 2008/2009, international trade declined for the first time after fifty years of more or less continuously rising trade volumes. In 2009 both developed, developing and emerging countries were experiencing trade declines, but developed countries

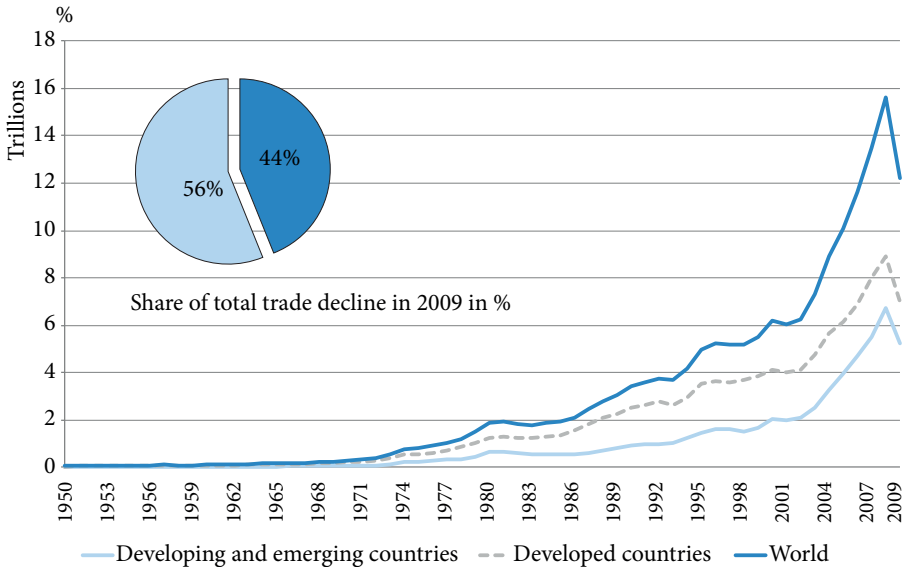


Figure 2. Import flows 1950–2009 for developing, emerging and developed countries in trillion US\$ and their share in the trade collapse in 2009

Source: Authors calculation (based on International Monetary Fund DOTs)

had a relatively higher share in the decline of the total global trade decrease (see Figure 2).

The decline in trade flows was significant and on a global scale. Almost all countries experienced declines in exports and imports. Even though developed countries accounted for the larger share of the total trade decline in 2009 some developing and emerging countries' exports were also hit hard during the financial crisis.

Previous literature suggests that the internationalization of production chains could account for the increased volatility of international trade in crisis. The importance of vertical linkages and the global production chain is well visible when looking at the share of differentiated goods³ in total trade. The share of differentiated goods has increased dramatically in the last fifty years. In the early 1960's their share in total imports was just over 45 percent and reached a peak in the early 2000's with over 72 percent of all imports (see Figure 3).

Besides GDP there are other indicators for trade promotion and trade disruption which need to be considered when analysing the trade decline of 2008/2009. Taking into account the behaviour of trade flows it is possible to identify the main possible factors by which international trade was affected by financial crisis. The OECD [2010] describes three direct ways how the financial crisis affected international trade. International trade is affected by the financial crisis through: (i) global demand and income, (ii) international trade finance

³ The definition of differentiated goods follows Rauch's [1999] conservative definition.

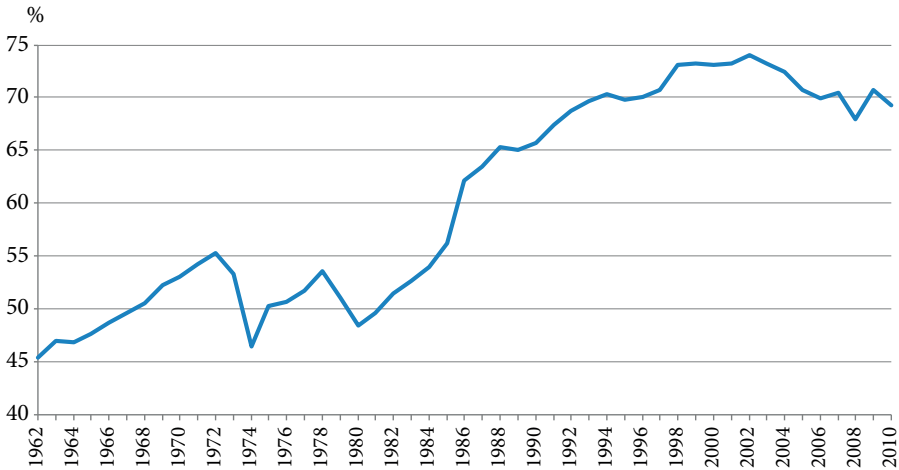


Figure 3. Share of differentiated goods of all imports (1962–2010)

Source: Authors calculation [based on: UN COMTRADE; Rauch 1999]

and (iii) composition of internationally traded goods. In light of the literature review a fourth channel of how financial crisis affects trade can be added. The way in which goods traded react to financial crisis also depends on the degree of economic development in exporting countries.

2.1. The income effect

The financial crisis affects international trade indirectly through reduced consumption and therefore through the decline in demand for goods [Eaton et al. 2013]. With a declining demand for foreign goods fewer imports are purchased and fewer exports are sold. The drop in demand has significantly contributed to the drop in trade but it cannot explain it fully. Thus the decrease of income due to the financial crisis is only one factor in explaining the decline in international trade.

2.2. The international trade finance effect

The availability of financial services is important for firms engaging in international business. During the financial crisis the sensitive cooperation of international financial service was severely disturbed and this affected international trade. Thus the price increase in trade financing or the absence of it has led to a decrease in global trade flows. This applies especially to developing countries which might have suffered from increased risk perception and therefore more expensive trade finance [Broll et al. 2001; Berman et al. 2012]. Information on detailed trade finance on a global scale is very difficult to obtain, especially for emerging and developing countries with less integrated and less developed banking and financial systems. In response to the change in market conditions

on trade finance, the International Monetary Fund (IMF) has undertaken a survey of major developed countries and emerging markets' banks. According to the IMF [2009a, b] several banks reported sharp increases in the cost of trade finance; seventy percent of the surveyed banks reported that the price for trade finance services has increased.

2.3. The trade compositional effect

A World Bank survey indicates that the biggest financing constraint particularly for firms operating in global supply chains is not access to trade credit (e.g., letter of credit) per se, but rather pre-export finance. Differentiated goods, such as investment and consumer goods, are therefore more demanding in terms of finance structures making them particularly vulnerable to a financial crisis. This observation indicates that a crisis might affect exports within global supply chains or with vertical linkages in a more severe way than other goods because in times of crises they require specific financial provisions which they otherwise would not need and which are even harder to obtain in times of financial turmoil. Thus, the composition of international trade has led to a distinctive decline of trade flows during the financial crisis.

2.4. The economic development effect

The way international trade reacts to financial crises depends also on the level of economic development of a country. On the one hand developing countries can be more dependent on trade exports relative to their GDP than developed economies. A trade slump therefore can have an amplified effect for developing countries. Available data indicate that trade in some regions – Asia, the Middle East, Northern Africa and South America – was more severely impacted by changes in short-term trade finance than other regions (Europe and North America). This may be due to the fact that countries in these regions were considered to be more exposed to risk. Therefore trade finance prices became less affordable for those countries. On the other hand, the lack of integration with the international financial system could have been a blessing in protecting developing and emerging countries against negative chain reactions [see for example Didier, Hevia, and Schmukler 2011].

The compositional effect of international trade is also quite different regarding the level of economic development. In general developing countries' exports differ from the exports of developed countries. If differentiated goods have a higher elasticity than other exports, developing countries might react differently compared with developed countries in times of crisis.

To sum up the arguments can be expressed in the following hypotheses.

H0: *Financial crises have, in general, a negative impact on international trade.*

H1: *Financial crises reduce trade due to income effects.*

H2: *Trade finance has played a role in trade disruption.*

H3: *Differentiated goods are more sensitive to financial frictions during financial crises.*

H4: *Emerging and developing countries differ in trade composition and access to trade finance during financial crises.*

3. Gravity trade equation, estimation method and data

The trade gravity approach has long been one of the successful models in international economics [Anderson and van Wincoop 2003, 2004]. The gravity equation is fundamentally about inferring trade costs in a setting where much of what impedes trade is not per se observable to the econometrician because there is only limited information on direct measures of trade costs.⁴ However, trade flows and proxies for different types of trade costs are observable.

3.1. Gravity equation

The gravity model states that export and import flows between countries (or regions) depend positively on the GDP of the trading partners (as a measure of economic size) and negatively on geographical distance (as a proxy for transaction costs):

$$\text{force of trade} = \frac{G[Y_i Y_j]}{\text{dist}_{i,j}^{(\text{elasticity}-1)}}, \text{ with } G \equiv \left(\frac{1}{\Omega_i} \right) \left(\frac{1}{P_j^{1-\text{elasticity}}} \right). \quad (1)$$

GDP of country i (j) is denoted by Y_i (Y_j); P_j is country j 's price index and Ω_i a proxy to what is called market potential in the economic geography literature (often measured by the sum of its trade partners GDPs divided by bilateral distance). It is an indicator for openness of a country i . The term G is the 'gravital un-constant', because it varies over time (as prices and GDPs change). This is what Anderson and van Wincoop called the multilateral trade resistance. Two countries will often exchange more goods and services the bigger they are and also the less further apart that they are. The average elasticity of international trade is estimated close to unity to around 0.9 says a meta-study by Disdier and Head [2008] on standard gravity estimations.

A structural gravity model has the following general form:

$$X_{ij} = \frac{Y_i Y_j}{Y_w} \left(\frac{t_{ji}}{P_i P_j} \right)^{1-\sigma}. \quad (2)$$

⁴ For a comprehensive and up to date introduction of the theories behind the gravity model see: [Chaney 2008; Head and Mayer 2013].

The volume of exports X_{ij} of a country i to country j in equation (2) is explained by the relative size of the exporter (measured as a proportion of income Y_i), the importer (measured as a proportion of income Y_j) and of the world GDP Y_w . In addition exports depend on the bilateral trade cost t_{ij} , which are all trade barriers. The elasticity of substitution between different types of goods is recognized by σ .

The unobservable trade cost factor t_{ij} can be written as a log-linear function of observable characteristics, namely as the bilateral distance d_{ij} and whether there is an international border b_{ij} between i and j . After some rearrangements we obtain the theoretical gravity equation:

$$\ln(X_{ij}) = \alpha + \beta_1 \ln(Y_i) + \beta_2 \ln(Y_j) + \beta_3 \rho \ln(d_{ij}) + \beta_4 \ln(b_{ij}) + \beta_5 \ln(P_i) - \beta_6 \ln(P_j) + \varepsilon_{ij}, \quad (3)$$

where α is a constant, ρ is $(1 - \sigma)$ and ε represents the normally distributed error term. Equation (3) is expanded by adding other factors to the trade cost as dummy variables such as common language, common currency, free trade union member, currency unions and common border. The fact that history played a role in shaping trade relationships can also be accounted for by including colony dummies, controlled by the same colonizer, similarities in religion, legal system and military conflicts [see Martin, Mayer, and Thoenig 2008; Head, Mayer, and Ries 2010].

3.2. Estimation method

A consensus has emerged in gravity literature on the use of fixed effects (FE) for panel trade flows. According to the literature replacing the remoteness variable with exporter and importer dummies to proxy for multilateral resistance is the 'correct specification' of the gravity model. Exporter and importer dummies will be added to equation (3). Estimation will be made for country pair dummies. To measure the effect that banking crises have on trade flows, a further adjustment has to be made. A dummy variable BC_{jt} for banking crises is introduced, which takes one when a banking crisis has occurred in the importing country at time t .

$$\ln(X_{ijt}) = \alpha + \beta_1 \ln(Y_{it}) + \beta_2 \ln(Y_{jt}) + \beta_3 \rho \ln(d_{ij}) + \beta_4 \ln(b_{ij}) + \beta_5 \ln(RER_{ijt}) + \beta_6 (T_{ijt}) + \beta_7 BC_{jt} + \beta_8 (\text{developing country}_{ij}) + \mu_{ij} + \varepsilon_{ijt}, \quad (4)$$

where T_{ijt} stands for a set of time-varying bilateral controls (like regional trade agreements, colonial relationships, currency unions, etc.). Because for a large sample of countries representative price indexes are not available, the best al-

ternative is to use real exchange rate (RER) indexes. RER_{ijt} is the bilateral real exchange rate between country i and j . Fixed effects are included with μ_{ij} . This allows control of all time independent country specific characteristics which might influence the bilateral trade relation.

The second dummy introduced in the equation (4) is the level of development for the partner's economy. To assess whether the financial crisis in the importing country has a different effect on developing and emerging countries the level of economic development dummy is included. The effect of a banking crisis on trade is expected to be negative. It is not clear however how exports from developing and emerging countries are affected by the banking crises because one can argue both ways. It is however tested that they have a different reaction to banking crises than developed countries.

It is assumed that differentiated goods are more prone to the effects of financial crises (our hypotheses H_3). Equation (4) estimates separately for exports of differentiated goods only. The negative effect of a banking crisis on trade is expected to be stronger for differentiated goods. Looking at the banking crises before the global financial crises in 2008 and the recent crises separately will allow an inference to be made about the different impact the financial crisis had on trade in this period.

3.3. Data

Trade data come from two sources. Aggregated trade flows are obtained from the International Monetary Fund Direction of Trade Statistic (IMF DOTS) dataset which covers trade flows of almost all country pairs of the world from 1949 onwards. Reported bilateral imports by the importing countries will be used. Disaggregated trade flows come from the UN COMTRADE. The data are transformed in a series of steps to match the classification of disaggregated goods provided by Rauch [1999].⁵ The data for banking crisis comes from Reinhart and Rogoff [2011], period 1950 until 2009. The occurrence of a banking crisis for a given year is marked by a binary variable for up to 69 different countries.

Banking crisis are defined by two types of events: (i) bank runs that lead to the closure, merging, or takeover by the public sector of one or more financial institutions; or (ii) if there are no runs, the closure, merging, takeover, or large-scale government assistance of an important financial institution (or group of institutions) that marks the start of a string of similar outcomes for other financial institutions.

Gravity relevant variables come from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) gravity data set which is publicly available and covers the period from 1948–2006. The updated version up to 2009 will be used for the estimations below. The definition for developed countries versus developing and emerging countries comes from the United Nations

⁵ On request the authors can provide more detailed information about this procedure.

Table 1. Gravity trade model for export flows

	IMF DOTS	UN COM-TRADE	IMF DOTS same	UN COM-TRADE same	IMF DOTS	UN COM-TRADE	IMF DOTS same	UN COM-TRADE same
lngdp_o	0.923 ^c (0.000)	0.856 ^c (0.000)	1.085 ^c (0.000)	0.929 ^c (0.000)	0.852 ^c (0.000)	0.844 ^c (0.000)	0.961 ^c (0.000)	0.888 ^c (0.000)
lngdp_d	0.816 ^c (0.000)	0.837 ^c (0.000)	0.835 ^c (0.000)	0.890 ^c (0.000)	0.777 ^c (0.000)	0.780 ^c (0.000)	0.844 ^c (0.000)	0.811 ^c (0.000)
lndistw	-1.046 ^c (0.000)	-1.307 ^c (0.000)	-1.094 ^c (0.000)	-1.199 ^c (0.000)				
lnexchange_rate_o_d	0.007 ^c (0.000)	-0.002 (0.407)	0.005 ^c (0.006)	-0.000 (0.907)	-0.005 ^c (0.000)	-0.002 (0.297)	-0.006 ^c (0.000)	-0.001 (0.455)
contig	0.532 ^c (0.000)	0.480 ^c (0.000)	0.479 ^c (0.000)	0.454 ^c (0.000)				
comcur	0.303 ^c (0.000)	0.101 (0.126)	0.050 (0.322)	0.062 (0.345)	0.442 ^c (0.000)	-0.019 (0.614)	0.181 ^c (0.000)	-0.021 (0.539)
rta	0.494 ^c (0.000)	0.092 ^c (0.000)	0.343 ^c (0.000)	0.219 ^c (0.000)	0.575 ^c (0.000)	0.342 ^c (0.000)	0.423 ^c (0.000)	0.357 ^c (0.000)
comlang_off	0.557 ^c (0.000)	0.658 ^c (0.000)	0.555 ^c (0.000)	0.620 ^c (0.000)				
comcol	0.359 ^c (0.000)	0.267 ^c (0.000)	0.353 ^c (0.000)	0.100 ^b (0.033)				
curcol	1.040 ^c (0.000)	1.157 ^c (0.000)	0.886 ^c (0.000)	1.645 ^c (0.000)	0.236 ^b (0.028)	0.923 ^c (0.000)	0.474 ^b (0.016)	1.382 ^c (0.000)
cursub	1.520 ^c (0.000)	0.405 (0.454)	0.822 ^c (0.001)	1.560 ^c (0.000)	1.509 ^c (0.004)	1.283 ^c (0.003)	1.057 ^c (0.000)	2.002 ^c (0.000)

comrelig	0.406 ^c (0.000)	0.390 ^c (0.000)	0.435 ^c (0.000)	0.351 ^c (0.000)			
comleg_posttrans	0.224 ^c (0.000)	0.159 ^c (0.000)	0.215 ^c (0.000)	0.208 ^c (0.000)			
Observations	317,045	271,210	218,652	218,652	317,114	271,210	218,652
R ²	0.703	0.766	0.734	0.761	0.836	0.879	0.869
Exporter and importer fixed effects	Yes	Yes	Yes	Yes	No	No	No
Country-pair fixed effects	No	No	No	No	Yes	Yes	Yes

Robust standard errors in parentheses, clustered by destination-year, with ^a, ^b, and ^c respectively denoting significance at the 1%, 5% and 10% levels. Year dummies are included in all estimations.

Exogenous Variables (table 1–3)

gdp_o	gdp origin (exporting country)
gdp_d	gdp destination (importing country)
distw	distance weighted
contig	contiguity
concur	common currency
rt	member of the same regional trade agreement
comlang_off	common official language
comcol	common colonizer post 1945
curcol	current colonial relationship
curtib	currently the same colonize
comrelig	common religion
comleg_posttrans	common legal origin
BKdDevel	banking crisis and developing countries (interaction effect)
globalgdp slowdown	global GDP slow down (when GDP grew less than 3 percent a year)

Source: [IMF DOTS; UN COMTRADE; Reinhart and Rogoff 2011; CEPII Gravity dataset (update)]; author's estimation.

Statistics Division [UN STATS].⁶ There are two final data sets used for the following estimations. One is based on the IMF DOTS trade flows and consists of 69 importing countries and 206 exporting countries from 1950 to 2009 and the second data set consists of 68 importing countries and 198 destination countries from 1962 to 2009. The lower number of importing countries for both datasets is due to the limited data of banking crises.

4. Empirical results

Estimation results, implied by equation (3) for two different data sets, are shown in Table 1. The overall fit is promising with R^2 ranging from 0.70 to 0.89. All the variables have the expected sign and plausible values. As suggested by the theory the elasticity of trade with respect to income is significant and close to unity. Column 1 and 5 display the estimation results for the full available sample of IMF DOTS bilateral export flows. The first column is estimated with exporter and importer fixed effects and column 5 is estimated with country pair fixed effects. The time invariant variables are therefore omitted in the country-pair fixed effects estimations in columns 5 to 8. Column 2 and 6 show the estimates for the full available sample for UN COMTRADE bilateral export data. Column 3, 7, 4 and 8 present the results for the sample available for both IMF DOTS and UN COMTRADE respectively. The estimated coefficient values for the same years of observation and trading partners slightly differ for IMF DOTS and UN COMTRADE bilateral export data but they correspond in sign and magnitude.

The following estimations will exploit the richness of the full samples available keeping in mind that IMF DOTS covers a longer time span – 12 years more – than the UN COMTRADE data.

Table 2 displays estimation results for equation (4). The estimated coefficient of banking crisis dummy variable is only significant for columns 5 and 6; the coefficient is negative as expected and its magnitude is in line with previous studies [Berman et al. 2012]. A dummy variable included for developing and emerging countries reveals a significant positive effect. If estimations include an interaction effect of the dummy for developing or emerging countries and financial crisis an interesting effect becomes visible. Exports involving only developed countries are more negatively affected by banking crises than exports for trading partners in developing and emerging countries.

The interaction effect of banking crisis and developing countries is statistically significant and strongly positive both for the estimations with IMF DOTS data and with UN COMTRADE data. The coefficient for banking crises when controlled for the level of economic development becomes statistically significant with a negative impact on exports between 27.1 and 41.3 per cent.

⁶ <http://unstats.un.org/unsd/methods/m49/m49regin.htm>.

When the estimations of Table 2 are replicated only for differentiated goods (results not displayed but available upon request) the negative effect of the banking crises gets even larger (32.4 compared to 27.1 per cent). International trade in differentiated goods are more vulnerable to financial frictions than homogenous goods.

When the banking crises dummy is split into two variables, a dummy for the recent crisis and a dummy for the previous banking crises, the results support the hypothesis that the effect on trade of the recent crisis was different compared to previous crises. The financial crises prior to 2008 had no statistically significant effect. For aggregated export flows a statistically significant negative effect of the recent financial crisis on exports between 25.2 and 26.8 per cent is estimated. The effect on differentiated goods of the recent financial crisis is even 10 per cent higher. When controlled for the level of economic development for the trading partner, this effect is more pronounced. For differentiated goods however both effects of the financial crises are magnified. For the previous financial crises a significant negative effect on trade of 31.3 per cent is estimated. The effect of the recent financial crisis is 47.7 per cent.

Table 3 shows the result from testing the income effect on trade during a financial crisis. We use an additional dummy variable for the income effect. The dummy variable is equal to 1 when the global GDP grew less than 3 percent in one year following the classification of a recession by the IMF.

The coefficient for the slowdown variable is significantly negative using the UN COMTRADE export aggregate and disaggregated data even when controlling GDP. Thus exporting responds more negatively than the GDP effect alone would imply. This result also holds good when including interaction effects of the level of economic development and a banking crisis. In addition to the negative effect of GDP slowdown on exports the effect of financial crisis continues to be significantly negative. This suggests that the statistically negative coefficient of a banking crisis holds beyond a recession effect. Other components of financial crises, such as the disruption of trade finance, play an independent role. Since there is no valid data available on international trade finance the specific factors other than GDP slowdown remain elusive.

The strong negative effect of the recent financial crisis and the higher volatility of trade for developed countries, generally trading more differentiated goods, can be interpreted as a support of the sector compositional hypothesis (Hypothesis H₃). Differentiated goods are more demanding in terms of finance structures making them particularly vulnerable to a financial crisis. This observation brings to mind that a crisis might affect exports within global supply chains or with vertical linkages in a more severe way than other commodities. The increased elasticity of international trade flows due to vertical linkages and therefore higher share of traded differentiated goods offers an explanation as to why international trade declined in response to a financial crisis. However, a gravity model capturing vertical linkages and the increased vulnerability of

Table 2. The effect of banking crises on export flows

	IMF DOTS	UN COM- TRADE	IMF DOTS	UN COM- TRADE	IMF DOTS	UN COM- TRADE	IMF DOTS	UN COM- TRADE	IMF DOTS	UN COM- TRADE	IMF DOTS	UN COM- TRADE
lngdp_o	0.923 ^c (0.000)	0.856 ^c (0.000)	0.907 ^c (0.000)	0.844 ^c (0.000)	0.905 ^c (0.000)	0.844 ^c (0.000)	0.852 ^c (0.000)	0.844 ^c (0.000)	0.852 ^c (0.000)	0.844 ^c (0.000)	0.852 ^c (0.000)	0.844 ^c (0.000)
lngdp_d	0.816 ^c (0.000)	0.837 ^c (0.000)	0.815 ^c (0.000)	0.841 ^c (0.000)	0.809 ^c (0.000)	0.840 ^c (0.000)	0.777 ^c (0.000)	0.780 ^c (0.000)	0.777 ^c (0.000)	0.780 ^c (0.000)	0.777 ^c (0.000)	0.780 ^c (0.000)
lndistw	-1.046 ^c (0.000)	-1.307 ^c (0.000)	-1.148 ^c (0.000)	-1.410 ^c (0.000)	-1.163 ^c (0.000)	-1.414 ^c (0.000)	-0.005 ^c (0.000)	-0.002 (0.297)	-0.005 ^c (0.000)	-0.002 (0.297)	-0.005 ^c (0.000)	-0.002 (0.297)
lnexchange_ rate_o_d	0.007 ^c (0.000)	-0.002 (0.406)	0.005 ^c (0.003)	-0.003 (0.170)	0.005 ^c (0.003)	-0.003 (0.166)	-0.005 ^c (0.000)	-0.002 (0.297)	-0.005 ^c (0.000)	-0.002 (0.297)	-0.005 ^c (0.000)	-0.002 (0.297)
contig	0.532 ^c (0.000)	0.480 ^c (0.000)	0.495 ^c (0.000)	0.435 ^c (0.000)	0.474 ^c (0.000)	0.428 ^c (0.000)	0.442 ^c (0.000)	0.442 ^c (0.000)	0.442 ^c (0.000)	0.442 ^c (0.000)	0.442 ^c (0.000)	0.442 ^c (0.000)
comcur	0.303 ^c (0.000)	0.101 (0.126)	0.347 ^c (0.000)	0.180 ^c (0.002)	0.373 ^c (0.000)	0.195 ^c (0.001)	0.373 ^c (0.000)	-0.019 (0.614)	0.442 ^c (0.000)	-0.019 (0.614)	0.441 ^c (0.000)	-0.019 (0.613)
rta	0.494 ^c (0.000)	0.092 ^c (0.658)	0.639 ^c (0.000)	0.289 ^c (0.000)	0.667 ^c (0.000)	0.305 ^c (0.000)	0.575 ^c (0.000)	0.342 ^c (0.000)	0.575 ^c (0.000)	0.342 ^c (0.000)	0.575 ^c (0.000)	0.342 ^c (0.000)
comlang_off	0.556 ^c (0.000)	0.658 ^c (0.000)	0.519 ^c (0.000)	0.611 ^c (0.000)	0.511 ^c (0.000)	0.608 ^c (0.000)	0.511 ^c (0.000)	0.608 ^c (0.000)	0.511 ^c (0.000)	0.608 ^c (0.000)	0.511 ^c (0.000)	0.608 ^c (0.000)
comcol	0.359 ^c (0.000)	0.267 ^c (0.000)	0.470 ^c (0.000)	0.390 ^c (0.000)	0.472 ^c (0.000)	0.391 ^c (0.000)	0.472 ^c (0.000)	0.391 ^c (0.000)	0.472 ^c (0.000)	0.391 ^c (0.000)	0.472 ^c (0.000)	0.391 ^c (0.000)
curcol	1.040 ^c (0.000)	1.157 ^c (0.000)	1.034 ^c (0.000)	1.141 ^c (0.000)	1.057 ^c (0.000)	1.151 ^c (0.000)	1.057 ^c (0.000)	0.923 ^c (0.000)	1.057 ^c (0.000)	0.923 ^c (0.000)	1.057 ^c (0.000)	0.923 ^c (0.000)

cursib	1.520 ^c (0.000)	0.405 (0.453)	1.564 ^c (0.000)	0.411 (0.467)	1.569 ^c (0.000)	0.413 (0.464)	1.509 ^c (0.004)	1.283 ^c (0.003)	1.509 ^c (0.004)	1.283 ^c (0.003)	1.509 ^c (0.004)	1.283 ^c (0.003)
comrelig	0.406 ^c (0.000)	0.390 ^c (0.000)	0.477 ^c (0.000)	0.460 ^c (0.000)	0.476 ^c (0.000)	0.459 ^c (0.000)						
comleg_post-trans	0.224 ^c (0.000)	0.159 ^c (0.000)	0.227 ^c (0.000)	0.168 ^c (0.000)	0.220 ^c (0.000)	0.165 ^c (0.000)						
banking_crisis_d	-0.026 (0.728)	-0.098 (0.111)	-0.030 (0.686)	-0.094 (0.129)	-0.532 ^c (0.000)	-0.316 ^c (0.000)	-0.010 (0.851)	-0.013 (0.776)	-0.010 (0.851)	-0.013 (0.776)	-0.085 (0.132)	-0.035 (0.533)
developing-countries			1.049 ^c (0.000)	1.169 ^c (0.000)	0.704 ^c (0.000)	1.021 ^c (0.000)						
BKdDevel					0.621 ^c (0.000)	0.274 ^c (0.000)			0.092 (0.275)		0.092 (0.275)	0.027 (0.722)
Observations	317,045	271,210	317,045	271,210	317,045	271,210	317,114	271,210	317,114	271,210	317,114	271,210
R ²	0.703	0.766	0.707	0.771	0.707	0.771	0.836	0.879	0.836	0.879	0.836	0.879
Exporter and importer fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Country-pair fixed effects	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses, clustered by destination-year, with ^a, ^b, and ^c respectively denoting significance at the 1%, 5% and 10% levels. Year dummies are included in all estimations.

Source: [IMF DOTS; UN COMTRADE; Reinhart and Rogoff 2011; CEPII Gravity dataset (update)]; author's estimation.

Table 3. Banking crises, GDP slowdown and level of economic development

	IMF DOTS		UN COMTRADE		UN COMTRADE differentiated goods	
	lngdp_o	0.906 ^c (0.000)	0.904 ^c (0.000)	0.844 ^c (0.000)	0.844 ^c (0.000)	0.994 ^c (0.000)
lngdp_d	0.815 ^c (0.000)	0.809 ^c (0.000)	0.841 ^c (0.000)	0.840 ^c (0.000)	0.950 ^c (0.000)	0.949 ^c (0.000)
lndistw	-1.150 ^c (0.000)	-1.164 ^c (0.000)	-1.410 ^c (0.000)	-1.414 ^c (0.000)	-1.537 ^c (0.000)	-1.543 ^c (0.000)
lnexchange_rate_o_d	0.005 ^c (0.003)	0.005 ^c (0.004)	-0.003 (0.170)	-0.003 (0.166)	-0.013 ^c (0.000)	-0.013 ^c (0.000)
contig	0.501 ^c (0.000)	0.481 ^c (0.000)	0.435 ^c (0.000)	0.428 ^c (0.000)	0.485 ^c (0.000)	0.475 ^c (0.000)
comcur	0.342 ^c (0.000)	0.368 ^c (0.000)	0.180 ^c (0.002)	0.195 ^c (0.001)	0.312 ^c (0.000)	0.336 ^c (0.000)
rta	0.635 ^c (0.000)	0.663 ^c (0.000)	0.289 ^c (0.000)	0.305 ^c (0.000)	0.259 ^c (0.000)	0.283 ^c (0.000)
comlang_off	0.519 ^c (0.000)	0.511 ^c (0.000)	0.611 ^c (0.000)	0.608 ^c (0.000)	0.704 ^c (0.000)	0.699 ^c (0.000)
comcol	0.469 ^c (0.000)	0.471 ^c (0.000)	0.390 ^c (0.000)	0.391 ^c (0.000)	0.485 ^c (0.000)	0.486 ^c (0.000)
curcol	1.034 ^c (0.000)	1.057 ^c (0.000)	1.141 ^c (0.000)	1.151 ^c (0.000)	1.227 ^c (0.000)	1.242 ^c (0.000)
cursib	1.565 ^c (0.000)	1.569 ^c (0.000)	0.411 (0.467)	0.413 (0.464)	-0.070 (0.920)	-0.067 (0.923)
comrelig	0.478 ^c (0.000)	0.477 ^c (0.000)	0.460 ^c (0.000)	0.459 ^c (0.000)	0.538 ^c (0.000)	0.537 ^c (0.000)
comleg_posttrans	0.228 ^c (0.000)	0.221 ^c (0.000)	0.168 ^c (0.000)	0.165 ^c (0.000)	0.165 ^c (0.000)	0.161 ^c (0.000)
banking_crisis_d	-0.031 (0.669)	-0.534 ^c (0.000)	-0.094 (0.129)	-0.316 ^c (0.000)	-0.051 (0.436)	-0.391 ^c (0.000)
globalgdpslowdownd	-0.121 (0.195)	-0.122 (0.192)	-1.874 ^c (0.000)	-1.871 ^c (0.000)	-2.148 ^c (0.000)	-2.144 ^c (0.000)
developingcountries	1.046 ^c (0.000)	0.702 ^c (0.000)	1.169 ^c (0.000)	1.021 ^c (0.000)	0.766 ^c (0.000)	0.539 ^c (0.000)
BKdDevel		0.620 ^c (0.000)		0.274 ^c (0.000)		0.419 ^c (0.000)
Observations	315,890	315,890	271,210	271,210	271,210	271,210
R ²	0.707	0.707	0.771	0.771	0.798	0.798

Standard errors in parentheses, clustered by destination-year, with ^a, ^b, and ^c respectively denoting significance at the 1%, 5% and 10% levels. Year dummies are included in all estimations.

Source: [IMF DOTS; UN COMTRADE; Reinhart and Rogoff 2011; CEPII Gravity dataset (update)]; author's estimation.

international trade remains to be thoroughly developed theoretically and empirically tested.

Conclusions

What happened during the crisis that led international trade to nearly collapse? Global trade decreased around 29 percent during the global recession of 2008–2009. The gravity model is one specific valuable economic instrument for studying and measuring the effect of financial crises on international trade. The gravity approach is helpful in addressing differences in country specific trade relations and the effect of financial crises over time. One of our results in the study is that developed countries seem to be effected more by financial crises than developing and emerging economies. The higher share of differentiated goods in exports traded by developed countries seems to be one reason for this phenomenon. The trade in differentiated goods suffered more during the financial crisis 2008–2009 with a statistical and economic significance of over 17 percent compared with aggregated international trade flows. Differentiated tradable goods are particularly vulnerable to financial crises because of their complex pre-finance structures.

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Aims and Scope

Economics and Business Review is the successor to the Poznań University of Economics Review which was published by the Poznań University of Economics Press in 2001–2014. The Economics and Business Review is a quarterly journal focusing on theoretical and applied research work in the fields of economics, management and finance. The Review welcomes the submission of articles for publication dealing with micro, mezzo and macro issues. All texts are double-blind assessed by independent reviewers prior to acceptance.

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