Essays on International Trade and Finance: An Empirical Assessment of Food Safety and Banking Crises

by

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Abstract

This dissertation is composed of three chapters examining how food policy and bilateral tariff affect international trade, and how 2007-2008 global banking crises influence MFIs performance. Chapter 1 explores the impact of Hazard Analysis Critical Control Point (HACCP) implementation on U.S. seafood imports. I offer a novel method to evaluate the impact of trade policies within the gravity model and event-specific changes. I build a panel database of seafood imports affected by HACCP as well as data for food imports unaffected by HACCP between the U.S., the European Union's (EU) 15 countries and 217 partner countries from 1988 to 2006. I employ a causal framework of analysis, define a “treatment group” of seafood imports to the U.S. and use two alternative control groups. The first control group consists of comparable non-seafood U.S. imports, not subject to HACCP, while the second control group contains EU seafood imports for the period for which seafood imports to the EU were not subject to such regulation. Using the gravity model framework, we study how HACCP implementation in the U.S. influences the intensive and extensive margins of U.S. seafood imports and compare results from previously used truncated OLS to our preferred specifications. Contrary to previous work, we find that HAACP implementation has no effect on the volume of U.S. seafood imports, while the estimates of the other key variables are consistent across the models and similar to previous work. Thus, we demonstrate that a causal approach to evaluating trade policy within the gravity model and event-specific policy changes could lead to better policy insights. Chapter 2 focuses on the identifying what factors determine blue and green virtual water trade (VWT) across

nations and tests whether the policy relevance of virtual water can be enhanced by considering the bilateral tariff, as well as whether virtual water has an endowment effect. To achieve this goal, I build a panel database on blue and green virtual water trade among paired trading countries from 1998 to 2002. Using an Anderson-van Wincoop (AvW) gravity model with fixed effects and estimating the Poisson Pseudo-Maximum Likelihood (PPML) specifications, I evaluate how the bilateral tariff affects the intensity of blue and green VWT. Results show that there are no obvious different effects between determinants of blue and green virtual water import, while there are differential effects among the determinants of VWT of 19 crops. Tariff has a negative effect on the blue and green virtual water import for more water intensive crops. Chapter 3 study how the spread of the financial troubles resulting from the 2007-2008 crisis affected these MFIs institutions' ability to achieve their double bottom line to remain financially sustainable and to reach as many marginalized clients as possible. Our data consist of 2,611 MFIs from 118 countries and is for the 1999-2011 period. We employ the fixed and random effect model with Difference in Difference (DID) specification and control for country and organization-specific characteristics. Results show that the global financial crisis had a negative impact on the ability of MFIs to serve many clients (measured by the number of active borrowers). However, it did not affect financial sustainability (measured by return on assets) or depth of the outreach (measured by average loan balance per borrower over GNI per capita). This suggests that MFIs have dealt with the crises just like banks, namely restricting credit and serving fewer presumably larger borrowers, and global financial crisis has no effect on the poverty level, since MFI is more likely to hold back more reserve to reduce the risk. The impact of a banking crisis itself could

affect MFI performance negatively, and these crises have been more devastating post the 2008 global financial crisis in term of breadth of outreach.

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List of Abbreviations

HACCP	Hazard Analysis and Critical Control Point
U.S.	United States
EU	European Union
MFIs	Microfinance Institutions
VWT	Virtual Water Trade

Chapter 1. The Impact of HACCP Implementation on U.S. Seafood Imports

1.1 Introduction

Seafood products are one of the most highly traded commodities in the world and more than half originate from developing counties (USGAO 2017), safety and nutrition linked to seafood consumption has become an increasing concern all over the world (Roosen et al. 2009). In 2011, Americans consumed nearly 5 billion pounds of seafood per year, or approximately 15 pounds of fish and shellfish per person (both wild-caught and farmed), which makes the United States second only to China in seafood consumption and second to EU in seafood imports. Of all the seafood consumed here in the United States, 91 percent are imported from countries with lax regulations like China, India and Vietnam, and only remaining 9 percent produced domestically, (NOAA 20121; USGAO 2017). U.S. seafood safety concerns such as unsafe drug residues, such as the Chinese shrimp with malakit green or deadly mussels have led to the development of Hazard Analysis and Critical Control Point (HACCP) regulations (USGAO, 2017). Over half the salmon sold globally are farm-raised salmon, with concentrations of dioxins, polychlorinated biphenyls (PCB), polybrominated diphenyl ethers (PBDEs), toxaphene and some pesticides significantly higher in farm raised Atlantic salmon than in wild Pacific salmon (Foran et al. 2005, Leiss and Nicol 2006). Methyl mercury, an organic form of mercury, is a another dangerous toxic compound that alters fetal brain development when there is significant prenatal exposure (Roosen et al. 2009).In addition, malachite green and furazolidone are potential carcinogenic and mutagenic agents, while residual enrofloxacin may lead to the development of drug resistant bacteria. The use of enrofloxacin, furazolidone and malachite green in aquaculture have been banned in many countries, but they are still be used by many countries due to the low cost and

[1] http://www.nmfs.noaa.gov/aquaculture/archive/09_13_12_top_seafood_consumed.html

high effectiveness of these drugs (Zhang et al. 2012). To ensure the safety of imported seafood, the Food and Drug Administration (FDA) requires processors and importers to follow its Hazard Analysis and Critical Control Point (HACCP) regulations. In addition, the U.S. Department of Agriculture's (USDA) and Food Safety and Inspection Service (FSIS) offered to importers a transition period from March 1, 2016 to September 1, 2017 (USGAO 2017). Recently in the U.S., President Obama signed the Food Safety Modernization Act (FSMA) into law on January 4, 2011 to ensure the food safety from the supply side (FDA 2016). Prior to its enactment, the U.S. implemented the hazard analysis critical control points system (HACCP) on December 18, 1997 (FDA 1995) for seafood products. In spite of the importance of the seafood industry and the implementation of HACCP two decades ago, there is little research assessing this policy and evidence on its impacts on trade is contradictory, limiting our understanding of the expected outcomes of similar food safety regulations on international trade. We offer new causal analysis of HACCP's impact and find that its implementation has not limited trade for either developed or developing countries.

Unlike other food safety policies that focus on a product, HACCP is a preventive approach to control each stage of the food chain, from the prime production, processing, and storage, to marketing and consumption. HACCP has been considered an effective alternative to the conventional end-point-testing (FAO/WHO 1984 and Bryan 1992) and recommended for commercial use (Roberts, Buzby and Ollinger 1996). After the implementation of HACCP in the United States in 1997 for seafood products, the European Union established HACCP with EC 852/2004 the European Food Hygiene Regulations in 2006 (European Commission, 2004); this fact is used to develop our causal framework for analysis. While many developed countries have adopted HACCP procedures, such procedures are also becoming increasingly popular in many

developing or emerging countries and target a variety of industries (e.g. Ecuador, Malaysia, Philippines, South Africa, Thailand, Brazil, Egypt, and Taiwan as reported by Caswell and Hooker 1996; Li, Saghaian and Reed 2013; and Ropkins and Beck 2000). Therefore, a proper evaluation of its impact is useful not only for evaluating similar policy changes in the U.S. but also potential policy changes that other countries may be considering.

The aim of HACCP is to improve food safety and facilitate trade flows (Caswell and Hooker 1996; Unnevehr and Jensen 1996; Unnevehr and Jensen 1999). While the measurement of public health outcomes from the food safety regulations remains daunting (Roberts, Buzby, and Ollinger 1996; Khatri and Collins 2007), scholars have tried to evaluate the effectiveness of HACCP by quantifying the effect of HACCP in trade flows. HACCP may have two contradictory effects on trade. On the one hand, HACCP could increase the compliance cost for the producers and decrease trade volume. On the other hand, HACCP could aid inspection by food control regulation and increase consumers' confidence in the food safety, thus enhancing trade volume (FAO 2015). Empirical evidence thus far shows mixed effects on U.S. seafood trade flows. For example, Anders and Caswell (2009) find that HACCP acts as a catalyst in seafood exporters from developed countries and as a barrier in seafood exporters from developing countries. Liu and Yue (2012) argue that HACCP results in an increase in consumer surplus, while a decrease in producer surplus with a net welfare increase. Li, Saghaian, and Reed (2012) find evidence that HACCP implementation has a positive effect on the U.S. mollusk exports, but an insignificant effect on U.S seafood exports of non-mollusks fish products and shellfish products. However, in relevant studies, researchers use a single dummy variable of HACCP implementation in the gravity model, which does not address the causal effect of

HACCP. In this paper, we identify the causal effects of HACCP with a difference-in-difference (DID) strategy.

Tello (2015) uses the standard gravity model with a DID specification to analyze how EU enlargement affects the intensity and direction of new EU countries' (EU 10) trade flows. Uchida, Roheim and Johnston (2017) conduct an auction experiment to investigate how health risk and benefit information affect individuals' preference for wild and farmed salmon, and swordfish. Random experimental trials are conducted with well defined treatment (FDA/EPA, Industry, University, NAS, Combined FDA/EPA and industry information) and control groups (No information mentioned above). Difference-in-difference test show that health benefit information has no impact regardless of source or message, but health benefit information have multiple effect on seafood demand across different types of guidance, and current guidance cannot help consumer to balance the health risks and benefits. The DID methodology is commonly used to compare the performances of the treatment group relative to those of the control group between pre- and post-treatment. This paper is the first to estimate the marginal effects of HACCP implementation using DID gravity model. The specific objectives are to (1) determine the effect of HACCP implementation using a difference-in-difference (DID) and difference-in-difference-in-difference (DIDID) model based on gravity specifications, and (2) estimate the change in U.S. seafood import intensity and extensive effects after the implementation of HACCP (intensive and extensive marginal effects). In a supplementary analysis, we examine whether the impact of HACCP enforcement is affected by development status by estimating our models separately by developing countries and developed countries.

The rest of the paper is organized as follows. Part 2 summarizes the relevant literature and part 3 describes the data. Part 4 is the model specification. Part 5 discusses the findings, and part 6 offers conclusions.

1.2 Literature Review

The majority of the studies using the gravity model to study HACCP focuses on the demand-oriented trade flows, such as imports to the U.S from other developed and developing countries, and less of the research is concerned with the supply side (Anders Caswell 2009; Baylis Nogueira and Pace 2010, Li Saghaian Reed 2012; 2013). One example is Anders and Caswell (2009) who find that that HACCP principles act as catalysts among developed seafood exporters and barriers for developing seafood exporters.

The traditional trade literature suggests that technical measures for food quality and safety are trade-impeding (Henson and Loader 2001; Didsier and Marette 2010; Otsuki,Wison and Sewadeh 2001; Disdier, Fontagne and Mimouni 2008; Winchester et al. 2012). Wilson and Otsuki (2004) study the impact of food regulation stringency and find a negative effect of pesticide chlorpyrifos notified by the Organisation for Economic Co-operation and Development (OECD) countries on banana exports, while Otsuki, Wilson, and Sewadeh (2001) study how stringency in peanut production (maximum residue limit or MRL) affect cereal export in African countries. Along these lines of work, Xiong and Beghin (2011) did not find evidence that EU maximum MRL decreased market access for African exporters, or affected the intensive margin to trade. Further, Colen, Maertens, and Swinnen (2012), Shepherd and Wilson (2013), Wilson (2017), and Swinnen, et al (2015) suggest that standards do not have a consistently negative effect on trade and potentially have enhanced trade. In this vein, the previous literature shows mixed effects of regulations of food safety.

The literature on the impact of HACCP is also mixed. Liu and Yue (2012) find that the implementation of HACCP has a significantly positive effect on the consumer confidence in imported not-from-concentrate orange juice (OJ). HACCP increased the elasticity of substitution between imported and domestic OJ products, not intra-EU imported OJ and extra-EU imported OJ. The EU HACCP standard did not increase the cost and the domestic supply elasticity. The implementation of HACCP resulted in an increase in consumer surplus, a decrease in producer surplus, and a net welfare increase.

Li, Saghaian and Reed (2013) evaluate the effects of HACCP implementation from the supply side. They use the Poisson pseudo-maximum likelihood (PPML) method with fixed effects to investigate the impact of HACCP implementation on U.S fish, mollusk, and shellfish other than mollusks export markets. Li, Saghaian and Reed (2012) estimate the export impact of of HACCP implementation in importing countries. The main similarity between these papers is that they use the gravity model and the dummy variable to capture the impact of HACCP on trade flows (Li, Saghaian and Reed 2012; 2013; Anders Caswell 2009). However, their approach fails to address the causal effect of HACCP, while our work is able to estimate a causal link.

Three issues must be addressed when estimating the gravity model given an event like implementation of HACCP. First, the theory underlying the gravity model requires controlling for the barriers that a country faces relative to the all other countries. Omitting multilateral resistance terms (MRTs), which address the relative effects, can bias the estimates of the gravity model (Anderson and van Wincoop 2003; Xiong and Beghin 2011). Fixed effects (approximated with country and time dummy variables) remove the influence of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable. Second, Silva and Tenreyro (2006) find that when we have zero trade values, the log-linearized OLS

model is biased in the presence of heteroskadasticity because of Jensen's inequality. They suggest instead a PPML model, as it provides robust results to different patterns of heteroscedasticity. Third, the selection bias of the treatment effect of HACCP results from non-natural experimental data. In such cases, the difference-in-difference (DID) strategy is appropriate to evaluate the causal impact of the implementation of a policy on the target group in general economics literature. In the international trade literature, DID applications are only emerging. For example, Tello (2015) uses the standard gravity model with a DID specification to analyze the impact of European Union (EU) integration on the intensity and direction of the new EU -10's trade flows. The DID methodology is commonly used to compare the performances of the treatment group relative to those of the control group between pre- and post-treatment.

1.2 The Data

We build a panel database of seafood imports affected by HACCP as well as data for food imports unaffected by HACCP between U.S., EU-15 counties, and 217 partner countries from 1988 to 2006. We use data on U.S. seafood imports (03), other non-HACCP U.S. edible imports (6 & 9-18), and EU-15 (3, 6 &9-18) imports[2] from 217 countries. The seafood and non-HACCP import data from the United Nations Commodity Trade Statistics Database (UN COMTRADE) span 1988-2006, which include the pre-HACCP period 1988-1997 and the post-HACCP period 1998-2006. The reason for cutting of the data at 2006 is that EU-15 as a control group established HACCP in 2006. The typical gravity variables, such as Distance_{ij}, Contiguous_{ij}, Colony_{ij}, $\text{Common Language}_{ij}$, Area_{ij}, RTA, NAFATA and EU are from CEPII, Eurostat, the Office of the U.S. Trade Representative, and World Bank Development Indicator. Other policy shock may have affect seafood trade flows coming into U.S. A case in point relating with this

[2] The EU-15 countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

topic is mandatory Country of Origin Labeling (COOL). Table 1.1 presents the definitions for the dependent variable and independent variables used in the following estimations.

Table 1.1 goes about here

Figures 1.1 and 1.2 go about here

In Table 1.2, we present outcome means by U.S. HACCP implementation status (U.S. seafood or not) and between pre- and post-1998 periods in U.S. As shown in the table, the average imports among seafood appear to be more than those of non-seafood commodities[3]. Moreover, this pattern appears to hold for both the pre-1998 and post-1998 periods. What is more interesting in Table 1.2 is the information revealed by a comparison between Columns 3 and 6, which gives us a sense of the differences in outcome between treatment group (U.S. seafood) and control group (U.S. non-seafood or EU seafood) from pre- to post-HACCP periods. As shown in column 7, the raw difference-in-difference measure ($\Delta_1 - \Delta_2$) is positive and statistically significant for the U.S. seafood imports relative to U.S. non-seafood commodities, which imply that U.S. consumers prefer seafood to other edible non-seafood commodities and switch to seafood commodities from non-seafood after U.S. HACCP implementation. This might explain that consumers have more confidence at food safety of seafood due to HACCP implementation. Meanwhile, the raw difference-in-difference ($\Delta_1 - \Delta_3$) is not statistically significant for the U.S. seafood imports relative to EU seafood imports, implying that U.S. consumers have no preference between U.S. seafood and EU seafood, and did not switch from the former to the latter after U.S. HACCP implementation.

[3] Non-seafood commodities are plants (06), coffee (09), cereals (10), milling products (11), oil seed (12), lac (13), vegetable plaiting materials (14), animal (15), meat food preparations (16), sugars (17), and cocoa (18). The two digit edible products under mandatory and voluntary HACCP procedures have been excluded, such as meat & poultry, juicy, and dairy.

In addition to the descriptive evidence presented in Table 1.2, we further enhanced our analysis with a set of visual exercises, in which we illustrate the trends in our outcome over time separately for the treatment and control groups. In Figure 1.1 and 1.2, we display the evolutions of the intensity of U.S. and EU-15's imports separately by periods leading up to and following 1998. In Figure 1.1, we displayed smoothed annually totals of U.S. seafood and non-seafood imports from other counties separately by periods before and after 1998. As shown in Figure 1.1, the U.S. imports increase over our sample time period, and the divergence between U.S. seafood imports and non-seafood imports becomes larger after U.S. HACCP enforcement in 1998. Similar patterns are observed for U.S. different non-seafood commodities, most notably coffee, cereals, milling products, oil seeds, lac, and vegetable painting materials, and to a lesser extent for preparations of meat, animal or vegetable fats, sugars and cocoa. As shown in Figure 1.2, similar patterns are observed for different EU countries seafood imports, only a less extent for France, Italy, Spain, Sweden and United Kingdom, and more notably for other EU countries, such as Austria, Belgium, Denmark, Finland, Germany, Greece, Ireland, Luxembourg, Netherlands, and Portugal. Both Figures 1 and 2 show no overlap of trend between treatment and control groups before 1998, and indicate a clear increase in the U.S. seafood imports relative to U.S. non-seafood or EU seafood imports. While the statistics in Table 1.2 along with the patterns presented in Figures 1.1 and 1.2 might be indicative of a causal relationship between the U.S. seafood imports and the HACCP implementation. We next turn to the description of our formal empirical DID strategy that essentially adjusted the raw difference-in-difference estimates by taking consideration of any permanent and time-variant difference in multivariate regression framework. This paper calls into question the effect of HACCP implementation on U.S. seafood imports.

1.4 Model Specifications

We employ a causal framework of analysis and define a "treatment group" of seafood imports to the US and use two alternative control groups. The first control group consists of comparable non-seafood US imports, not subject to HACCP, while the second control group contains EU seafood imports for the period for which seafood imports to the EU were not subject to such regulation. Within the gravity model framework, we study how HACCP implementation in U.S. influences the intensive and extensive margins of U.S. seafood imports.

We start by using a baseline application of the existing approach, namely using a single dummy variable of HACCP implementation in the gravity model, following Anders and Caswell (2009) and Li, Saghaian and Reed (2012 & 2013). However, the effect of HACCP may vary across time, other unobservable factors such as international shocks or economic recessions during the same period may affect U.S. seafood imports. Therefore, the causal effect of HACCP enforcement on U.S. seafood imports must be derived from the counterfactual, which cannot be observed. However, a DID strategy can be used to estimate the causal effect of a treatment on an outcome using non-experimental data. Therefore, we use a DID strategy to evaluate the impact of HACCP implementation and enforcement on U.S. imports of seafood. We define as "treatment group" all food imports classified as seafood and use two different control groups to identify the pure regulation impact. The first control group contains other non-HACCP commodities, and the second control group is EU-15 seafood for the period of the study. We also use DIDID for a robustness check. Finally, within the DID strategy we test for differential effects between the developing and developed countries. We group our analysis into three categories—effects based on U.S non-HACCP commodities as the control, effects based in EU-15 seafood as the control, and analysis segregated by developing and developed country effects. Poisson family

regressions and Heckman specification have been very commonly used in the empirical analysis of the gravity model and it is therefore important to ensure that results using OLS are robust to their application (Grant and Boys 2012; Disdier, Fontagné, and Mimouni 2008; Tran, Wilson, and Anders 2011; Xiong and Beghin 2011). However, DID is not straightforward or changing interpretation of interaction terms for non-linear models, and difficult to implement (Blundell, and Dias 2009); the linear model is always used to help with interpretability of DID strategy. Therefore the nonlinear Poisson family models will not be employed in this paper, and we only include DID in OLS and Heckman selection models.

1.4.1 Simple dummy for HACCP implementation

Firstly, following Anders and Caswell (2009) and Li, Saghaian and Reed (2012 & 2013), a simple dummy $\mathrm{D_{HACCP\ Time}}$ reflects the implementation and enforcement of HACCP requirements in Model 1a.

1.4.1.1. The "Anders and Caswell model" with single dummy - U.S. as the importer only

$$\ln(\mathrm{Import_{ijt}}) = \alpha_0 + \alpha_\mathrm{j} + \alpha_\mathrm{t} + \beta_1 \mathrm{D_{HACCP}} + \sum_{\mathrm{i}=2}^{13} \gamma_\mathrm{i} \mathrm{X_{ij}} + \delta_1 D_{COOLi} + \theta_1 D_{development\ status j} + \varepsilon_\mathrm{jt} \quad (1a)$$

where $\mathrm{Import_{ijt}}$ denotes U.S. seafood imports. X_{ij} includes control variables ($\mathrm{GDP_{it}}$, $\mathrm{GDP_{jt}}$, $\mathrm{Distance_{ij}}$, $\mathrm{contiguity_{ij}}$, $\mathrm{Common\ Lanaguage_{ij}}$, $\mathrm{Colony45_{ij}}$, $\mathrm{Colony_{ij}}$, $\mathrm{Current\ Colony_{ij}}$, $\mathrm{Common\ Currency_{ij}}$, $\mathrm{Area_i * Area_j}$, $\mathrm{Regional\ Trade\ Agreement_{ij}}$, $\mathrm{EU_{ij}}$, $\mathrm{NAFTA_{ij}}$); α_j, and α_t are fixed effects of exporter country and year. $D_{HACCP\ Time}$ is equal to 0 if U.S. seafood imports are from 1988 to 1997 (pre-HACCP) and 1 from 1998 to 2006 (post-HACCP).

$D_{development\ status j}$ is equal to 1 if the partner country is from developed countries[4], and 0 from developed counties.

1.4.1.2. Random Effect Gravity Model with Single Dummy - U.S. and EU-15 as importers

Since U.S. is the only importer with multiple exporters in Equation 1a, we include the EU-15 countries in Equation 1b to represent multiple importers and exporters, a structure more commonly found in the estimation of the gravity model,

$$\ln(\mathrm{Import}_{ijt}) = \alpha_0 + \alpha_i + \alpha_j + \alpha_t + \beta_1 \mathrm{D}_{\mathrm{U.S.}} * \mathrm{D}_{\mathrm{HACCP}} + \sum_{i=2}^{13} \gamma_i X_{ij} + \delta_1 \mathrm{D}_{\mathrm{U.S.}} * D_{COOLi} + \theta_1 \mathrm{D}_{\mathrm{U.S.}} * D_{development\ status j} + \varepsilon_{jt} \quad (1b)$$

where Import_{ijt} denotes seafood imports of U.S. and EU-15 countries, $\mathrm{D}_{\mathrm{HACCP\ Country}} * \mathrm{D}_{\mathrm{HACCP\ Time}}$ is equal to 1 if the seafood are imported to U.S after 1998, 0 otherwise. Importer's fixed effect is α_i. Other variables have the same definitions with them as in Equation 1a.

1.4.1.3. The PPML Model with Single Dummy - U.S. and EU-15 as importers

To address the potential heteroscedasticity and the presence of zero trade value, the PPML model with fixed effects will been applied in Equation 1c. All of variables in Equation 1c are the same as in Equation 1b.

[4] "Developing economies" were divided into low income and middle income from World Development report, thus low, low-middle, and upper-middle are categorized into developing countries, and high income counties into developed countries this paper.

$$E\left(\text{Import}_{ijt} \mid X_{ij}, D_{\text{HACCP Country}} * D_{\text{HACCP Time}}\right) = \exp(\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \beta_1 D_{\text{HACCP Country}} * D_{\text{HACCP Time}} + \delta_1 D_{\text{U.S.}} * D_{COOLi} + \theta_1 D_{\text{U.S.}} * D_{development\ status j} + \sum_{i=2}^{13} \gamma_i X_{ij}) \quad (1c)$$

1.4.2 DID strategy - U.S. non-HACCP commodities as the control

Tello (2015) employs a DID strategy into the standard gravity model to estimate how EU enlargement affects the intensity and direction of EU-10 trade flows, by determining whether trade flows change before and after EU enlargement by comparing EU-10 (the target group) and the rest of world (the control group). Following Tello (2015), we apply the gravity model with a DID specification into our analysis and choose U.S. imports of non-HACCP commodities as the control group, to estimate the causal effect of HACCP implementation. We assume that the treatment (U.S. seafood) and control (other non-HACCP commodities) groups have the same trend in the outcome in the pre- and post-HACCP periods to control for the changes caused by existing differences between the two groups. Thus, the DID model allows us to compare U.S seafood imports (the treatment group) under pre- and post-HACCP implementation with other non-HACCP imports (the control groups) during the same period, and the unobservable time-invariant factors affecting U.S. seafood imports have been considered. The graphical explanation of DID specification (Figure A1) shows, our treated group is the U.S. seafood imports, and our control group is U.S imports of non-HACCP commodities (6 & 9-18).

We apply the DID approach to a model influenced by the theoretical gravity model (Anderson and van Wincoop 2003; Grant and Anders 2011; Grant and Boys 2012; Disdier and Marette 2010; Tran, Wilson and Anders 2011). Since this paper employs panel data, a test to

determine the fixed effect model or the random effect specification is appropriate. The gravity model has time-invariant variables, such as distance, common language, common border, colonial relationship, regional trade agreement, and so on. The fixed–effect specification cannot estimate the effects of the time-invariant variables, thus random effects with DID specification and diff package[5] will be employed.

1.4.2.1 DID Gravity Model with country and time dummies and US imports

$$\begin{aligned}\ln(\mathrm{Import}_{ijt}) = {} & \alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \beta_1 \mathrm{D}_{\mathrm{HACCP}} + \beta_2 \mathrm{D}_{\mathrm{Seafood}} \\ & + \beta_3 \mathrm{D}_{\mathrm{HACCP}} * \mathrm{D}_{\mathrm{Seafood}} + \delta_1 \mathrm{D}_{\mathrm{Seafood}} * D_{COOLi} + \theta_1 D_{development\ status j} \\ & + \theta_2 \mathrm{D}_{\mathrm{Seafood}} * D_{development\ status j} + \sum_{i=1}^{13} \gamma_i X_{ij} + \varepsilon_{ijt}\end{aligned} \tag{2}$$

where the variables have the same definitions as in Model 1. $D_{HACCP\ Commodity}$ is equal to 1 for U.S. seafood imports, 0 for U.S. imports of other commodities. The coefficient (β_3) of $D_{HACCP\ Commodity} * \mathrm{D}_{\mathrm{HACCP\ Time}}$ is the difference in seafood imports between U.S. seafood imports and U.S imports of the other edible commodities during the period of pre-HACCP, compared to those during the period of post-HACCP. The graphical explanation of DID specification (Figure A1 in Appendix) shows, our treated group is the U.S. seafood imports, and our control group is U.S imports of non-HACCP edible commodities.

The difference in groups pre-HACCP is β_2; the difference in groups post-HACCP is $\beta_2 + \beta_3$; thus, the difference in difference in groups pre-HACCP and groups post-HACCP is the pure

[5] Random effect uses panel analysis with DiD specifications (xtreg, re); diff package is used to estimate the treatment effect from the pooled baseline and follow up dataset in Stata 14 (diff). The Breusch-Pagan Lagrange multiplier (LM) test has been used for the choice of random effect versus pooled OLS. According to the Breusch-Pagan Lagrange multiplier (LM) test, if we reject the null hypothesis of no significant difference across units, implying no panel effect, and conclude that random effect model is appropriate.

treatment effect (β_3), which controls for differences between the control and treatment groups[6]. Thus, the coefficient that we are interested in is the $HACCP_i * Time_t$ (β_3) under the hypothesis that β_3 is statistically significant and different from zero, implying the treatment can affect the outcome. If β_3 is statistically insignificant, we fail to reject the null hypothesis that policy cannot influence U.S seafood imports.

1.4.3 Alternative DID Gravity Model – EU-15 Control Group

In an alternative estimation strategy, we choose U.S. seafood imports as the treatment group and the EU-15 seafood imports from 248 countries as the control group in Model 3. We assume that the treatment (U.S. seafood) and control (EU-15 seafood) have the same trend in the seafood imports in the pre- and post-HACCP periods to control for the time-invariant changes between the two groups. Thus, the DID model allows us to compare U.S seafood imports (the treatment group) under pre- and post-HACCP implementation with EU seafood imports (the control group) during the same period and estimate the pure effect of HACCP enforcement on U.S. seafood imports.

1.4.3.1 Gravity Model with DID and country and year dummies

$$\ln(\mathrm{Import}_{ijt}) = \alpha_0 + \alpha_i + \alpha_j + \alpha_t + \beta_1 \mathrm{D}_{\mathrm{HACCP}} + \beta_2 \mathrm{D}_{\mathrm{U.S.}} + \beta_3 \mathrm{D}_{\mathrm{HACCP}} * \mathrm{D}_{\mathrm{HACCP\ Country}} \quad (3)$$
$$+ \delta_1 \mathrm{D}_{\mathrm{U.S.}} * D_{COOLi} + \theta_1 D_{development\ status j}$$
$$+ \theta_2 \mathrm{D}_{\mathrm{U.S.}} * D_{development\ status j} + \sum_{i=1}^{13} \gamma_i X_{ij} + \varepsilon_{ijt}$$

[6] Difference in groups pre-HACCP=$E(\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \beta_2 + \sum_{i=1}^{13} \gamma_i X_{ij} + \varepsilon_{ijt}) - E(\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + + \sum_{i=1}^{13} \gamma_i X_{ij} + \varepsilon_{ijt}) = \beta_2$; difference in groups post-HACCP=E($\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \beta_1 + \beta_2 + \beta_3 + \sum_{i=1}^{13} \gamma_i X_{ij} + \varepsilon_{ijt}$)-E($\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \beta_1 + \sum_{i=1}^{13} \gamma_i X_{ij} + \varepsilon_{ijt}$)= $\beta_1 + \beta_3$; thus HACCP effect= ($\beta_2 + \beta_3$)-β_2=β_3

The definitions of all of the variables are the same as the variables in Equation 2, except $D_{HACCP\ Country}$ and $D_{HACCP\ Time} * D_{HACCP\ \ Country}$. $D_{HACCP\ Country}$ is equal to 1 if seafood imports are to the U.S., 0 to EU. $D_{HACCP\ Time} * D_{HACCP\ \ Country}$ (β_3) is difference between U.S. seafood imports and EU seafood imports before U.S. HACCP enforcement, relative to those after U.S. HACCP enforcement. β_3 is the pure effect of HACCP enforcement considering the time-invariant factors affecting the U.S. and EU seafood imports. The coefficient of interest here is β_3. A statistical and negative (positive) coefficient indicates that HACCP enforcement resulted in a decrease (increase) on U.S. seafood imports.

1.4.3.2. Gravity Model with DIDID

$$\begin{aligned}\ln(\mathrm{Import}_{ijtc}) = {} & \alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \beta_1 D_{HACCP} + \beta_2 D_{U.S.} + \beta_3 D_{Seafood} + \beta_4 D_{HACCP} \\ & * D_{U.S.} + \beta_5 D_{U.S.} * D_{Seafood} + \beta_6 D_{HACCP} * D_{Seafood} + \beta_7 D_{HACCP} * D_{U.S.} \\ & * D_{Seafood} + D_{U.S.} * D_{COOLi} * D_{Seafood} \\ & + \theta_1 D_{development\ statusj} + \theta_2 D_{development\ statusj} * D_{U.S.} \\ & + \theta_3 D_{development\ statusj} * D_{Seafood} + \theta_4 D_{development\ statusj} * D_{Seafood} \\ & * D_{U.S.} + \sum_{i=1}^{13} \gamma_i X_{ij} + \varepsilon_{ijtc}\end{aligned} \quad (4)$$

A more robust analysis than either of the DID analyses is a difference-in-difference-in-difference estimation strategy (DIDID) is to use a different country and product as the control groups in Model 4. All of variables are the same as the previous equations. We label the two periods (pre- and post-HACCP), the country implementing HAACP or not (U.S. and EU-15), and the product (seafood and non-seafood). In equation 4, the variable of interest is $D_{HACCP} * D_{U.S.} * D_{Seafood}$ (β_7), β_7 controls for the two potentially confounding trends: changes in seafood

imports across different countries and the changes in U.S. imports of edible products between the period of pre- and post-HACCP. If β_7 is statistically insignificant, we can conclude that HAACP enforcement did not affect the U.S. seafood imports.

1.4.4 Robustness check: Heckman Selection Model with Difference-in-Difference – EU-15 and U.S. non-seafood as the controls

As a robustness check, we tackle the problem of zero trade values with the Heckman selection model (Heckman, 1976). Heckman selection model with DID strategy could deal with the concern of the bias of zero trade and help to estimate the casual effect of HACCP implementation. This approach corrects for selection bias by allowing the separation of the extensive marginal effect (the selection equations from Equation 5a) and intensive marginal effect (the outcome equations from Equation 5b), where the two error terms can be correlated.

$$\begin{aligned}\Pr(\text{Import}_{ijt} > 0) = \Phi(&\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \beta_1 D_{\text{HACCP}} + \beta_2 D_{\text{U.S.}} + \beta_3 D_{\text{HACCP}} * D_{\text{U.S.}} \\ &+ \delta_1 D_{\text{U.S.}} * D_{COOLi} + \theta_1 D_{development\ status j} \\ &+ \theta_2 D_{\text{U.S.}} * D_{development\ status j} + \sum_{i=1}^{12} \gamma_i X_{ij} + \gamma_{13} \text{Common language}_{ij} \\ &+ \varepsilon_{ijt})\end{aligned} \tag{5a}$$

$$\begin{aligned}\ln(\text{Import}_{ijt} > 0) = &\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \beta_3 D_{\text{HACCP}} * D_{\text{U.S.}} + \sum_{i=1}^{12} \gamma_i X_{ij} \\ &+ \delta_1 D_{\text{U.S.}} * D_{COOLi} + \theta_1 D_{development\ status j} \\ &+ \theta_2 D_{\text{U.S.}} * D_{development\ status j} + \delta_1 \text{IMR}_{ijt} + \varepsilon_{ijt}\end{aligned} \tag{5b}$$

Following Helpman, Melitz and Rubinstein (2008), Disdier and Marette (2010), Tran, Wilson and Anders (2011), and Grant and Boys (2012), the variable "common language" serves as the exogenous identifying variable. It is assumed that this variable does not affect the volume of trade but that it affects the likelihood of trading. Equation 5a is a standard probit binary choice model and uses the standard normal cumulative distribution function. The treatment effect is simply the incremental effect of the coefficient (β_3) of the interaction term in the probit DID model or in any other non-linear DID model with a strictly monotonic transformation function like in Equation 5a (Puhani 2012; Karaca-Mandic, Norton and Dowd 2012). Thus, we interpret the sign of the interaction term, and regard it as the sign of the treatment effect but not the magnitude[7]. Since the outcome equation is a liner regression (Equation 5b), the DID specification works well in the outcome equation of Heckman selection model. All variables are defined as in Equation 3, and the coefficient estimate of interest is the β_3 in the outcome equation, which is a proxy of pure effect of HACCP enforcement in Equation 5b, indicating the difference in seafood imports between U.S. and EU-15 during the period of pre-HACCP, compared to difference of imports during the period of post-HACCP.

1.5 Empirical Analysis of HACCP effects of U.S. seafood imports

1.5.1 U.S. HACCP implementation as a single dummy-the comparable results

[7] Coefficients and marginal effects have the same signs, because marginal effects $\frac{\partial Pr}{\partial \mathrm{X_j}} = \Phi(X'\beta)\beta_j$, and $\Phi(X'\beta) > 0$; $\Phi(X\beta)$ is a strictly monotonic function, the sign of treatment effect in a non-linear "DID" with a strictly monotonic transformation function of a linear index is equal to the sign of the coefficient of the interaction term (Puhani 2012). Thus, we only interpret the sign of interaction term in the selection equation of Heckman selection mode.

Following Anders and Caswell (2009), we use the imports of seafood from country i to U.S. as the dependent variable and a single dummy of HACCP implementation to make it comparable (U.S. as the only importer or U.S and EU-15 as importers), and then choose U.S. imports of non-HACCP edible products as the control group to find the correlation of HACCP implementation with seafood imports. Heterogeneity is controlled for by the individual fixed effects, i.e. importer (α_i), exporter (α_j), year (α_t), and commodity(α_c). In all cases, the standard errors (SEs) are clustered at the paired reporter-partner level (distance between exporter and importer).

Table 1.3 presents the results when a single dummy of post-HACCP is a proxy of U.S. HACCP implementation. Model 1 is the OLS model of HACCP as a single dummy using the random effects when U.S. is the only importer, following Anders and Caswell (2009), and the dummy variable of $D_{U.S.} * D_{HACCP}$ is an indicator of U.S. HACCP implementation in Models 3 and 4. Models 3 and 4 are the random effects OLS and the PPML model when U.S. and EU-15 countries are as importers. The Breusch-Pagan Lagrange multiplier (LM) test shows that random effect is preferred to pooled OLS for Models 1, and 2, thus random effects have been applied for these three models rather than the pooled OLS. PPML [8]model is applied, since it does not only consider zero trade value, but also provides robust results in presence of heteroskadasiticiy (Silva and Tenreyro 2006, 2010).

We observe that while the variable for HACCP implementation has a negative and significant effect in the simple Model 1, the estimates for HACCP effects on seafood imports in Models 2, and 3 are not statistically significant. In model 1, the HACCP elasticity is -0.477,

[8]We use the method of Santos Silva and Tenreyro (2010), and stata code is ppml.

which translates to an average marginal annual loss in trade value of $28.77 million.[9] This effect is comparable to previous work by Anders and Caswell (2009) who found a smaller negative effect of HAACP implementation on U.S. seafood imports for the years 1990-2004. However, the estimate of the interaction term of *D(HACCP)*D(Seafood)* in Models 2 and 3 is not statistically significant, we conclude that HACCP implementation has a mixed effect on U.S. seafood imports when we choose a single dummy being a proxy of U.S. HACCP implementation. That is to say, the effect of U.S. HACCP implementation is varying with different data sample (U.S. importers only or EU 15 and US as imports), when the single dummy is defined as a proxy of U.S. HACCP implementation. Therefore, the single dummy of HACCP variables biases the estimated effect of HACCP implementation by not detangling the HACCP effect and other unobservable effects. Next, we turn to DID strategy to estimate whether HACCP effect is changing across different data sample and whether there exist consistent causal effect of HACCP implementation after taking consideration of other time-invariant unboreable factors affecting U.S. seafood imports.

Table 1.3 goes about here

1.5.2 Overall effects of HACCP implementation - EU-15 seafood and U.S non-seafood as the controls

Table 1.4 presents the results when we choose DID strategy instead of single dummy of HACCP implementation. Model 4 is the OLS model of the U.S. non-HACCP imports as the control group

[9] From the definition of elasticity, $\varepsilon = \frac{\Delta y/y}{\Delta x/x} = \frac{\partial \ln Y}{\frac{\partial x}{x}} = \frac{\partial \ln Y}{\partial x} x = \beta_1 x = -0.840 * 0.568 = -0.477$, $\Delta y = \varepsilon y = -0.477 * 60.3 = -\$28.77$ million, where y is U.S seafood imports from country i and x is the indictor of HAACP enforcement. The percentage change in trade value due to the dummy switching from 0 to 1 is $\frac{y_1 - y_0}{y_0} = \exp(\beta_1) - 1 = -56.83\%$, where $\ln\left(\frac{y_1}{y_0}\right) = \ln y_1 - \ln y_0 = \beta_1$

in the DID specification, and U.S. seafood and non-seafood commodities have been included. Model 5 is OLS model when EU-15 countries have been included into the importers, and data sample is U.S. and EU 15 seafood. Model 6 is DIDID model using a combination of U.S. seafood and EU seafood and non-seafood as controls, and U.S and EU seafood and non-seafood have been collected as data sample. All of model are refression by random fixed effect according to Breusch-Pagan Lagrange multiplier (LM) tests. The causal effect of HACCP enforcement on U.S. seafood imports is the estimate of the interaction term of *D(HACCP)* D(Seafood.)* and *D(HACCP)* D(U.S.)* in the DID specification (Models 4 and 5) or the interaction term of *D(HACCP)*D(Seafood)*D(U.S.)* in DIDID specification (Model 6). The insignificant coefficients of these interaction terms support the results of the previous models (Model 2) of no HACCP effect on seafood imports into U.S.

From the results of Table 1.4, the estimated coefficients of the above interaction variables of interest are not significant, concluding that HACCP implementation had no impact on seafood imports into the U.S, no matter what control group we choose, the U.S non-seafood, EU-15 seafood imports or a combination of U.S. and EU 15 seafood and non-seafood. This result is different form Model 1 in Table 1.2, because DID captures the unobservable factors decreasing the U.S. seafood imports. However, the single dummy of HACCP enforcement variable does not.

The preferred specifications are Models 4-6 in Table 1.4 to Models 1, 2 and 3 in Table 1.3. It shows that the single dummy of HACCP enforcement in Model 1 overestimates the effect of this event and offers incorrect policy insight. All other coefficients in the standard gravity model are statistically significant and of the expected signs in Table 1.4. Importers' GDP denote the demand of U.S. seafood and a 1% increase of it can result in an increase between 0.243% and 1.095% of seafood import; exporters' GDP denote the supply of seafood, and a 1% increase in

GDP result is associated with 0.198% to 0.236% increase of seafood import. However, the magnitude of estimated coefficient for the distance between countries is larger than in Anders and Caswell's (2009) distance elasticity between -0.719 and -0.10 for the seafood import into U.S. and, has overlap with -0.87 to -1.12 for the agricultural trade (Grant and Boys 2012). The coefficient estimates of the dummy variables show that countries that share borders, and the same languages, have colonial ties and larger areas, trade more.

COOL affects the processor's cost, transaction cost, consumer's willingness to pay (Lewis et al. 2017; Lim et al. 2013; Bienenfeld et al. 2016), welfares of consumers and producers (Joseph, Lavoie, and Caswell 2014; Rude, Iqbal, and Brewin 2006), thereby international trade. To isolate effect of HACCP principle from other food safety regulations on U.S. seafood, we take mandatory COOL into consideration. COOL is a labeling law that requires retailers, such as full-line grocery stores, supermarkets and club warehouse stores to notify their customers with information regarding the source of certain foods. It stems from the 2004 Farm Bill, which was published in October 5, 2004 by an interim final rule (IFR) for fish and shellfish (7 CFR Part 60), and became effective on April 5, 2005. The final rule for all other commodities (7 CFR Part 60) was published on August 1, 2008, and became effective on September 30, 2008[10]. The effects of U.S. COOL implementation on seafood imports are consistent across models 4, 5, and 6 in Table 1.4. Specifically, the insignificances of the proxies of the enforcement of U.S. COOL, such as *D(COOL)*D(Seafood)* in Model 4, *D(COOL)*D(US)* in Model 5, and *D(COOL)*D(Seafood)*D(US)* in Model 6, show that COOL enforcement has no effects on U.S. seafood imports from other countries. It might explain that U.S. consumer are not willing to pay the extra costs for COOL. This conclusion is consistent with Rude, Felt and Twine

[10] https://www.ams.usda.gov/rules-regulations/cool

(2016)'s no evidence of structural change for pork trade flows that could be associated with COOL. However, this is contrary with Rude, Felt and Twine (2016) where COOL affects U.S./Canada feeder and slaughter hog trade flows, and Pouliot and Sumner (2014)'s negative effect of COOL on ratios of imports to total domestic use for both fed and feeder cattle.

DIDID estimates start with the time change in averages for U.S. seafood imports and then nets out in means for EU seafood imports and the change in means for imports of non-HACCP edible products. This could control for two potentially confounding trends: changes in seafood imports across different countries, that would have nothing to do with the HACCP enforcement; and the changes in U.S. imports of edible products, possibly due to other non-HACCP policies that affect imports of all edible products, or changes in the economy that influence all imports of edible products. Model 6 is estimated with a heteroscedasticity-robust standard error. The interaction term of *D(HACCP)*D(Seafood)*D(U.S.)* is again not statistically significant, implying that HACCP implementation had no effect on U.S. seafood imports, when potentially confounding economic trends in and outside of the U.S have been considered.

The key question in this study is how HACCP implementation in U.S. influences the intensive and extensive margins of the U.S. seafood imports. Models 4, 5 and 6 with the DID specification or DIDID specification) shows that there is no casual effect of HAACP implementation on U.S. seafood imports, that is to say, HACCP did not influence the volume (intensive margin) of U.S. seafood imports. We will turn to Heckman selection model next section, to estimate whether this results is consistent and robustness or not across different models, and how HACCP effect the extensive margin of U.S. seafood imports, that is to say, whether this policy implementation increase U.S. seafood market assess for other exporters.

Table 1.4 goes about here

1.5.3. Heckman selection results - EU-15 and U.S. non-seafood as the controls

In the Heckman selection model with DID, we consider Heckman's (1979) model, which controls for sample selection bias by including the inverse Mills ratio (IMR_{ijt}) from the first stage-probit model into the second stage-outcome equation (Grant and Boys 2012; Tran, Wilson and Anders 2011;Helpman, Melitz and Rubinstein 2008). The Wald test in Heckman selection model indicates that the correlation is very significant, which implies the decision to trade as an endogenous outcome. Moreover, the correlation coefficient (rho) between the selection and the outcome equations is statistically significant, implying that there is selection bias caused by omission of zero values. Following Disdier and Marette (2010), Tran, Wilson and Anders (2011) and Tran, Wilson and Hite (2013), the common language is the only excluded variable for Heckman selection model, and this variable has statistically significant and positive effect on the extensive margin to seafood imports. Therefore, the Heckman selection model with DID and three-way fixed effects performs well and is appropriate for the EU as the control.

1.5.3.1 Heckman selection results – overall effect of HACCP implementation

Models 7 and 12 are preferred according to the significances of the excluded variable (common language) and the Wald test of ($\rho = 0$). The estimates in the selection equation also show that a larger exporter (higher GDP), historical colonial ties, common language, and NAFTA are associated with the presence of seafood imports into USA and EU-15. The negative sign on importer GDP is surprising, relative to the other specifications. The sign of

The sign of treatment effect in a non-linear "DID" with a strictly monotonic transformation function of a linear index is equal to the sign of the coefficient of the interaction term (Puhani 2012). Thus, we only interpret the sign of interaction terms (*D(HACCP)* D(Seafood.)* and *D(HACCP)* D(U.S.*) in the selection equation of Heckman selection mode. The HACCP implementation has the significant and positive effect on the extensive margin to U.S. seafood imports in Models 7 and 12. In other words, the HACCP policy increases market access for other trading exporters, no matter we choose U.S. non-seafood or EU-15 as a control. .

From the outcome equation of the Heckman selection models in Models 7 and 12, we find evidence that the implementation of HACCP does not influence bilateral seafood imports, which is different from those predicted by Anders and Caswell (2009) with a decrease from 33.5% to 45%, and Li Saghaian and Reed (2013) with a 26%-56% increase in mollusk exports. The outcome equation of Heckman selection model with DID specification provides evidence that HAACP implementation has no effect on the value of U.S. seafood imports. However, the selection model suggests that HACCP could increase the extensive margin of seafood imports into U.S., implying that HACCP enforcement could increase market access for U.S. seafood imports, but cannot affect the volume of U.S. seafood imports. These findings suggest that HACCP increases the consumer confidence in the imported seafood quality and more similar standards for the seafood production among trading partners, thus increase the probability of exporting into U.S. seafood market, but have no effect on volume. This confirms the previous results from Table 1.4, that HACCP has no effect on U.S. seafood volume, that is to say, we get the consistent and robustness results across models (random effects and Heckman selection models) and across different data sample (U.S. Non-seafood or EU seafood as a control group).

In terms of other variables, such as distance, colonial relationship, area, common currency, EU, and NAFTA have the expected signs and have reasonable magnitudes in Models 5, 6, and Heckman Selection Model with DD. For example, GDP, colonial relationship, area, common currency, EU, and NAFTA increase the seafood imports into U.S., and distance decreases the U.S. seafood imports, which is in line with previous literature.

Table 1.5 goes about here

Table 1.6 goes about here

1.5.3.2 Heckman selection results-Developing and developed countries effects of HACCP implementation

Developed countries are assumed to have more resources to improve production standards faster than developing countries (Anders and Caswell 2009). In addition, HACCP procedures have become increasingly popular among developing and developed countries. To test the differential effects of HACCP between developing and developed countries, we estimate the gravity model with DID specification using the sub-dataset of the developing and developed countries, which account for other unobservable factors affecting U.S. seafood imports (Anders and Caswell 2009). We use the EU-15 countries as the control group. Random effects and Heckman selection model with DID specifications have been applied in this section, and the results are in Table 1.4.

Modes 8 and 11 are preferred to Models 9 and 10 in Table 1.5, and Models 13 and 15 are preferred to Mode 14 and 16 in Table 1.6, according to the significance of Wald test and excluded variable (common language). As discussed before, HACCP implementation has no effect on U.S. seafood imports from 1988 to 2006, when other determinants of trade in

traditional gravity model, such as GDP, distance, common language, common border, and colonization and so on are included in the models. Similarly, the effect of HACCP implementation for developed and developing countries is the same. However, according to the results of Modes 8 and 11, and Models 13 and 15, we get different results. When we choose EU-15 as a control, HACCP implementation cannot change intensity of U.S. seafood imports among developed or developing countries; while HACCP results in a significant increase in probability of trading with developing countries in Modes 8 and 11 (Table 1.5). That is to say, HACCP implementation does not increase the market access for U.S. seafood imports from developed countries; it results in an increase in the likelihood of exporting into U.S. seafood market from developing countries when we choose EU-15 as a control.

At the same time, Models 13 and 15 in Table 1.6 present the results of the HACCP effect on U.S seafood imports for developing and developed countries using random effect models when U.S. non-seafood are chosen as a control. The Wald test confirms that there is not sample selection for the developing countries (Model 15) and developed countries (Model 13).The estimates of the causal effects of HACCP enforcement are statistically significant for both developed and developing countries, suggesting that HACCP decrease the intensity of U.S. seafood import from developed and increase it from developing countries. That is to say, HACCP enforcement decreases the U.S seafood imports from developed countries and increase them from developing countries.

In summary, estimates of the impact of HACCP enforcement on U.S. seafood imports which only use a simple dummy are not reliable. Our improved specifications with two different control groups (U.S. non-seafood imports, EU seafood imports, or the combination of them as a control group using DIDID) show consistently that HACCP enforcement does not affect U.S.

seafood imports. It seems that HACCP requirements have helped food control through the entire production process and increased consumer confidence, even if they might have increased procurers' compliance costs, leaving a net null effect.

1.6 Conclusion

The aim of HACCP is to increase consumer confidence and thus increase the demand of trade. The existing literature used a simple dummy variable for HACCP implementation to study its effect on trade and found mixed results. This paper is the first to disentangle the causal effect of HACCP implementation in the U.S by controlling the unobserved factors affecting U.S seafood imports using DID. Specifically, I chose imports of U.S. non-HACCP commodities and EU-15 seafood as two alternative control groups to estimate the casual effect of HACCP implementation. To check the robustness of our results we used DIDID estimation strategy with different countries and products as the control groups.

I use panel data of seafood imports in the U.S. between 1988 and 2006 to estimate the impact of HACCP implementation. Empirical results demonstrate that HACCP implementation only has statistically significant positive effects on the extensive margin of U.S seafood imports and no effect on its intensive margin. In other words, HACCP improves market access for U.S. seafood imports and has no effect on the volume of U.S seafood imports. These results are different from those by Anders and Caswell (2009), who estimate that HACCP lowered U.S. seafood imports. The results from the alternative specifications suggest that previous work failure to separate the HAACP effect from other unobserved factors may bias results. The lack of impact that I find has another possible explanation. The seafood HACCP requirement was announced in December 18, 1995 and enforced two years later in December 18, 1997. Thus, seafood producers had time to adjust their production practices to HACCP standards. Similar

conclusion can be found in a different trade barrier, such as anti-dumping tariffs. Asche (2001) finds that anti-dumping and countervailing duties on Norwegian salmon by U.S. did not benefit U.S. production nor U.S. market share. Moreover, these duties resulted in other producers taking over Norwegian salmon market share; however, they did not affect U.S. prices. Keithly and Poudel (2008) find that U.S. antidumping duties on shrimp from six named counties - China, Vietnam, India, Thailand, Ecuador, and Brazil, led to a limited trade deflation and have marginal protection to domestic shrimp industries. There appear to be a large amount of trade diversion from six named countries mentioned above to non-named countries. That is to say, the barriers, such as anti-dumping duties, led to reallocation of trade patterns but no change in U.S. prices, which strengthen my main conclusion. Finally, the results contribute to emerging studies showing that DID specifications within the gravity framework are useful in evaluating the impact of various trade related policy changes.

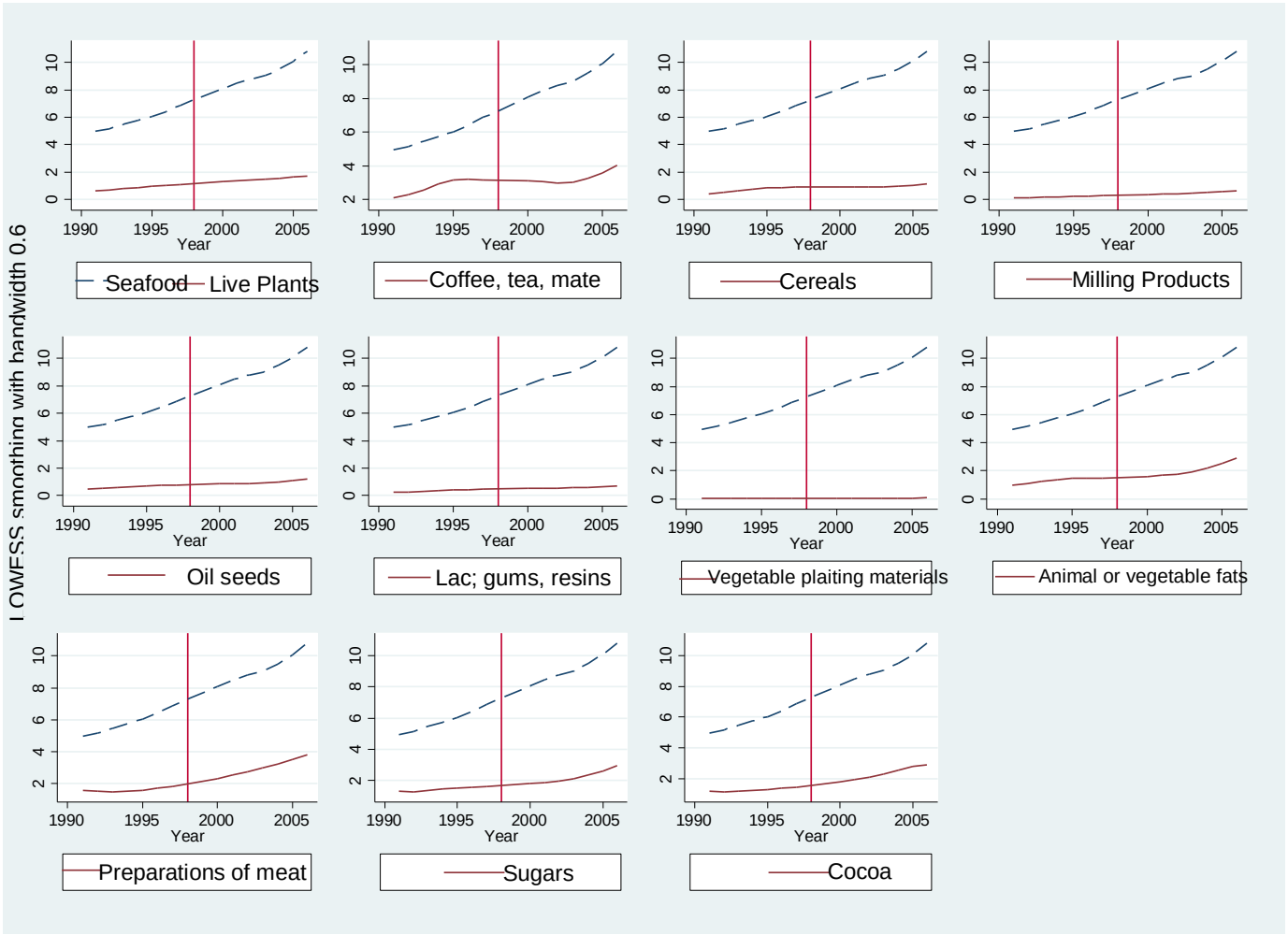

Figure 1.1. U.S. Seafood Import (03) and U.S. Import of Other Edible Commodities (6 & 9-18)

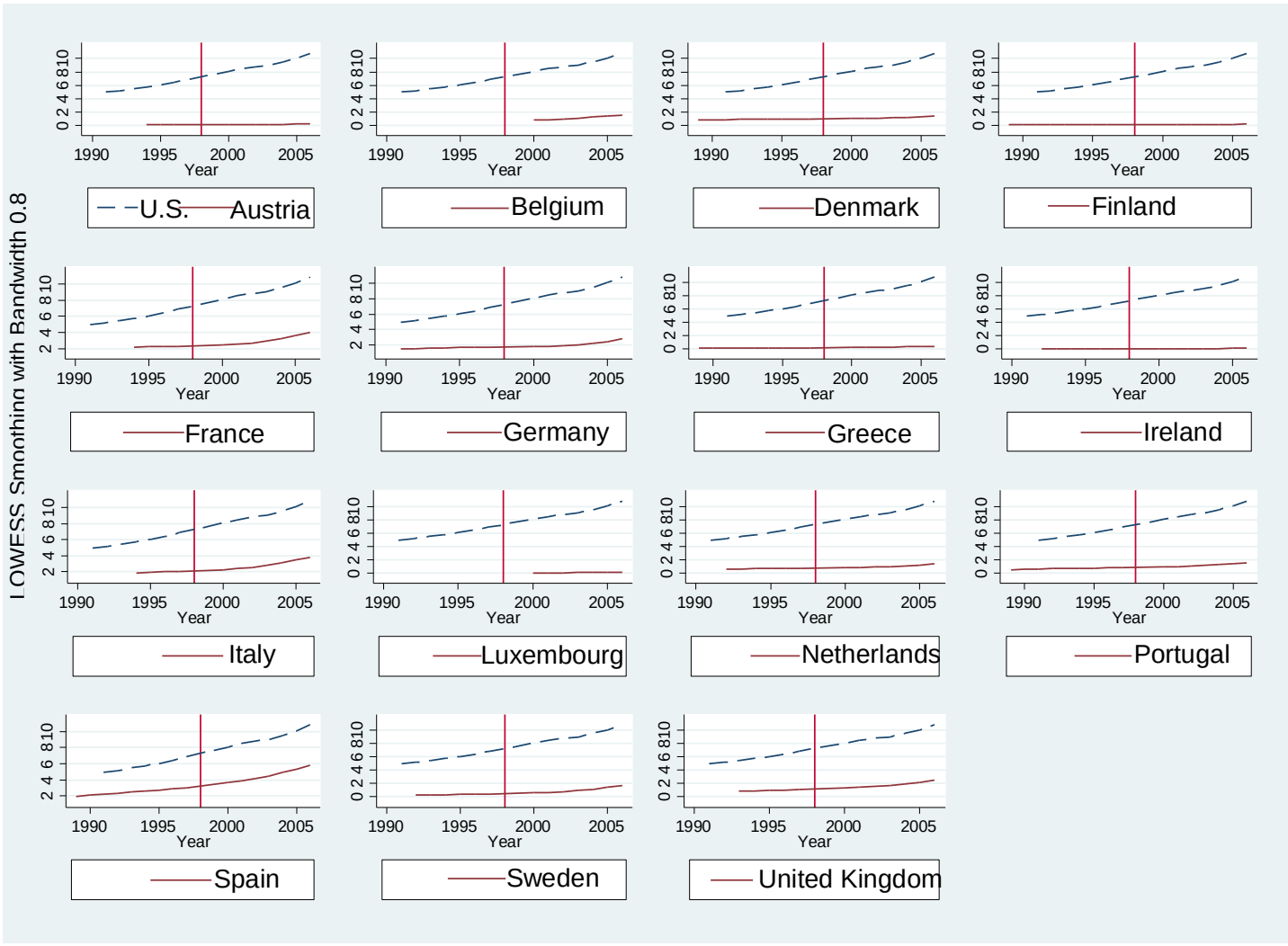

Figure 1.2. EU-15 and U.S. Seafood Import (03)

Table 1.1 Definition of Variable

Variables	Variable Description
	Dependent Variable
Import_ijt	Value of annual seafood imports in country i from country j (thousand dollar)
	Independent Variable
D(HACCP Time)	1 if year after 1997, 0 otherwise
D(HACCP Country)	1 if seafood imports to U.S; 0 otherwise
D(HACCP Commodity)	1 if the commodity is seafood; 0 otherwise
lnGDP(it)	Impoter's GDP
lnGDP(jt)	Expoter's GDP
lnDIST(ij)	Weighted Distance between country i and country j
Contiguity(ij)	1 if two trading country share the same border, 0 other wise
Common language(ij)	1 if two trading country share the same lanague, 0 other wise
Colony_1945(ij)	1 for pairs in colonial relationship post 1945, 0 other wise
Common Colony(ij)	1 for common colonizer post 1945, 0 other wise

Current Colony(ij)	1 for pair currently in colonial relationship, 0 other wise
$\ln[\text{Area}_i * \text{Area}_j]$	Area of importer times that of exporter (sq. kms)
Common Currency(ij)	1 for pairs has Common Currency, 0 other wise
Regional Trade Agreement(ij)	1 for regional trade agreement in force, 0 other wise
EU	1 for pairs in EU, 0 other wise
NAFTA	1 for pairs in NAFATA, 0 other wise
COOL[11]	1 if U.S. seafood import is later than 2005, 0 otherwise

[11] COOL has been prompted in EU to protect and/or to promote production of food, especially from regions with a reputation for high quality ((Loureiro and Umberger 2007). Country of origin labeling (COOL) was already mandatory for fishery and aquaculture products (Regulation 1379/2013), and mandatory COOL has been enacted into force 1 January, 2014 in EU .By comparison, U.S. publish an interim final rule for fish and shellfish (7 CFR Part 60) in October 5, 2004, and effective on April 5, 2005. In addition, the final rule for all other commodities (7 CFR Part 60) was published August 1, 2008, and effective September 30, 2008 (Preston and Kim 2008).

Table 1.2 Means in pre- and post-HACCP

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	U.S. seafood imports			U.S. non-seafood imports			
variable	pre-1998 (N=805)	post-1998 (N= 1,061)	over time difference (col. 2-1) Δ1	pre-1998 (N= 5,541)	post-1998 (N= 8,008)	over time difference (col. 5-4) Δ2	Difference in difference (Δ1-Δ2)
	14.448	14.888	0.440	13.330	13.402	0.072	0.369**
variable	U.S. seafood imports			EU seafood			
	pre-1998 (N=816)	post-1998 (N= 1,079)	over time difference (col. 2-1) Δ1	pre-1998 (N= 6,818)	post-1998 (N=10,536)	over time difference (col. 5-4) Δ3	Difference in difference (Δ1-Δ3)
	14.409	14.846	0.437	13.062	13.274	0.212	0.225

Table 1.3. Gravity model estimates of HACCP impacts on U.S. seafood imports, baseline of models for single dumpy being the proxy of HACCP enforcement

	(1)	(2)	(3)
VARIABLES	Model 1 RE	Model 2-RE	Model 3-PPML
D(HACCP)	-0.840***		
	(0.177)		
D(HACCP)*D(U.S)		0.134	0.046
		(0.130)	(0.099)
lnGDP(it)	3.498***	0.788***	-0.175
	(0.155)	(0.177)	(0.261)
lnGDP(jt)	0.754***	0.136	0.243**
	(0.274)	(0.096)	(0.123)
lnDIST(ij)	-3.746***	-2.083***	-1.496***
	(0.511)	(0.099)	(0.110)
Contiguity(ij)	-0.947***	0.429*	0.144
	(0.183)	(0.226)	(0.189)
Common Language(ij)	0.132	-0.107	0.080
	(0.212)	(0.154)	(0.173)
Colony_1945(ij)	5.302***	0.030	0.266
	(0.640)	(0.266)	(0.327)
Common Colony(ij)	-1.399	0.657***	0.664***
	(1.462)	(0.184)	(0.224)

Current Colony(ij)		2.706**	2.603***
		(1.302)	(0.641)
ln_area_od	-0.522***	0.678***	1.240***
	(0.168)	(0.150)	(0.215)
Common Currency(ij)	0.173	0.312***	0.334***
	(0.224)	(0.101)	(0.125)
Regional Trade Agreement(ij)	-0.352	-0.148	0.220*
	(0.222)	(0.102)	(0.118)
EU		0.819*	1.113***
		(0.418)	(0.317)
NAFATA		6.239***	6.076***
		(0.915)	(1.422)
D(COOL)	-0.514***		
	(0.106)		
D(COOL)*D(U.S)		-0.094	-0.227***
		(0.099)	(0.079)
develop_status	0.429		
	(0.444)		
develop_status_US		-0.207	0.315
		(0.304)	(0.203)
Constant		-4.680**	-17.709***
		(2.320)	(3.494)

Observations	1,921	19,249	52,752
Number of pairid	177	2,134	
Importer fixed effect	No	Yes	Yes
Exporter fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Commodity fixed effect	Yes	No	No
Random effect	Yes	Yes	No
Pseudo log-likelihood			-1.36E+11
R-sq: between	1	0.769	
R-squared			0.794

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 1.4. Gravity model estimates of HACCP impacts on U.S. seafood imports using DID and DIDID

VARIABLES	Model 4 U.S seafood VS U.S. non-seafood RE with DD	Model 5 U.S. seafood VS EU seafood Model 5-RE with DID	Model 6 US seafood VS EU seafood vs US non-seafood VS EU non-seafood DDD
D(HACCP)	-0.154	0.315	0.087
	(0.281)	(0.244)	(0.128)
D(Seafood)	1.365***		1.293***
	(0.422)		(0.126)
D(HACCP)*D(Seafood)	0.175		0.222***
	(0.126)		(0.040)
D(US)		-3.694***	-6.791***
		(1.083)	(0.545)
D(HACCP)*D(US)		0.133	0.270***
		(0.130)	(0.052)
D(Seafood)*D(US)			0.170
			(0.342)
D(HACCP)*D(Seafo			-0.040

od)*D(US)			
			(0.130)
lnGDP(it)	1.095*	0.787***	0.243***
	(0.639)	(0.177)	(0.088)
lnGDP(jt)	0.236**	0.141	0.198***
	(0.117)	(0.097)	(0.044)
lnDIST(ij)	-3.635***	-2.084***	-0.959***
	(0.378)	(0.099)	(0.067)
Contiguity(ij)	0.619***	0.427*	1.230***
	(0.234)	(0.226)	(0.155)
Common			
Language(ij)	5.459***	-0.109	-0.002
	(1.666)	(0.153)	(0.082)
Colony_1945(ij)	2.021***	0.031	-0.150
	(0.202)	(0.265)	(0.153)
Common Colony(ij)	-1.094	0.658***	0.442***
	(1.511)	(0.184)	(0.119)
Current Colony(ij)		2.691**	1.228***
		(1.279)	(0.410)
ln_area_od	0.813***	1.482***	2.070***
	(0.302)	(0.344)	(0.170)
Common Currency(ij)	0.859	0.320***	0.351***
	(0.784)	(0.101)	(0.048)

Regional Trade Agreement(ij)	0.034	-0.141	0.030
	(0.116)	(0.102)	(0.044)
EU		0.911**	0.254
		(0.420)	(0.195)
NAFATA		4.219***	-2.260***
		(1.272)	(0.635)
D(COOL)*D(US)		-0.097	
		(0.099)	
D(COOL)*D(Seafood)	-0.089		
	(0.096)		
D(COOL)*D(Seafood)*D(US)			-0.125
			(0.091)
D(development status)			0.100
			(0.084)
D(development status)*D(US)		-0.330	-0.095
		(0.311)	(0.137)
D(development status)*D(Seafood)	-0.075		-0.162

	(0.338)		(0.113)
D(development status)*D(US)*D(Sea food)			0.128
			(0.349)
Constant		-24.762***	-39.182***
		(6.926)	(3.428)
Observations	15,415	19,249	155,843
Number of pairid	1,536	2,134	18,990
Importer fixed effect	No	Yes	Yes
Exporter fixed effect	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Commodity fixed effect	Yes	No	Yes
Random effect	Yes	Yes	Yes
R square: between	0.584	0.769	0.487

Table 1.5. Gravity model estimates of HACCP impacts on U.S. seafood imports import for developing and developed countries, EU-15 countries as the control, panel data, 1988-2006

	Model 7		Model 8	Model 9		Model 10	Model 11	
	All countries		Developed Countries			Developing Countries		
	Heckman			Heckman			Heckman	
VARIABLES	with DID		RE with DID	with DID		RE with DID	with DID	
D(HACCP)	0.727***	3.271***	0.405	0.436	4.083***	0.476	1.411***	3.214***
	(0.263)	(0.171)	(0.390)	(0.404)	(0.459)	(0.328)	(0.359)	(0.199)
D(US)	-3.339***	-4.483***	-1.202	-0.922	-3.857***	-5.552***	-7.266***	-5.188***
	(1.127)	(0.691)	(1.717)	(1.727)	(1.399)	(1.335)	(1.455)	(0.797)
D(HACCP)*D(US)	0.147	0.219***	-0.105	-0.003	0.226	0.228	0.270	0.267***
	(0.133)	(0.085)	(0.147)	(0.149)	(0.188)	(0.165)	(0.169)	(0.102)
lnGDP(it)	0.630***	-0.803***	0.910***	0.922***	-0.854***	0.681***	0.315	-0.847***
	(0.183)	(0.134)	(0.256)	(0.251)	(0.279)	(0.241)	(0.260)	(0.161)
lnGDP(jt)	0.254**	0.092	-0.312	-0.229	-0.104	0.208*	0.319***	0.139**
	(0.099)	(0.061)	(0.227)	(0.241)	(0.229)	(0.107)	(0.110)	(0.065)

lnDIST(ij)	-2.309***	-0.864***	-1.826***	-1.801***	-0.502***	-2.312***	-2.745***	-1.073***
	(0.103)	(0.055)	(0.157)	(0.173)	(0.104)	(0.127)	(0.135)	(0.062)
Contiguity(ij)	0.176	-0.628***	0.643**	0.536**	-0.136	0.678*	0.389	0.221
	(0.226)	(0.167)	(0.259)	(0.244)	(0.172)	(0.388)	(0.361)	(0.250)
Common Language(ij)		0.252***	-0.301		-0.176	-0.070		0.419***
		(0.064)	(0.240)		(0.120)	(0.191)		(0.066)
Colony_1945(ij)	0.220	0.287**	-0.027	0.465	0.368	0.062	0.233	0.187
	(0.250)	(0.134)	(0.653)	(0.439)	(0.277)	(0.303)	(0.294)	(0.141)
Common Colony(ij)	0.712***	0.212*	0.709***	0.686***	0.144	0.537**	0.637***	0.121
	(0.160)	(0.111)	(0.230)	(0.234)	(0.194)	(0.243)	(0.206)	(0.116)
Current Colony(ij)	2.379***	0.668*	2.153**	2.082***	1.072**	3.373***	2.955***	1.438**
	(0.578)	(0.348)	(1.090)	(0.609)	(0.510)	(0.957)	(0.924)	(0.705)
ln_area_od	1.731***	1.951***	0.929*	0.869*	1.875***	1.927***	2.678***	2.152***
	(0.357)	(0.240)	(0.527)	(0.518)	(0.496)	(0.450)	(0.489)	(0.287)
Common Currency(ij)	0.194	0.956***	0.419***	0.466***	0.909***	-0.603	-0.534	-0.299
	(0.138)	(0.161)	(0.112)	(0.144)	(0.192)	(0.783)	(0.489)	(0.281)

Regional Trade								
Agreement(ij)	-0.159	-0.010	0.140	0.079	0.301	-0.212*	-0.298**	-0.046
	(0.124)	(0.077)	(0.175)	(0.315)	(0.214)	(0.121)	(0.140)	(0.087)
EU	1.505***	-0.283	1.642***	1.834***	-0.032	-0.303	-0.314	-0.726***
	(0.398)	(0.191)	(0.419)	(0.421)	(0.289)	(0.868)	(0.749)	(0.274)
NAFATA	3.416***	-1.843**	5.533**	1.782	-5.437***	2.396***	2.575***	-0.479
	(1.301)	(0.874)	(2.413)	(2.109)	(1.865)	(0.928)	(0.910)	(0.558)
D(COOL)*D(US)	-0.169	-0.243***	-0.275	-0.197	-0.623**	-0.064	-0.183	-0.170*
	(0.108)	(0.084)	(0.174)	(0.182)	(0.263)	(0.121)	(0.138)	(0.091)
D(development status)	0.274*	0.032						
	(0.156)	(0.100)						
D(development								
status)*D(US)	-1.096***	0.008						
	(0.320)	(0.173)						
		-			-			-
Constant	-29.139***	37.145***	-7.053	-3.561	31.143***	-33.266***	-46.570***	40.132***

	(7.167)	(4.494)	(11.669)	(10.938)	(9.077)	(8.802)	(9.564)	(5.331)
Observations	53,264	53,264	5,972	10,478	10,478	13,277	42,786	42,786
Number of pairid			601			1,647		
Importer fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Commodity fixed effect	No	No	No	No	No	No	No	No
Random effect	No	No	No	No	No	No	No	No
athrho	0.143***			0.060*			0.244***	
	(0.022)			(0.031)			(0.027)	
lnsigma	0.584***			0.393***			0.641***	
	(0.013)			(0.028)			(0.015)	
Log pseudolikelihood	-56012.39			-14070.88			-40931.19	
Wald test of(rho = 0):								
chi2(1)	41.44***			3.81*			83.12***	
R square: between			0.842			0.713		

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 1.6. Gravity model estimates of HACP impacts on U.S. seafood imports import for developing and developed countries, U. S. non-HACCP commodity as the control, panel data, 1988-2006

	Model 12		Model 13	Model 14		Model 15	Model 16	
	All countries			Developed Countries			Developing Countries	
VARIABLES	Heckman with DID		RE with DID	Heckman with DID		RE with DID	Heckman with DID	
D(HACCP)	-0.148	-0.560***	0.051	0.431	-0.996***	-0.096	-0.298	-0.468***
	(0.335)	(0.050)	(0.418)	(0.458)	(0.143)	(0.364)	(0.442)	(0.052)
D(Seafood)	1.423**	0.436***	1.861***	1.380*	0.527***	1.325***	1.725***	0.705***
	(0.585)	(0.136)	(0.685)	(0.711)	(0.152)	(0.369)	(0.407)	(0.075)
D(HACCP)*D(Seafood)	0.186	0.207***	-0.261**	-0.212*	0.388**	0.331**	0.341*	0.186***
	(0.138)	(0.057)	(0.120)	(0.121)	(0.180)	(0.162)	(0.175)	(0.065)
lnGDP(it)	1.021	2.089***	0.335	-0.450	3.503***	1.065	1.579	1.790***
	(0.753)	(0.135)	(0.967)	(1.019)	(0.424)	(0.809)	(0.976)	(0.129)
lnGDP(jt)	0.228*	0.425***	0.446*	0.073	0.464***	0.190	0.285**	0.414***
	(0.122)	(0.025)	(0.244)	(0.220)	(0.064)	(0.126)	(0.138)	(0.028)

lnDIST(ij)	-2.790***	-0.607***	0.801	-6.376***	-0.382	-3.793***	-3.015***	-0.632***
	(0.370)	(0.094)	(1.472)	(1.988)	(0.322)	(0.421)	(0.427)	(0.099)
Contiguity(ij)	1.651***	-1.045***	4.465**	-13.134*	-1.554***	0.471*	1.421***	-0.783***
	(0.120)	(0.241)	(1.761)	(7.049)	(0.550)	(0.276)	(0.143)	(0.174)
Common Language(ij)		0.419***	-0.624		0.732***	5.884***		0.363***
		(0.088)	(1.475)		(0.206)	(2.127)		(0.094)
Colony_1945(ij)	1.744***	0.213				-3.275	2.742***	-0.360*
	(0.207)	(0.321)				(2.951)	(0.493)	(0.192)
Common Colony(ij)	2.759***	0.120	-0.095	-1.745	-0.210	4.041***	1.980***	0.730***
	(0.594)	(0.258)	(2.880)	(1.425)	(0.275)	(1.069)	(0.201)	(0.139)
ln_area_od	-0.014	-0.051**	-0.066	1.847**	0.005	0.898**	-0.042	-0.056**
	(0.073)	(0.021)	(0.099)	(0.849)	(0.043)	(0.386)	(0.080)	(0.024)
Common Currency(ij)	-0.534***	-0.454*	-5.013***	0.879	-0.760	0.922	-0.703***	-0.053
	(0.149)	(0.255)	(0.245)	(2.612)	(0.482)	(0.993)	(0.167)	(0.085)
Regional Trade Agreement(ij)	0.026	0.554***	-0.232**	-0.199	0.553***	0.126	0.130	0.484*

	(0.132)	(0.127)	(0.092)	(0.135)	(0.181)	(0.103)	(0.156)	(0.251)
D(COOL)*D(Seafood)	-0.118	-0.710***	-0.125	0.095	-1.324***	-0.135	-0.252*	-0.601***
	(0.115)	(0.068)	(0.182)	(0.262)	(0.227)	(0.115)	(0.142)	(0.067)
D(development status)	0.178	0.383***						
	(0.153)	(0.118)						
D(development status)*D(Seafood)	0.185	0.275*						
	(0.542)	(0.162)						
Constant	19.038	- 30.873***		27.942*	-57.190***		12.295	-25.303***
	(11.720)	(2.313)		(16.693)	(7.755)		(15.384)	(2.226)
Observations	39,948	39,948	4,632	7,848	7,848	10,783	32,100	32,100
Number of pairid			431			1,198		
Importer fixed effect	No	No	No	No	No	No	No	No
Exporter fixed effect	Yes	No	Yes	Yes	No	Yes	Yes	No
Year fixed effect	Yes	No	Yes	Yes	No	Yes	Yes	No

Commodity fixed effect	Yes	No	Yes	Yes	No	Yes	Yes	No
Random effect	No	No	Yes	No	No	Yes	No	No
athrho	0.059			-0.150			0.197**	
	(0.047)			(0.158)			(0.082)	
lnsigma	0.756***			0.653***			0.786***	
	(0.021)			(0.047)			(0.027)	
Log pseudolikelihood	-52202.47			-12822.11			-38887.79	
Wald test of(rho = 0):								
chi2(1)	1.57			0.9			5.71**	
R square: between			0.660			0.549		

Chapter 2. Virtual Water Trade: Does Bilateral Tariff Matter?

2.1 Introduction

Economic growth, changing dietary habits, and climate change may exacerbate problems of water scarcity and uneven distribution of water (Debaere 2014). Thus, an evaluation of the movement of water between nations may serve as a useful tool to monitor this scarce resource. Analysis of virtual water trade (VWT) provides a way to evaluate the amount of water in products traded between countries. First proposed by Allan (1997, 1998), virtual water is the volume of water used during the entire production chain, a measure of embedded water in a product (Fracasso 2014). Blue VWT is the trade of irrigation water embedded in traded product, and green water is the precipitation on land, stored in soil or vegetation. Following the trade of embedded water may provide a useful way to identify and mediate the challenges of water scarcity.

Fracasso (2014) demonstrates that countries with scarce water tend to import water-intensive goods from water abundant countries using a gravity model. Debaere (2012) finds that relatively water abundant countries tend to export more water-intensive products. However, Ansink (2010) uses a 2×2×2 model to prove that comparative advantage in the production of water-intensive goods only holds under certain conditions and that virtual water trade does not necessarily follow the Heckscher–Ohlin-Vanek (HOV) trade model.

To explore whether bilateral tariff reshapes the VWT flows across nations, I augment the gravity model of VWT with water-relevant variables, following Fracasso (2014). I extend this model by including ad valorem equivalents (AVE) of tariffs to consider the effect of trade policy on VWT. To tackle the problem of multilateral resistance terms (MRT), the presence of zero

virtual water trade value and the potential heteroscedasticity problem, I estimate PPML model with importer, exporter, year and commodity fixed effects. There are four main differences between this paper and Fracasso (2014), the first is that I provide the theoretical foundation for virtual water trade (VWT) with HOV theory. In addition, virtual water trade is for 19 different crops rather than the aggregate agricultural goods. Moreover, I interpret the empirical result with the water intensity and that not in Fracasso's paper. Lastly, the bilateral tariff is more suitable in the gravity model and has been applied into our AvW gravity model instead of unilateral tariff, and the results demonstrate bilateral tariff could decrease the virtual water import significantly, compared with insignificant impact in Fracasso's paper.

This paper is the first to estimate the determinants of bilateral blue and green virtual water trade using PPML model with fixed effects of importer, exporter, year and commodity. The purpose of this paper is to estimate the determinants of the VWT using the AvW gravity model. The specific objectives are to determine: 1) whether bilateral tariffs affect the VWT flows; 2) whether the policy relevance of virtual water can be enhanced by considering bilateral tariff.

2.2 Literature Review

Virtual water is always calculated by the environmental engineering methods (Siebert and Döll 2010; Konar 2011; 2013); virtual water is defined as the volume of water used during the entire production chain (Fracasso 2015). VWT does not originate within the economic literature, which was first proposed by Allan (1997, 1998). Most of VWT has been calculated into unilateral value and only a few into bilateral amount (Hoekstra and Hung 2002; Oki etc. 2003; Ashok 2008; Wang etc. 2013; Konar 2011; Hoff 2013).

Most literature supports that virtual water trade could alleviate the problem of uneven water distribution, reduce the potential water conflict and verify the comparative advantage of virtual water. For example, Fracasso (2014) demonstrated that countries with scarce water tend to import the service of water embodied in the water-intensive goods and vice versa. Reimer (2012) demonstrated the comparative advantage using 2 country by 2 goods model. Debaere (2012) finds that relatively water abundant countries tend to export more water-intensive products, and verify water as the comparative advatange, but its effect is less than the traditional production factors affecting the trade flows, such as labor and physical capital. However Ansink (2010) uses $2\times 2 \times 2$ model to prove that comparative advantage in the production of water-intensive goods only holds under certain conditions, and virtual water trade does not necessarily follow the Heckscher–Ohlin-Vanek trade model. Moreover, Fracasso, Sartori and Schiavo (2015) provide the empirical results to support Ansink (2010) using the gravity model, they find that the country with the abundant water does not necessarily export the water-intensive service to other countries. However, there are few papers to provide the economic foundation for the import tariff impact on virtual water trade.

To date, the gravity model is one of most successful empirical models in economics (Anderson 2011), and it has often been used to analyze bilateral trade flows. The gravity model is a useful tool to investigate bilateral virtual water trade (Konar and Caylor 2013; Tamea et al. 2014). Although the gravity model was ad hoc, it was found to have high explanatory power when applied to the real data and the double-log relation makes more economic sense than a linear specification. Given its empirical success, formal theoretical foundations have already been provided by Anderson and van Wincoop (2003) (a conditional Armington-type specification), Eaton and Kortum (2002) (a Ricardian or supply side specification), and Helpman

and Krugman (1985) (a monopolistic competition model). Applying a gravity model to focus on the determinants of virtual water trade is not new. Within this literature, particularly relevant for our analysis, the bilateral trade are studied among the supply-oriented trade flows. For example, Fracasso (2014) use the gravity model to test the hypotheses whether virtual water trade is in line with HOV theory, countries export their relative water intensity based on the water endowments, as well as whether virtual water trade reflects the water endowment in one country. His empirical results show that water endowment and water pressure matters the water content of bilateral trade in agricultural products, and countries with scarce water tend to import the service of water embodied in the water-intensive goods and vice versa. However, they retain the policy implication from their findings, only when water efficiency, dietary regimes, regional disparities within countries, and the like are included into the gravity model. Fracasso, Sartori and Schiavo (2015) also apply the gravity model to investigate the determinants of the virtual water trade, but they find the country with the larger water endowment does not necessarily export virtual water to other counties; higher water irrigation price reduces the virtual water trade. Consideration of the comparative advantage of the water could help us to understand the virtual trade pattern and policy implications, and provide a possible way to make the policy implication in the perspective of virtual water trade.

From a technical perspective, there are three main problems which need to be taken into consideration when we estimate the drivers of VWT. Omitting these Multilateral Resistance Terms (MRTs) can bias the estimates of the gravity model (Anderson and van Wincoop 2003; Xiong and Beghin 2011). Fixed effect removes the effect of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable. Fixed effect can also be used to capture the size effects of incomes (Disdier, Fontagne and Mimouni 2008; Disdier and

Marette 2010) and correct the bias from omitting MRTs (Baier and Bergstrand 2007; Nhuong et al. 2013). Second, in presence of zero trade value, Silva and Tenreyro (2006) find that the Jensen's inequality results in the log-linearized model using OLS misleading in presence of the heteroscedasticity, PPML provides the robust results to different patterns of heteroscedasticity based on the Mont Carlo simulation and shows no sign of the misspecification. To deal with the zero trade value, they also use $\ln(1 + T_{ij})$, Tobit ($\ln(a + T_{ij})$, NLS (T_{ij}), PPML ($T_{ij} > 0$), and PPML (T_{ij}) covering 136 countries in 1990. They conclude that log-linearity of the gravity equation suffers from severe misspecification because of the presence of heteroscedasticity and the incompatibility with zero trade value; PPML is superior to other methods when they use the AvW gravity model. Third, the selection bias of the treatment effect results from non-natural experimental data.

The aim of the VWT metaphor is to alleviate the uneven water distribution and solve the water scarcity problem by trading the virtual water across nations. Recently scholars have estimated determinates of the virtual water, found the evidence to support VWT coincide with HOV theory, and made the policy implications. At the same time, the idea that VWT is a comparative advantage only holds under some special conditions.

2.3 The Theoretical Foundation of Virtual Water Trade

We first present a theoretical foundation for virtual water trade (VWT) with HOV theory. Though the maximization of constant elasticity of substitution (CES) utility provides the basis from consumption side for the gravity model, HOV theory can provide the basis from production, thus this section is a good theoretical supplement.

Allan (1997) first referred to the new terms of "virtual water," but water content is another name of virtual water (Davis and Weinstein, 2003), which has a long history in international trade. Virtual water is the water 'embodied' in a product and the amount water input per unit of output times the trade volume of crops, not in real sense, but in virtual sense. It links food, trade and water together. It refers to the water needed for the production of the product. Global trade in goods and services brings along global trade in "virtual water." VWT is the volume of water embedded in trade, which may be a useful tool to reduce the problem of water scarcity and uneven distribution problems.

Water content in the import of crop products is calculated using the amount water input per unit of output times the trade volume of crops; we use the VWT based on Hoff et al. (2013), who calculated the water content embedded in the imports of crop products. Reimer (2012) provides the economic foundation for virtual water trade without a tariff from production side; we extend him to develop a theoretical model of virtual water trade with and without the tariff. We use n× 2 × 3 model, that is to say, there are many countries, we take the home country and foreign country as example and both of them are small open economy (SOEs), two factors (capital K and water W), and three goods (other grains, paddy rice, and the wheat). I will denote the notions for home country and notions with asterisk (*) for foreign country. M_1, C_1 and y_1 denote the quantity of import, consumption and output of good 1 in home country; $X_2, y_2,$ and C_2 denote the quantity of export, consumption and output of good 2 in home country. Two factors are water (W) and capital (K) and assumed to be immobile.

By comparison, the home country is water scarce, and the foreign country is water abundant: $\frac{W}{K} > \cdots > \frac{W^*}{K^*}$;

The good 1 is water intensive:

$$\frac{a_{1W}}{a_{1K}} > \cdots > \frac{a_{19W}}{a_{19K}}$$

$$(\frac{W}{K})_1 > (\frac{W}{K})_2 > \cdots > (\frac{W}{K})_{19}$$

Where a_{iW} (a_{iK}) denotes the amount of water (capital) input per good i $(i = 1,2, \dots, 19)$. We assume perfect competition in product markets and factor markets, identical and homothetic tastes across countries, free trade, and no transportation costs. Home country p rice and foreign country price are equalized, saying $p_i = p_i^*$. Identical technology has also been assumed, and thus a_{iW} and a_{iw}^* are the same among nations.

Under trade, home country imports water intensive good 1 (M_1), and export capital intensive good 2 (X_2):

$$M_1 = C_1 - y_1$$

$$X_2 = y_2 - C_2$$

The water content of consumption:

$a_{1W}(y_1 + M_1) + a_{2W}(y_2 - X_2) = W + a_{1W}M_1 - a_{2W}X_2$

The home country budget constraint: $p_1c_1 + p_2c_2 = p_1y_1 + p_1y_2$, $p_1M_1 = p_2X_2$, we can get $M_1 = \frac{X_2P_2}{P_1}, X_2 = \frac{M_1P_1}{P_2}$, thus water content of consumption: $W + a_{1W}M_1 - a_{2W}X_2 = W +$ $M_1\left(a_{1W} - a_{2W}\frac{P_1}{P_2}\right)$, or $W + a_{1W}M_1 - a_{2W}X_2 = W + X_2(a_{1W}\frac{P_2}{P_1} - a_{2W})$

Zero profit condition-free entry: $a_{1W}n + a_{1K}r = p_1;\ a_{2W}n + a_{2K}r = p_2$

Thus water content of consumption becomes into $W + X_2\left(\frac{a_{1W}*a_{2K}-a_{2w}*a_{1K}}{a_{1W}w+a_{1K}r}\right) > W$, since $a_{1W} * a_{2K} - a_{2w} * a_{2K}$ is positive, and water content of production stays the same, this home country (water scarce) must be a net importer of water.

Import tariff on good 1

In n countries cases (countries all over the world), we assume the home country and foreign country are SOEs, both countries are price takers and tariff cannot affect the p_1 and p_1^*. If the home country raises a tariff on the import of good 1 (water intensive product), this will lead to an increase of good 1's price 1 from p_1 to (1+t) p_1. Water consumption of home country becomes:

$W + a_{1W}M_1 - a_{2W}X_2 = W + a_{1W}M_1 - a_{2W}\frac{M_1P_1(1+\mathrm{t})}{P_2} = W + M_1\left(a_{1W} - a_{2W}\frac{P_1(1+\mathrm{t})}{P_2}\right) = W +$

$M_1[\frac{(a_{1W}a_{2K}-a_{2W}a_{1K})r}{a_{2W}w+a_{2K}r} - \frac{(a_{1W}a_{2W}w+a_{2W}a_{1K}r)t}{a_{2W}w+a_{2K}r}] \gtrless W.$ Since $a_{1W}a_{2K} - a_{2W}a_{1K}$ is positive, thus $M_1[\frac{(a_{1W}a_{2K}-a_{2W}a_{1K})r}{a_{2W}w+a_{2K}r} - \frac{(a_{1W}a_{2W}w+a_{2W}a_{1K}r)t}{a_{2W}w+a_{2K}r}]$ has the indeterminate sign. When home country imposes import tariff on water intensive good 1, we are not sure whether the home country is net water importer. The tariff might be prohibitive, and then there would be no trade. That is to say, even water is a potential source of comparative advantage under trade without the import tariff might reshape water embodied in import. However, the home country would never export water in 2× 2 × 2 mode.

2.4 Data

The data are a panel dataset of VWT from 1998 to 2002, with 2,234,265 observations 68.23% of which is zero virtual water trade flows. We focus on contributors to bilateral imports of virtual water trade of 19 crops among 248 countries. Our blue and green virtual water trade data comes from Hoff et al. (2013) for comtrade sector[12]. The data set includes nineteen products (Potatoes,

[12] United Nations Statistics Division, commodity trade sector

Pulses, dry, Citrus, Grapes, Wheat, Rye, Barley, Maize, Rice, Sorghum, Soybean, Rapeseed, Sunflower, Cocoa, Cassava, Dates, Coffee, Millet, and Groundnuts), which are categorized into seven GTAP types (Veg & Fruit, Other Grain, Wheat, Paddy Rice, Oil Seeds, Other Food, and Other Crop). Data for distance, common border, colonial relationship, regional trade agreements, and common language are from the CEPII database. Data of bilateral ad valorem equivalent of tariff (AVE) of grain (HS-11) are from the Market Access Map (MAcMap), which are computed at the detailed level and measures applied protection at a bilateral level. We merger these four datasets by the country code, ISO country name, year and commodities into one dataset. The information of variables of EU and NAFTA come from Eurostat and the Office of the U.S. Trade Representative. Table 2.1 below presents the definitions and descriptive statistics for the dependent variable and independent variables, which will be used in the following estimations.

Table 2.1 goes about here

The water intensity (water input over output) and water abundance data are calculated based on Debaere (2014), since $\frac{W}{Y} = \frac{W}{K} * \frac{K}{Y}$ and all of products are crops and water intensive products, and $\frac{K}{Y}$ are assumed to be similar and fixed for each product, and thus the water intensities of seven categories of crops are ranked by $(\frac{W}{Y})_j$. From Table 2.2, we can see the rank of products according to their water intensity and water abundance.

Table 2.1 goes about here

2.5 Model Specifications

In this section, we estimate the determinants' effects of blue and green virtual water trade, and whether the VWT can be reshaped by the bilateral tariff. In addition, the gravity model is one of the most successful empirical models in estimation of factors affecting international trade (Anderson 2011). However, there are three main problems of the multilateral resistance terms,

the presence of the zero trade value and the heteroscedasticity, which have to be taken into consideration using gravity model (Anderson and van Wincoop 2003, Tran etc. 2011, among others). To address the MRTs, potential heteroscedasticity and the presence of zero trade value, the PPML model with fixed effects will been applied. The inclusion of GDPs has been questioned without micro-foundation (Tran etc. 2011; Disdier and Marette 2010). Thus, we will follow Anderson and van Wincoop (AvW) (2003) gravity model with fixed effects (exporter, importer, time, and product fixed effect) and without GDPs using PPML methods.

The standard gravity model

$$VWT_{ijt} = \exp(\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c)\left(1 + tariff_{ijt}\right)^{\gamma_1} \prod_{s=1}^{8} x_{s,ijt}^{\beta_s} \times u_{ijt}, \quad (1)$$

where *i* denotes exporting country and *j* importing country. In particular, X_{ij} are paired control variables of traditional gravity model: Distance_{ij}, $\text{Regional Trade Agreement}_{ij}$, Contiguity_{ij}, $\text{Common Currency}_{ij}$, Colony_{ij}, $\text{Common Language}_{ij}$. $\alpha_i, \alpha_j, \alpha_t,$ and α_c are exporter, importer, time, and product fixed effects. u_{ijt} is a random error such that $E(u_{ijt}|x_{ijt}, tariff_{ijt}) = 0$.

The basic specification of gravity model

Taking logs of the above equation gives a standard log-linear equation

$$\ln(VWT_{ijt}) = \alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \gamma_1 \ln(1 + tariff_{ijt}) + \sum_{s=1}^{8} \beta_s \ln x_{s,ijt} + \varepsilon_{ijt},$$

where $\varepsilon_{ijt} \equiv \ln u_{ijt}$. (2)

The specification of PPML model

Also, from the first equation above, it's follows that

$$E(VWT_{ijt}|x_{ijt}, tariff_{ijt}) = \exp(\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c)\left(1 + tariff_{ijt}\right)^{\gamma_1} \prod_{s=1}^{8} x_{s,ijt}^{\beta_s}, \quad (3)$$

since we assume that $E(u_{ijt}|x_{ijt}, tariff_{ijt}) = 0$.

To estimating this conditional mean via PMML, following Silva and Tenreyro (2006), we rewrite it as follows:

$$E(VWT_{ijt}|x_{ijt}, tariff_{ijt}) = \exp\big((\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c) + \gamma_1 \ln(1 + tariff_{ijt}) + \sum_{s=1}^{8} \beta_s \ln x_{s,ijt}\big). \quad (4)$$

VWT_{ij} represents virtual water embodied in the grain products exported by country i to country j. We test the hypothesis that whether tariff has a negative effect on WVT of crops, this is to say, whether import tariff could decrease WVT of crops. The coefficient we are interested in is $\boldsymbol{\gamma_1}$, under the hypotheses that $\boldsymbol{\gamma_1}$is significantly negative, implying that virtual water trade coincides with HOV theory and tariff could reshape virtual water trade. Policy makers might solve water scarcity and uneven distribution issue by enforcing different tariff on different crops. If they are statistically insignificant, tariff has no effect on the virtual water trade.

2.6 Empirical Results

To explore the determinants of virtual water trade across nations and test whether virtual water is the comparative water or not, we include the traditional trade factors into the gravity model with fixed effects. We focus on the bilateral blue VWT, not unilateral trade (net virtual water import or net virtual water export), and also conclude other key factors affecting the trade flows, such as the distance, regional trade agreement, common language, colonial relationship, area, currency and border between any paired countries. PPML model with importer, exporter, year and commodity fixed effects are estimated respectively to address the MRTs problem, the presence of zero virtual water trade value and the potential heteroscedasticity problem.

RESET test using powers of the fitted values of trade, the null hypothesis is that model has no omitted variables. Following Silva and Tenreyro (2006), PPML estimates are adequate

based on the p-values (bigger than 0.1) of the heteroskedasticity-robust RESET test. Standard errors are robust to clustering by country pair at the sector level (panel id).

Table 2.3 and Table 2.4 report the results of PPML models for blue and green VWT across 19 crops and specific crops (other grains, paddy rice, and wheat) with and without bilateral import tariff. Our interested coefficient (γ_1) of $\ln(1 + t\text{ariff})$ [13] is estimated as the price elasticity of importing countries' demand for virtual water, estimated "on average" for all years and countries. The tariff has statistically negative effects on blue and green virtual water trade. One percent tariff raise decreases VWT of all nineteen crops by 0.416% and 3.154%. The tariff has negative effects on green and blue virtual water trade for less water intensive crops; the effect ranges from -0.416 % to -3.621%. In sum, our results show little difference in the determinants of blue virtual water import and green virtual water imports. However, we find differential effects among the determinants of VWT across 19 crops. The tariff has a negative effect on the blue and green virtual water imports for more water intensive crops, since Other Grains, wheat and paddy rive are more intensive crops than Vegetable & fruit, other crops and other food in our 19-crop sample.

The different effects of bilateral import tariff on blue or green virtual water trade can be explained by differences in elasticities for different categories of crops; thus, VWT may respond to price effects from tariffs in a different way, as suggested by the water elasticities estimated in Chen (2016). This means tariff reductions may increase the trade flow of virtual water and make the water redistribution more efficient. Trade policies such as tariffs may shift the trade of water

[13] We assume tariff is the water price change. From algebra, $E(VWT_{ijpt}|x_{ijt}) = \exp[\alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \beta_1 \ln(1 + \text{tariff}) + \sum_1^8 \gamma_1 x_{ijt}]$ is equivalent to $\ln(VWT_{ijpt}|x_{ijt}) = \alpha_0 + \alpha_i + \alpha_j + \alpha_t + \alpha_c + \beta_1 \ln(1 + tariff) + \sum_1^8 \gamma_1 x_{ijt}$, where $\Delta P = \text{tariff}$, and P is water price.

embedded in products. Results suggest tariffs might be a useful policy instrument for managing the flow of virtual water across countries, thus addressing issues associated with water scarcity.

The estimates demonstrate that a historical Conical tie or common language increase virtual trade among any two countries. Distance is the key determinant of virtual water import, and the absolute value of its coefficient is different from previous literature and range from 1.014 to 1.607, such as Grant and Boy (2011) with -1.12 and Anders and Caswell (2009) between -0.719 and -0.10. Dummy variables of countries that share the same border and have colonial ties always trade more, and vice versa. The impact of Contiguous variable on blue virtual water export flow is much higher than other scholars' estimates. The countries with common border contribute to an increase of 63.07 %[14] virtual water import flow, while a 0.28% decreases of fishery import as estimated by (Wilson 2013). Historical colony increases by 188.35%. All signs of variables are as expected.

The incorporation of the bilateral tariff does not change the marginal effects of the control variables much, implying the robustness of estimates. One percentage point decrease of the AVE reduced VWT by 0.416% and 3.154% for blue and green virtual water import, which is much greater then Disdier, Fontagné, and Mimouni (2008) with a decrease of 0.02 on agricultural trade. This means tariff reduction could increase the trade flow of virtual water and make the water redistribution more efficient. Trade policies such as tariffs may shift the trade of water embedded in products. These results point to the policy relevance of virtual water trade analysis.

In summary, there are no big different effects between determinants of blue virtual water import and green virtual water import; there are different effects among the determinants of

[14] $e^{(-1.014)}$-1=0.6307

VWT of 19 crops. In addition, the tariff has a negative effect on the blue and green virtual water import for more water intensive crops, but positive or no effect on less water intensive crops.

Tables 2.3 and 2.4 go about here

2.7 Conclusion

To explore the determinants of virtual water trade across nations and test whether bilateral import tariff reshape virtual water trade or not, I include the traditional trade factors and bilateral import tariff in to the gravity model with fixed effects. Previous literature always uses the truncated OLS and PPML specifications of gravity model to estimate the factors affecting the VWT (Fracasso 2014; Fracasso, Sartori and Schiavo 2015). In addition, unilateral trade, such as net virtual water import or net virtual water export, rather than bilateral trade, have been considered in Debaere (2012) and Hoekstra Hung (2005) paper, which might hinder other key characteristics of paired country affecting the trade flows, such as the distance, regional trade agreement, common language and border between any paired countries. To tackle the problem of MRTs, the presence of zero virtual water trade value and the potential heteroscedasticity problem, PPML model fixed effects have been estimated. Virtual water metaphor is to address the problems of water scarcity and uneven distribution of water across the globe. If only the endowment effect of VWT is considered, the estimates of VWT are always biased, thus I take the comparative advantage into consideration. This paper is the first to estimate the determinants of bilateral virtual water trade with the bilateral tariff, rather than unilateral trade, using PPML with fixed effects of exporters, importers, year and commodity.

The results of PPML model show that traditional trade factors affect the blue virtual water exports, a historical conical tie or common language increase virtual trade any two countries; the distance decreases the VWT. The variables of interest also have expected

statistically significant negative signs, and thus show that the tariff has a negative effect on the blue virtual water trade.

Table 2.1. Definitions of Variable and Sample Statistics

Dependent Variables		Mean	Std. Dev.
Blue Virtual Water Import	Blue virtual water embodied in the grain products imported by country i from country j	8.694	467.568
Green Virtual Water Import	Green virtual water embodied in the grain products imported by country i from country j	9.297	44.593
Independent Variables			
$Ln(1+ tariff_{ijt})$	Bilateral ad valorem equivalent of tariff (AVE)	0.108	0.146
$lnDIST_{ij}$	Weighted distance between exporter and importer km	8.697	0.764
$Contiguity_{ij}$	1 for common border between importer and exporter;0 otherwise	0.020	0.140
$Common\ Language_{ij}$	1 for common official of primary language; 0 otherwise	0.129	0.335
$Colony\ post\ 1945_{ij}$	1 for pair ever in colonial relationship post 1945; 0 otherwise	0.008	0.087
$Common\ Colony_{ij}$	1 for pair ever in colonial relationship; 0 otherwise	0.013	0.114
$current\ Colony_{ij}$	1 for pair current in colonial relationship;0 otherwise	0.0002	0.015
$ln[Area_i * Area_j]$	Area of importer times that of exporter (sq. kms)	3.002	3.174
$Common\ Currency_{ij}$	1 for Common Currency; 0 otherwise	0.010	0.0991
$Regional\ Trade\ Agreement_{ij}$	1 for regional trade agreement in force; 0 otherwise	0.059	0.236
EU	1 for both countries from EU; 0 otherwise	0.008	0.088

NFATA	1 for both countries from NAFATA; 0 otherwise	0.020	0.141
No. of Obs	2,234,265		

Table 2.2 Direct and Indirect Water Intensity Rank with average bilateral tariff

Water Intensity Rank[15] (W/y)	Crop Name	Average Tariff
	All Crops	0.145
1	Osd: Oil Seeds	0.087
	(Soybean, Rapeseed, Sunflower, Groundnuts)	
2	Gro: Other Grains	0.111
	(Pulses, Rye, Barley, Maize, Sorghum, Millet	
2	Wht: Wheat	0.093
	(Wheat)	
2	Pdr: Paddy Rice	0.276
	(Rice)	
5	V_f: Veg & Fruit	0.186
	(Potatoes, Citrus, Grapes, Cassava, Dates)	
6	Ocr: Other Crops	0.108
	(Coffee)	
7	Ofd: Other Food	0.155
	(Cocoa)	

[15] Direct and indirect water

Table 2.3 Result of blue virtual water import for all crops and specific crops with and without Tariff

VARIABLES	(1) tariff	(2) no tariff	(3) tariff	(4) no tariff	(5) tariff	(6) no tariff	(7) tariff	(8) no tariff
	19 crops	19 crops	Other grains	Other grains	Paddy rice	Paddy rice	Wheat	Wheat
$Ln(1+ tariff_{ijt})$	-0.416**		1.261**		-3.708***		-3.621***	
	(0.198)		(0.558)		(1.205)		(0.951)	
$lnDIST_{ij}$	-1.014***	-0.989***	-1.846***	-1.799***	-1.206***	-1.205***	-1.685***	-1.607***
	(0.122)	(0.116)	(0.269)	(0.256)	(0.178)	(0.179)	(0.292)	(0.277)
$Contiguity_{ij}$	0.489**	0.503**	0.666	0.668	0.850**	0.829**	0.305	0.335
	(0.249)	(0.246)	(0.451)	(0.434)	(0.361)	(0.337)	(0.363)	(0.353)
$Common\ Language_{ij}$	-0.106	-0.102	0.0858	0.145	0.0730	0.0245	0.255	0.217
	(0.199)	(0.195)	(0.524)	(0.527)	(0.250)	(0.244)	(0.283)	(0.279)
$Colony\ post\ 1945_{ij}$	1.059***	1.073***	1.139	1.046	0.546	0.911**	1.237*	1.147
	(0.405)	(0.403)	(0.724)	(0.702)	(0.495)	(0.435)	(0.741)	(0.765)
$Common\ Colony_{ij}$	0.134	0.143	0.167	0.157	0.902*	0.656*	-1.131**	-1.078**
	(0.254)	(0.250)	(0.420)	(0.419)	(0.483)	(0.398)	(0.508)	(0.523)
$Current\ Colony_{ij}$	-0.859	-0.854	-2.657**	-2.588**	-0.761	-0.834	-1.737	-1.317
	(0.880)	(0.875)	(1.041)	(1.012)	(0.927)	(1.123)	(1.221)	(1.188)
$ln[Area_i * Area_j]$	-3.518*	-3.494*	1.346	0.718	-4.186*	-4.092*	-3.967*	-4.191*
	(1.931)	(1.925)	(2.585)	(2.572)	(2.175)	(2.221)	(2.406)	(2.223)
$Common\ Currency_{ij}$	-0.244	-0.231	-0.701***	-0.693***	-0.290*	-0.154	0.494*	0.538*
	(0.160)	(0.158)	(0.203)	(0.201)	(0.170)	(0.170)	(0.293)	(0.290)
$Regional\ Trade\ Agreement_{ij}$	0.619***	0.642***	0.0120	0.174	-0.169	0.00316	0.467	0.623*
	(0.217)	(0.216)	(0.375)	(0.375)	(0.368)	(0.388)	(0.354)	(0.342)
EU_{ij}	1.893***	1.942***	3.780***	3.501***	0.682	1.892***	2.712***	2.767***
	(0.377)	(0.365)	(0.724)	(0.687)	(0.484)	(0.403)	(0.613)	(0.624)
$NAFATA_{ij}$	15.10***	15.02***	12.46*	14.20**	22.03***	21.68***	22.73***	22.63***

	(4.922)	(4.907)	(6.508)	(6.483)	(5.608)	(5.717)	(6.132)	(5.681)
RESET test P-values	0.415	0.652	0.013	0.016	0.014	0.012	0.135	0.261
Constant	27.06**	26.68**	-5.723	-2.359	32.32**	31.63**	35.76**	36.89***
	(11.89)	(11.86)	(15.33)	(15.33)	(13.53)	(13.84)	(14.44)	(13.43)
Observations	2,234,265	2,932,650	590,610	758,880	77,960	101,920	69,635	81,445
R-squared	0.192	0.190	0.393	0.384	0.411	0.396	0.328	0.319
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **and * significant at 1%, 5%, and 10%, respectively; numbers in parentheses are robust standard errors clusters in importer, exporter, and products.

Table 2.4 Result of green virtual water import for all crops and specific crops with and without Tariff

VARIABLES	(1) tariff	(2) no tariff	(3) tariff	(4) no tariff	(5) tariff	(6) no tariff	(7) tariff	(8) no tariff
	wheat	wheat	paddy rice	paddy rice	19 crops	19 crops	Other grains	Other grains
$Ln(1+ tariff_{ijt})$	-3.154***		-2.590**		-0.0218		0.520	
	(0.845)		(1.314)		(0.263)		(0.530)	
$lnDIST_{ij}$	-1.513***	-1.493***	-1.168***	-1.204***	-0.960***	-0.954***	-1.593***	-1.591***
	(0.161)	(0.156)	(0.221)	(0.204)	(0.102)	(0.0994)	(0.159)	(0.159)
$Contiguity_{ij}$	0.350	0.384	1.297***	1.187**	0.281	0.294	0.772***	0.760***
	(0.287)	(0.288)	(0.502)	(0.470)	(0.188)	(0.188)	(0.242)	(0.244)
$Common\ Language_{ij}$	0.238	0.249	-0.0526	-0.0406	-0.0381	-0.0457	-0.0512	-0.0484
	(0.201)	(0.195)	(0.289)	(0.280)	(0.162)	(0.160)	(0.256)	(0.257)
$Colony\ post\ 1945_{ij}$	1.476**	1.468**	0.137	0.678*	1.701***	1.708***	0.459	0.477
	(0.697)	(0.699)	(0.487)	(0.391)	(0.361)	(0.360)	(0.563)	(0.560)
$Common\ Colony_{ij}$	-0.768	-0.797	0.838**	0.681*	-0.446	-0.442	-0.326	-0.322
	(0.548)	(0.553)	(0.419)	(0.352)	(0.286)	(0.285)	(0.427)	(0.428)
$Current\ Colony_{ij}$	-4.952***	-1.148	0.439	-1.859	-0.408	-0.410	-0.927	-0.916
	(1.263)	(1.350)	(1.122)	(1.239)	(1.052)	(0.999)	(1.154)	(1.146)
$ln[Area_i * Area_j]$	-5.386	-5.485*	-5.884***	-5.855***	-2.991	-2.977	-0.424	-0.604
	(3.361)	(3.330)	(1.335)	(1.359)	(1.845)	(1.844)	(2.098)	(2.094)
$Common\ Currency_{ij}$	-0.130	-0.122	-0.0798	0.0314	0.102	0.102	0.0598	0.0725
	(0.385)	(0.388)	(0.249)	(0.260)	(0.170)	(0.169)	(0.196)	(0.196)
$Regional\ Trade\ Agreement_{ij}$	0.538**	0.692***	0.152	0.223	0.320	0.316	0.270	0.304
	(0.270)	(0.252)	(0.378)	(0.385)	(0.195)	(0.193)	(0.217)	(0.215)
EU_{ij}	0.120	0.0905	0.194	1.096**	-0.380	-0.381	-0.318	-0.370

	(0.373)	(0.376)	(0.574)	(0.455)	(0.287)	(0.284)	(0.365)	(0.365)
$NAFATA_{ij}$	31.09***	30.95***	24.67***	24.63***	15.22***	15.18***	9.353*	9.876*
	(8.615)	(8.526)	(3.495)	(3.555)	(4.699)	(4.696)	(5.379)	(5.359)
RESET test P value	0.07	0.039	0.483	0.514	0.000	0.000	0.036	0.048
Constant	34.81*	35.50*	39.16***	39.13***	22.27*	22.17*	12.98	14.06
	(20.58)	(20.39)	(8.096)	(8.302)	(11.43)	(11.42)	(13.04)	(13.01)
Observations	27,560	32,260	89,900	117,520	2,436,087	3,196,902	758,820	976,440
R-squared	0.709	0.705	0.522	0.511	0.251	0.250	0.404	0.408
Importer FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

***, **and * significant at 1%, 5%, and 10%, respectively; numbers in parentheses are robust standard errors clusters in importer, exporter, and products.

Chapter 3. Banking Crises and the Performance of MIFs

3.1 Introduction

Microfinance Institutions (MFIs) serve over 200 million clients who are without other access to financial services (Summit Campaign Report, 2015). More than half of these clients are poor borrowers who received their first loan. The financial crisis that started in the USA in 2008, had ripple effects across the globe and consequences repercussions for the financial system of all countries and affected traditional banking as well as the microfinance industry (Laeven and Valencia, 2013; Wagner 2012). Relative to traditional banking, MIFs are more resilient to banking crisis because they have different ownership, target group mission, capital structures, financial services technologies, and different efficiency levels (Wijesiri 2016; Wagner 2012). A financial or a banking crisis may affect different MFI ownership types differently, such as the banks, non-bank financial institutions (NBFIs), non-government organizations (NGOs), and Credit Unions. Similarly, the financial systems of countries of various regions and level of economic development were affected differentially by the global financial troubles following 2008. There have been many banking crisis in many countries and these are captured by significant signs of financial distress and banking policy intervention measures as a consequence of significant losses in the banking system, which created by Laeven and Valencia (2013). A banking crisis is defined as significant bank runs, losses in the banking system, and/or bank liquidations (Laeven and Valencia 2013). The global financial crisis is always been measured according to the eruption period 2007-2008. For example, Wijesiri (2016) uses the periods before (2005-2007), during (2007-2008), and after the global financial crisis (2008-2011); while a crisis dummy for years 2008–2009 and a post-crisis dummy for years 2010–2011 is used by

Silva and Chávez (2015). A time dummy variable that is 1 in 2008 and 2009 is used in Wagner and Winkler (2013), and a year dummy for 2007-2008 in Di Bella (2011). Silva and Chávez (2015) find that MFIs operating in a higher quality of institutional county and stronger governance are more resilient. Wagner and Winkler (2013) demonstrates that the crisis have a negative effect on the credit growth controlling for country-, MFI-, macroeconomic-, and structural characteristics- specific variables. In this paper, I evaluate how the shock of a banking crisis in general and of a banking crisis following up the 2008 global financial crisis affected the ability of MFIs to reach their dual objective of outreach and financial sustainability.

In the analysis, I use a global dataset of over 621 MFIs with from over 118 countries for the period 2001-2011. The data contains variables of measuring various MFI characteristics, financial statements variables, as well as recently published banking crisis data identifiers, and data from 3 rounds of the World Bank survey of Central Banks covering the study period. The method employed is simple exogenous dummy as well as Difference-in-Difference (DiD). The goal is to see how outreach, measured by (log of) the number of active borrowers and average loan balance per borrower over GNI per capita, and sustainability, measured by the return on assets (financial results) were affected by a banking crisis and by a banking crisis after the global financial crisis.

While a few papers have tried to explain various aspects of the post-2008 financial environment for MFIs and the institution' reaction, this is the first study of the impact of a banking crisis and if a banking crisis have been more devastating after the 2008 global financial crisis. The global financial crisis and the following banking crises are not natural experiments but can be considered an exogenous quasi experiment or event impact. I use the DID specification to control for the MFIs and environment's unobserved characteristics.

3.2 Conceptual Framework and Previous Literature

Wagner and Winkler (2013) include the MFI-and country-level data and MIF fixed effect to control for the unobservable potential variables using panel analysis and cross-section analysis. They conclude that the MIFs became more vulnerable to the 2008-2009 global financial crisis, and that the credit growth drops sharply after 2008. Imai et al. (2011) study the impact of the macroeconomic factors or the crisis or macro-institutional factor on the performance of MIFs using three stages least squares (3SLS) and fixed effect vector decomposition (FEVD). They find that share of domestic credit to GDP, GDP has positive impact on MFIs' profitability, operation expense ratio and portfolio quality. Silva and Chávez (2015) estimate the influence of country institutional and governance characteristics on the performance of MIFs during the global financial crisis using a MFI fixed effects panel data regression. They support that MIFs in a stronger institutional quality are more resilient to the effect of the global financial crisis, thus they believe that the government can create an enabling environment for MFIs and play a crucial role in supporting MIFs in terms of outreach and sustainability. Quayes (2015) uses a large panel data to provide an empirical evidence that the there exists a trade-off between outreach and financial sustainability, that is to say, the greater outreach to the poor has a positive impact on the financial performance. Wijesiri (2016) employs a Malmquist Luenberger productivity index (MLPI) to estimates effect of the 2008 global financial crisis on the productivity dynamics of different MFI ownership types, since he supports that different MFI ownership types have different technologies efficiency levels. They find that non-bank and bank suffers more during and early post-2008 global financial crisis, but perform better immediately pre-crisis. However, cooperatives and non-government organizations were less influenced by the eruption of crisis. Wagner (2012) comments that MFI has greater resilience to financial crisis compared to the traditional banking.

The MIFs has a dual objectives from an organizational perspective, one is outreach, try to reach as many as poor people or entrepreneurial poor; another is sustainability, to cover its cost and produce healthy returns (Conning Jonathan and Udry 2007). Thus, this paper estimates how the global banking crisis affects the number of outstanding borrowers and the sustainability of MIFs. Table 3.1. Shows a brief summary of the previous finding about the effect of the financial crisis on MFIs.

Table 3.1 goes about here

In this paper we rely on a Difference-in-difference (DID) framework because DiD estimators are helpful to study on the policy implication by isolating the policy impact from the observational factors, such as macroeconomic indicator changes (Antwi, Moriya and Kosali 2015; Cameron & Trivedi 2005). DID methodology has often implemented by the interaction term between the time and group indictor, which refers to the difference over time in the outcome variable between groups (Puhani 2012). Researchers, traditionally in applied economics, use the DID strategy to evaluate the causal impact of the implementation of a policy on the target group. For example, Card and Krueger (1994) introduce DID to compare the employment growth at stores in New Jersey and Pennsylvania, and estimate the impact of New Jersey's minimum wage increase on employment outcome. Antwi, Moriya and Kosali (2015) studied on the impact of the ACA young adult health insurance expansion on inpatient hospitalizations for young adult who aged 27-29 and aged 19-25 years, comparing the change of their mental visit and general health visit.

We believe that DID method is appropriate because it can isolate the banking crisis effect from the unobservable change which might affect MFIs performance. The DID methodology is

commonly used to compare the performances of a "treatment" group relative to those of a "control" group between pre- and post-treatment However, we know of only one application of DID into the MFIs. Kuchler (2012) uses the fixed effect model with a DID specification to analyze whether microfinance programs have affected fertility in Bangladesh, and he finds there is no effect of participation of MFIs program on fertility. Garmaise and Natividad (2010) employs a regression discontinuity model to estimate the effect of eligibility criteria of a subsidy inn the operational efficiency of MFIs. Results show that the effect of such subsidy is mixed.

Our paper differs from previous work in several aspects. First, we study the impact of any bank crisis and compare those with results from the specific impact of banking crises that started after the global financial turmoil of 2008. In addition, unlike previous work we do not ignores the dual aspect of the MFI's goals – namely the fact that they must outreach and sustainability. This is important because the literature provides evidence for a trade-off between the outreach and the sustainability dimensions of MFIs' performance, suggesting that financial success may come at the expense of serving fewer and less poor clients "mission drift" that is MFIs may focus on maintaining their financial results at the expense of their outreach to the poor. Several studies confirm the existence of the "mission drift" (Cull et al., 2007 & 2009; Augsburg and Fouillet, 2010; Nawaz, 2010, Armendariz and Szafarz, 2011; Hermes, Lensink and Meesters, 2011, Hartarska et al., 2013; Quayes, 2015), while some suggest that financial sustainability and social outreach complement and reinforce each other (Gonzalez and Rosenberg, 2006; Schicks, 2007). Thus, we addresses the concern by evaluating how banking crises affect sustainability and outreach

3.3 Data

Data for this study come from several sources. First, individual MFI data come from MIX MARKET information platform (www.mixmarket.org). The data for the study period of 1998-2011 contains information for 621 MFIs from 118 countries, which result in about 2,192 individual annual MFI observations. Only observations with at least three stars for quality of reporting are used.

Banking crisis data are from Laeven and Valencia (2013) and contain information for a period up to and including 2011. A banking crisis is defined by the authors as cituation characterizes by banks run, significant losses in the banking system, and/ or bank liquidation. Within the sample, we find two countries with fully fledged banking crisis –Russia in both pre and post-global financial crisis period and Kazakhstan after the global financial crisis. This is the case because, unlike previous financial crises, the 2008 US financial crisis lead to a wave of banking crisis affecting mostly advanced economies.

The rest of the data comes from several rounds World Bank sponsored survey of central banks (see Barth, Caprio and Levine, 2013). Since MFI has the dual objectives, one is to reach as many as poor people or poor business, and sustainability, to cover its cost and produce healthy returns (Conning Jonathan and Udry 2007). Thus, the number of active borrowers is a proxy of the MFI's outreach-how many poor clients MFI could reach. In addition, it includes measure of the return-to-assets for the banking system to measure opportunity costs to microfinance activities as well as an index of the independence of the supervisory body to measure the stringency of banking regulations within a country. Moreover, the average loan balance per borrower / GNI per capita is most widely used measure for depth of outreach, that is to say, how poor clients the outreach could reach. Table 3A1 presents the definitions of dependent and independent variables.

The MFIs in sample are from 1999 to 2011, most of banking crisis have happened in 2005 (9.15%), 2006 (10.53 %) and, 2007 (19.76%). Table 3.2 shows that the summary statistics of the variables used in the empirical analysis with and without (the global) banking crisis. There are statistically significant difference between pre-global financial crisis and post- global financial crisis in terms of the NAB and depth, and no significant difference for return on assets. In addition, most of variables MFI characteristics and country characteristics are statistically different before and after global financial crisis, except ratio of loans outstanding to total assets and portfolio-at-risk from the t test in Table 3.2.

The overall data constitute an unbalanced panel, as for 1999-2011 and includes over 621 MFIs. In terms of regions, there are 59 observations from Africa, 48 from East Asia and the Pacific region (EAP), 118 from Eastern Europe and Central Asia (ECA), 233 from Latin America (LAC), 29 from Middle East and North Africa, and 134 from South Asia (SA). Table 3.3 provides the number of MFIs, banking crisis and their percentages across six different regions and shows most of MFIs are from Eastern Europe and Central Asia (15.3%), Latin America and The Caribbean (43.6%), and South Asia (22.2%), but banking crisis only occurs in Eastern Europe and Central Asia.

The diversity of organizational structured on MFIs is reflected in our sample. We have 28 Banks, 84 Credit Unions/Cooperative (CU), 253 non-bank financial institutions (NBFIs), 213 non-governmental organizations (NGOs), 40 rural banks and 4 other tapes. Summary statistics by groups of MFIs with and without banking crisis are presented in Table 3.2. In this paper, MFI types are measured by Bank, CU, NBFI, NGO, rural bank and other types, and Bank has been omitted as the reference group (Hartarska 2005). The number and percentages of MFIs and banking crisis across six different legal statuses in Table 3.4 demonstrate that the Credit Union /

Cooperative of MFIs might oversample (over present), since CU only accounts for 9.4% but it occupied about 51.4% of banking crisis. It could be explained that CU are more easily to be affected by banking crisis compared with other types of MFIs, such as Bank, NNFI, and NGO. In addition, there are 9%, 40%, and, 40% banking crisis happen in Bank (5%), NBFI (44.6), and NGO (36.8), and thus these three types of MFIs are appropriate presented for the effect evolution of global banking crisis.

Analysis of the data reveals that all of the banking crisis recorded during the study period were in Eastern Europe and Central Asia, with 2 countries Russia and Kazakhstan in our sample, and two of them had a banking crisis after 2008 (Russia and Kazakhstan). Only Russia has had banking crises before the global financial crisis with over 66 observations in total. However, since our data is unbalanced data, there is no between-in difference for the specific MFIs, that is to say, banking crisis is time-invariant in our sample.

Table 3.2 goes about here

3.4 Model Specification

The aim of this paper is to estimate whether the 2008-2009 global banking crisis has a significant effect on the outreach and sustainability of MFIs, such as returns on assets, and the number of outstanding borrowers, controlling for the MFI specific and country level variables. Moreover, we also control for the impact of the global banking crisis differs depending on the banking regulations by including financial system characteristics (returns of assets of the banking system' and an index of financial statement transparency).

While a variety of approaches are useful to evaluate whether a treatment (or an event) effects an outcome of interest – such as propensity score matching, regression discontinuity design and

Instrumental Variable Methods (Cameron & Trivedi 2005), we set out to use Difference-in-Differences. A banking crisis is not imposed as a controlled experiment, resulting in the non-randomization of assignment into treated and control groups. For an MFI operating in a country it can be considered and exogenous event or treated. The selection bias (into affected and not affected by the financial crisis to develop a banking crisis). Graph 1, shows that there is no obvious jump at cut off (2008 year), which does not satisfy the key assumption of the regression discontinuity design. Besides, there is no endogeneity of MFIs being in a country with a bank crisis, since it can be in a fixed location anywhere all over the world. Thus, a Difference-in-Differences will capture the best the results of the post-crisis impact (Lei & Lin, 2009) and we estimate the "treatment" effect or the impact of a banking crisis on MFI performance. We assume the treatment and control group have the same trend in the outcome pre- and post-treatment to control for the changes caused by existing different between those two groups. This is a strong assumption, but it hold because we can consider that the MFIs have "randomly" chosen to be in any country when the crisis hit. Specifically, we estimate

$$outcome_{it} = \beta_0 + \beta_1 Banking\ Crisis_{it} + \beta_2 Post2008_i + \beta_3 Banking\ Crisis * After\ 2008_{ijt} + f(X_{ii,jt}) + \varepsilon$$

Performance of MFIs (returns on assets, the number of outstanding borrowers, and the depth of outreach measured by average loan balance per borrow) are the proxies of outcome_i. $Post2008_i$ is equal to 0 if the individual is from 1995 and 2007 (pre-crisis), 1 if the individual from 2008 and 2014 (post-crisis), $Banking\ Crisis\ jt$ here is one if a country j had a banking crisis in year t. The coefficient of interest here is β_3 with positive coefficient indicating that after the financial crisis MFIs had a better performance (positive impact) and a negative coefficient

indicating that worsened MFIs performance. $\text{Banking Crisis} * \text{Post } 2008_{jt}$ is the difference in outcome for the MIFs suffer from crisis before 2008 compared to those after 2008. $X_i t$ denotes all other controlling variables. It included country characteristics (such as inflation and the size of the economy), MFIs characteristics (MFI age, ratio of capital to total asset, the total assets, ratio of saving to total assets, ratio of loans outstanding to total assets, portfolio-at-risk > 30 days, the type of MFIs and whether it is regulated by a government regulatory agency).

From Graph 1 shows four potential specification of model- Linear with same slope an intercept, Linear with different slope and intercept, Quadratic form with same slope and intercept, Quadratic form with different slope and intercept. Intuitively, quadratic form could not do a better job than linear-form, thus we should choose the simplest one of the liner forms, thus the specification of empirical analysis is below. The empirical analysis of MFIs performance usually specifies the performance of a function of MFI specific, macroeconomic, institutional factors and regulatory framework (Hartarska and Nadolnyak 2007 & 2008; Hartarska 2005; Wagner & Winkler 2013). Following these studies, the detailed specification estimated is:

$$P_{it} = \beta_0 + \beta_1 Banking\ Crisis_{it} + \beta_2 Post2008_i + \beta_3 Banking\ Crisis * After\ 2008_{ijt} + \alpha MFI_{ijt} + \beta' C_{jt} + \gamma FS_{jt} + \varepsilon_i + \varepsilon_j + \varepsilon_t + u_{ijt}$$

$$P_{it} = \beta_0 + \beta_1 Banking\ Crisis_{it} + \beta_2 Post2008_i + \beta_3 Banking\ Crisis * After\ 2008_{ijt} + \beta_4 time\ since\ 2008 + \alpha MFI_{ijt} + \beta' C_{jt} + \gamma FS_{jt} + \varepsilon_i + \varepsilon_j + \varepsilon_t + u_{ijt}$$

Where *i* denotes microfinance, *j* denotes country, *t denotes* time; P_{it} is a performance variable for MFIi ate time *t*: the number of active borrowers which measures the outreach goal, as well as the ROA, which measure MFIs ability to cover its cost. We cluster standard error at

microfinance institutional level to solve the potential heteroscedasticity (Wagner & Winkler 2013; Hartarska and Nadolnyak 2007; Hausman Taylor estimates 1981).

Since our empirical results use panel data, thus we use a test of fixed vs. random effects, which could be seen as a test of overidentifying restrictions. The fixed effects assume the repressors (X_{it}) are uncorrected with residuals (u_{ijt}),), i.e., $E(X_{it} * u_{ijt}) = 0$ and random effects assumes the repressors are uncorrected with unobserved individual effects ε_i, i.e., $E(X_{it} * \varepsilon_i) = 0$; both of these conditions are overidentifying restriftions. A Wald test of the significance of additional regressors have been implemented using an artificial regression of a random effects equation (Xtoverid), since it extends Hausman version to heteroskedastic- and cluster-robust versions (Schaffer and Stillman 2010 STATA help).

MFI_{ijt} is a vector of MFIs institutions specific characteristics; C_{jt} includes macroeconomic country-specific variables; FS_{jt} are the characteristics of the financial system. And $\varepsilon_i,\ \varepsilon_j,\ and\ \varepsilon_t$ are the MFI, country and year fixed effects, these fixed effects estimators are to control for all unobservable persistent MFIs-, country- and time- specific effects, u_{ijt} is an error term. Since the empirical analysis uses panel data, the financial crisis of interest is changing all the time, we can choose the fixed effects to control for the individual unobservable effect.

The variables of MFIs level are used to analyze the factors affecting MFIs performance from the supply side. By contrast, macroeconomic country-specific variables and of the financial system could influence the MFIs performance from demand side (Igan & Pinheiro 20111; Wagner & Winkler 2013). Following Bulletin (2008), MFI leverage is defined by the ratio of capital to total asset. MFI size is measured by the logarithm of total asset, and age classified into

three categories (Mature, New and Young) according to difference between the inception and the year of data submitted by MFIs (Mix market 2017). We also include the measure of lending, saving, and risk exposure using the ratio of gross loan portfolio to total assets, ratio of deposits to total assets, and ratio of capital to total asset (Hartarska and Nadolnyak 2008). MFI regulated or not also matter its performance by entry restrictions and /or some supervision (Hartarska and Nadolnyak 2008), thus a dummy of whether MIF is regulated by a government regulatory agency has also be considered. MFI type and original region measured by five (CU, NBFI, NGO, Other, and Rural Bank; and Bank as reference group) and one dummies (EECA, non-EECA as reference group).

Our country characteristics variables, such as inflation-average consumer price index (Wagner & Winkler 2013; Hartarska and Nadolnyak 2008), economics size (the logarithm of GDP) and control corruption influence the interest of deposits from depositors (Hartarska and Nadolnyak 2008). Financial system characteristics variables, such as supervisor tenure, independence of supervisory authority, external governance index, return on assets of bank, and financial statement transparency could reflect the level of regulation of MFIs and its competitors, which definitely affect clients. More poor infrastructure, more difficult to serve in a profitable manner, and vice versa (Hartarska 2005).

Difference in groups pre-treatment is β_2; difference in groups post-treatment is $\beta_2 + \beta_3$, thus the difference between difference in groups pre-treatment and group post-treatment is the pure treatment effect (β_3), which can control for the existing difference between the control and treatment group. Thus, the coefficient that we are interested in is the $Banking\ Crisis * Post\ 2008_i$ (β_3) under the hypothesis that $Banking\ Crisis * Post\ 2008$ (β_3) is statistically

insignificant from zero, implying the 2008 global financial crisis affected the MFI outcome. If β_3 is statistically significant, we reject the null hypothesis that the global 2008-2009 financial crisis did not affect performance of MFIs. Following Silva and. Chavez (2015), the time since 2008 variable is defined as a non-negative number equals to current year minus 2008 and 0 if negative, and included to capture the lagged effect of the global financial crisis on the performances of MFIs.

Before we estimate the DiD effect, we estimate a specification where we use a simple dummy variable for a banking crisis to see what affect it has on outreach and sustainability of MFIs. This is achieved by estimating model 3 without including Post 2008 and Post 2008*Banking Crisis.

3.5 Empirical Results

The basic assumption in our approach is that the banking crisis following 2008 reduced the number of active clients because lending becomes more expensive and MFIs offer larger, less expensive loans to service and monitor, thus fewer borrowers are able to get a loan. We also expect that MFIs would have suffered losses due to a banking crisis post 2008. Additionally, we explore how outreach and sustainability of MFIs operating in a better financial and banking system (financial statement transparency and returns on the banking system) have better performance.

For all of regressions, country dummies are included to control for all unobservable country specific effects; we also cluster the stander error at the MFI level. Since it is an unbalanced panel data, the fixed and random effect models have been applied into the empirical analysis. Moreover, a test of overidentifying restriction is used to estimate whether random effects are appropriate (fixed effects VS random effects). The rejection of this artificial

regression test shows that fixed effect is preferred, and vice versa. Last, we test whether the global financial crisis influenced the MIFs' performances, sustainability (return on asset) and outreach (number of active borrowers and average loan balance per borrower over GNI per capita). Overall, our results seem to support the main idea for some sort of tradeoff between outreach and sustainability in the aftermath of a financial crisis. Specifically, the global financial crisis has no effect on ROA and depth, but influences a number of active borrowers negatively, no matter in the full dataset or across different legal statuses (Bank, CU, NBFI, and NGO) and EECA. The implication is the global financial crisis results in MFIs sacrificing the outreach (NAB) and turn to the bigger and better borrowers. That is to say, MFIs may focus on maintaining their financial results and keeping more reserves at the expense of their outreach to the poor to cope with the risks from global financial crisis. This provides evidence for a tradeoff (Mission drift of institutions) between the outreach and the sustainability dimensions of MFIs' performances in the process of commercialization, suggesting that financial success may come at the expense of serving fewer and less poor clients (Cull et al., 2007 & 2009; Augsburg and Fouillet, 2010; Vanroose and D'Espallier 2013; Hartarska et al., 2013).

Table 3.3 presents the estimation of impact of the global financial crisis on sustainability, whilst Table 3.4 and Table 3.5 show the estimates of impact on outreach (on NAB and on Depth). Labeled columns 1-8 present the results form regressions where ROAs, log of NAB and Depth are the dependent variables in Tables 3.3A, 3.3B, and 3.3C; Table 3.4A, 3.4B, and 3.4C; Table 3.5A, 3.5B, and3.5C. The results from the simple dummy regression and a regression with panel DiD specifications have been presented in Tables 3-5 with and without time sensitivity variable since 2008. Our variables of interest are the interaction terms of banking crisis and time post 2008, which is a proxy of the pure effect of global financial crisis considering the other

unobservable and time-invariant factors affecting MFIs' performances. The interested coefficients of interaction terms show that global banking crisis has no effect on ROA and Depth, negative effect on NAB, implying reducing MFIs' outreach to the clients, but no effect on loan size. Moreover, the results are robust when the fixed effect and random effect with single banking crisis and DiD specification are applied in Tables 3.3-3.5. The rejection of the overidentifying restrictions test provides the evidence that fixed effect model is more preferred, and global banking crisis results in 1.771% decrease of the number of active borrowers. This finding is in line with the market-failure hypothesis, MFIs are more profitable when the traditional financial sectors do not fulfill or fail (Vanroose and D'Espallier 2013), since the global banking crisis cannot decrease the ROA as it did to the formal financial sector. A banking crisis itself induces MFIs to cut back the number of active borrowers, but cannot affect the depth of outreach and financial sustainability. However, MFIs' NAB were more affected by the global financial crisis compared with a banking crisis, since a banking crisis could result in 1.07% decrease, less than the impact of the global financial crisis (1.77%).

Table 3.3A goes about here

Turning down to other MFI specific characteristics variables, mature MFIs perform better in terms of financial sustainability (ROA) and the breadth of outreach (NAB) than the new and young MFI, which has been also found by Vanroose and D'Espallier (2013) and Hartarska and Nadolnyak (2007), but MFI has no obvious advantage over the Depth. Across specifications, MFI sizes cannot affect the ROA, but have a significantly positive effect on the breadth and depth of outreach, which is consistent with Silva and Chavez's (2015) positive relationship between MFI size and the outreach measured by the NABs growth and loan size growth. That is to say, mature MFIs with big asset sizes could reach more clients compared to new/young MFIs

with small sizes, which is consistent with Hartarska and Nadolnyak (2007). The results also show that capital ratio has the significantly negative and strong effect on the number of active borrowers in Table 3.4, but no effect on the depth of outreach and financial sustainability, implying less leveraged MFIs hold, the more willingness donors provide equity to MFIs, the more active marginalized clients MFIs could reach. However, leverage could help MFIs to reach more poor clients and make more financial benefits. In the preferred specifications, the ratio saving is negative associated with NAB, no relation with ROA and depth; the ratios of loans are positively associated with all of these three performances. This is contrary with Hartarska and Nadolnyak (2007), it might be explained that MFIs hold more reserves (higher proportion of saving), and reach fewer clients to cope with potential risks. Because MFIs with more saving means more reserves cannot reach more clients and only better borrowers can be loaned to, saving ratio cannot affect financial sustainability and the poorer level they reach. The portfolio at risk has a negative effect on the number of borrowers. However, the regulated status of MFIs cannot affect the number of borrowers. The legal status of MFI matters, MFIs with bank status reach more borrowers than those with CU, NBFI, NGO, and Other statuses.

Regulated MFIs have no effect on the sustainability and outreach from Table 3.3A and 3.4A, implying MFIs who transform into regulated ones are not likely to achieve better financial sustainability or reach more marginalized/vulnerable clients. Regulation itself is costly, since regulated MFIs are subject to the additional requirement and supervision costs (Di Bella 2012). However, there might be an indirect benefit from the regulation if regulation itself is the only way to collect the saving (Hartarska and Nadolnyak 2007). This is confirmed by the significantly positive sign of regulation in the estimates of depth in Table 3.5A, because the NAB and depth

are always the good proxies for the two dimensions (breadth and depth) of MFI outreach (Hartarska and Nadolnyak 2007).

Across macroeconomic factors, we find the average consumer price index (inflation) and GDP are significantly positive in explaining the number of active borrowers, but insignificant in return on asset and depth of outreach, which is in line with Silva and Chavez's (2015) negative effect of GDP on NABs growth and no impact on loan size growth. However, Hartarska and Nadolnyak (2007) and Demirguc-Kunt and Huizinga (1999) support a positive link between inflation and financial outcome, since MFI might develop more safeguard in the inflationary environment and performs better in terms of financial performance. This is probably because greater GDP and inflation results in more investment and increased loans to reach more clients, but might not produce higher profit and reach more poor clients because of high inflation. There is no linear relationship between control corruption and MIFs outreach and financial sustainability, such as NAB and ROA and depth of outreach.

Table 3.4A goes about here

In terms of financial system characteristics variables, banking's returns on assets have no effect on number of active borrowers, a positive relationship on financial sustainability and depth of outreach, while financial transparency cannot affect NAB and ROA, but significantly negatively influence depth of outreach. Because MFIs have different ownership and capital structures, financial service technologies, and different efficiency levels relative to traditional banking, MFIs are more resilient to the banking crisis and less influenced by the financial environment (Wijesiri 2016). Silva and Chavez (2015) also find that a more developed financial system results in a more constrained ability for MFIs to increase their loan size, since credit

market development has a negative effect on pertaining self-sufficiency, but there exists no effect of financial transparency on NAB's growth.

Table 3.5A. goes about here

Table 3.3B -3.5B present the results from estimation with the sample of MFIs in Eastern Europe and Central Asia (ECA). This is done because only this region has had a banking crisis after the 2008 global financial crisis. That is to say, the 2007-2008 global financial crisis only has a negative effect on MFIs in ECA region and no effect on MFIs in other regions, such as Africa, East Asia and the Pacific (EAP), Latin America and The Caribbean (LAC), Middle East and North Africa (MENA), and South Asia (SA). This is consistent with Wagner (2012) and Di Bella (2011) demonstrates that MFIs in ECA reordered the strongest credit growth before the global financial crisis, and were most affected by the 2008 global financial crisis compared with ASP and SAC regions. There is no preference between fixed effect and random effect according to the test of the overidentifying restrictions in Tables 3.3B-3.5B. Results show that the 2007-2008 global financial crisis only has a negative effect on the number of active borrowers, but no effect on return on asset and depth of outreach. Specifically, the global financial crisis results in 2.086% decrease of the number of active borrower, which is higher than the impact (1.771%) for MFI from all over the world, this confirmed that MFIs in ECA were most affected in ECA than other regions in Wagner (2012) and Di Bella (2011)'s papers. The coefficients on the control variables are consistent with our expectations. MIF characteristics like MFI age, size, and loan are consistent with previous studies. Larger size, age, and loan have a positive effect on MFI performance (Hartarska and Nadolnyak 2007). However, our results indicate a clear relationship between MIF's performance (breadth of outreach and financial sustainability) and financial statement transparency, since better financial statement transparency contributes to better

fundamental environments for microfinance service. Our previous results show that financial statement transparency affect depth of outreach negatively and cannot influence NAB and ROA, which is contrary with the impact of financial transparency on MFIs' performance in ECA. Because most countries in ECA are more advanced compared with countries from other regions, financial system is more mature, transparence, and more efficient to contribution to MFIs' development. Consistent with this conclusion, returns on asset of banking system have a positive effect on MFIs' financial sustainability in Table 3.3B. Among the macroeconomic variables, we find that GDP and financial statement transparency are positively related to the number of active borrowers, which implied the more advanced countries with better financial statement transparency are more like to reach more borrowers.

Table 3.3B, 3.4B and 3.5 B go about here

Since MFIs with different legal status using different technologies result in different efficiency levels (Wijesiri 2016; Sevin et al. 2012), a banking crisis may affect the NGOs, NBFIs and Credit Unions differently. Similarly, the financial systems of countries of various regions and level of economic development were affected differentially by the global financial troubles following 2008. Thus, we split the sample data along the lines of MFI legal status, and report the impact of global financial crisis on financial sustainability and outreach of MFIs across Bank, CU, NBFI, and NGO in Table 3.3C-3.5C. Only the key variables of interest, interaction terms of post 2008 and banking crisis were included, the complete results have been presented in the Appendix. The main results are consistent with our previous results, and they show that the global financial crisis has the significantly negative effect on NAB of MFIs with bank, CU, and NBFI status, only NGO is an exception and cannot be affected by the global financial crisis in Table 3.3C. This might be explained because NGOs mainly work in remote rural areas thereby

providing financial services to the persons with no access to banking services (Microfinance and microcredit.2017[16]), and thus less influenced by the global financial crisis relative to Bank, CU, and NBFI. The legal status of MFIs also matters, since Banks (the reference group) could reach more clients and make more returns on assets compared with CU, NBFI, NGO, and Othe statuses from the results of interaction term of Banking crisis*Post 2008. Because Banks are more commercially oriented, and banks serve most rich clients of all types of institutions from the estimates of depth of outreach in Table 3.5A. The results in Tables 3.3C-3.5C suggest that return on asset and depth are found to be unaffected by the banking crisis after 2008 (the global financial crisis) among Bank, CU, NBFI, and NGOs, only exception is that the global financial crisis is associated with richer borrowers. Since NGOs are created as non-for-profit organizations, and the other three are most for-profit organizations, larger loans result in lower operation cost per dollar loaned (Silva and Chávez 2015).

Tables 3.3C, 3.4C, and 3.5C go about here

In summary, after controlling for country macroeconomic characteristics, financial system characteristics variables, and MIF characteristics, our results indicate the global banking crisis induces MFIs to cut back on serving borrowers and leads to smaller outreach and results in 1.771% decrease of the number of active borrowers. While the breadth of outreach has decreased after a post 2008 banking crisis, the financial results and depth of outreach were mostly unaffected. These findings are in line with Laeven and Valencia (2012) that shows advanced economies tend to experience larger output losses and increases in public debts; whilst Silva and Chávez (2015) find the global financial crisis has the substantial and negative impact on the number of borrowers and OSS. Moreover, banks were most affected by the global financial crisis

[16] Available at: http://www.microfinanceinfo.com/micro-financial-institutions/

compared with CU, NBFI and Others, because Banks are more commercial and serve more rich clients, relative to the other three types of MFIs, and get more integrated into the financial system. In addition, we find that macroeconomic condition has a complementary effect in supporting microfinance in terms of sustainability and depth of outreach, since MFIs operating in the environment with a higher institutional quality could contribute to a better fundamental environment for microfinance service and are more resilient to the impact of the global financial crisis (Silva and Chávez 2015). Lastly, results can be interpreted as a tradeoff between outreach and sustainability –to protect earnings, MFIs are reaching fewer and likely wealthier borrowers. This is consistent with commercial banks curtailing lending to smaller businesses, so the financial crisis affected MFIs in the same way as it did banks, indicating MFIs have become integrated into the global financial system and are exposed to the (global) risk factors (Silva and Chávez 2015; Di Bella 2011; Wagner 2012).

3.6 Robustness Checks

We conduct a counterfactual model as the sensitivity test to check for the robustness of our empirical results. We rerun our sample data using the counterfactual model to test whether our results are robust or not.

Barros etc. (2014) apply a counterfactual analysis of bank mergers, and compare the effects of loan flows and interest rates with and without merger effect. They find that merger has a positive effect on firms' access to credit and have a negative effect on interest rates. Hayashi (2014) also uses a counterfactual to compare counterfactual GDP with actual GDP and concludes that the government policy cannot increase Japan's GDP to the expected level. Thus, an alternative method-statistical counterfactual model also has been employed in this paper to check whether our results are robust or not. We predict the performance of MIFs without the 2008-2009 global

financial crisis, then test whether there is a statistically significant difference between predicted performance and the actual performance of MFIs during the period of the post-global financial crisis, and the graphic explanation of counterfactual model is in Graph 2.

We first develop a fixed and random effect model using the data of pre-global financial crisis, and then to estimate what would have happened in the absence of this intervention-global financial crisis using the data post-2008. At last, we test whether MFIs perform better or worse if there does not exist the 2007-2008 global financial crisis. The null and alternative hypothesis is as follows.

$$H_0: \hat{P}_{it}^{post} - P_{it}^{post} = 0$$

$$H_a: \hat{P}_{it}^{post} - P_{it}^{post} \neq 0$$

$P_{it}^{pre} = \beta_0^{pre} + \beta_1^{pre} Banking\ Crisis_{it} + \beta_2^{pre} Post2008_i + \alpha^{pre} MFI_{ijt} + \beta'^{post} C_{jt} +$

$\gamma^{pre} FS_{jt} + \varepsilon_i + \varepsilon_j + \varepsilon_t + u_{ijt}$ data of pre-global financial crisis

$\hat{P}_{it}^{post} = \beta_0^{pre} + \beta_1^{pre} Banking\ Crisis_{it} + \beta_2^{pre} Post2008_i + \alpha^{pre} MFI_{ijt} + \beta'^{post} C_{jt} +$

$\gamma^{pre} FS_{jt} + \varepsilon_i + \varepsilon_j + \varepsilon_t + u_{ijt}$ data of post-global financial crisis

The definitions of all variables are consistent with variables in the above equations. Tests of overidentifying restrictions (FE VS RE) show that fixed effect is preferred to the random effect for the number of borrowers, but random effect is preferred for the return on asset and depth.

Table 3.6 presents the estimates of outreach and sustainability using counterfactual method, t values are significant at 95% confidence level and reject the null hypothesis and accept the alternative hypothesis that MFIs perform better if there were not the global financial crisis. It is clear that the global financial crisis has a significant and negative impact on the number of outstanding borrowers, return on assets of MFIs and depth. Specifically, the global financial crisis results in 1.66% and 5.08% decrease of number of active borrowers and ROA, and a tiny drop (0.075%) of depth. This is consistent with the results of the number of borrowers of MFIs, but does not coincide with the MFI performance for returns on assets and depth. The obvious difference between counterfactual results and DiD results is the global financial crisis on return on asset, since the effect of global financial crisis on depth is very tiny. It might be explained that there may exist other key determinants increasing the returns of the assets of MFIs, such as the documented gradual increase in commercialization of MFIs over time (Silva and Chavez 2015).

Table 3.6 goes about here

3.7 Conclusion

The global financial crisis of 2008 affected millions of people and almost every industry (Laeven and Valencia 2013). I evaluate how the breadth and depth of outreach and financial sustainability of MFIs is affected by a banking crisis and compare these results to the effect of the banking crisis post 2008. The results indicate that any banking crisis induces MFIs to cut back on serving more borrowers, possibly at the expense of serving less poor borrowers, which also shows in better return. Moreover, the results show that in the post 2008 environment, the global financial crisis has led MFIs to cut back to their outreach but their financial results and depth of outreach were not improved. Specifically, MFIs have had more adverse effects post the 2008 global financial crisis (1.07% decrease) relative to any banking crisis (1.77% decrease) in terms of the

breadth of outreach. Banks are more affected compare with CU, NBFI, and Other organizational types, since Banks are commercial and non-for-profit, and more integrated into the financial system. In addition, the empirical results show that MFIs have been integrated into the global financial system and exposed to the global of financial crisis in terms of NAB, consistent with Silva and Chávez (2015), Di Bella (2011), and Wagner (2012). Lastly, MFIs in ECA were affected most by the 2007-2008 global financial crisis with a decrease of 2.219%, since MFIs operation in ECA are more integrated into the global financial market with a better and more efficient banking market (Wagner 2012; Silva and Chavez 2015).

Macroeconomic conditions have important supporting rule in microfinance, and the results show that MFIs in countries with higher GDP have better outreach. I find a relationship between MIF performance and returns of commercial (nonMFIs) banks (Banking ROA), possibly because better financial results in all financial institutions have contributed to better fundamental environment for microfinance service. This suggest that enabling environment for MFIs even in countries with strong non-microfinance intermediaries, can play a crucial role to improve the outreach of MFIs to clients excluded from the more formal financial system.

Finally, the results support previous finding of a tradeoff between outreach and sustainability. They show that in the pre-2008 period with banking crises, lower outreach was associated with improved financial results, while in the aftermath of 2008 financial crisis a domestic country banking crisis limited outreach but did not affect the financial result. MFIs reached fewer and larger loans (less poor clients), resulting in possible “mission drift”. There is no difference in reaching more poor clients between periods leading up to and following 2008, since MFIs are likely to keep more reserve to reduce the risk. This is consistent with commercial banks curtailing lending to smaller businesses so the financial crisis affected MFIs in the same

way as it did banks, and confirmed by Silva and Chavez (2015), Wagner (2012) and Di Bella (2011). They support that MFIs have become more integrated into the global financial system, struggle with the freezing of global credit market and are exposed to global risk factors, like traditional banking.

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Table 3.1. Summary of empirical cross-country analysis on the impact of the Global financial crisis of 2008 on MFI performance

Study	Data	Method	Finding
Di Bella (2011)	1998-2009,353 MFIs (MIX)	Fixed-effects regression	MFIs performance is correlated with economic conditions and international capital markets[17].
Silva and Chávez (2015)	2004-2011, 364 MFIs (MIX)	A MFI fixed effects panel data regression	MFIs in countries with stronger governance, more resilient to the effect of global financial crisis[18]
Wagner (2012)	2003-2009,MIX International Financial Statistics	correlation	MFIs have integrated into the international financial system and exposed to the global credit cycles[19]
Wijesiri (2016)	2005-2011, 298 MFIs (MIX)	a Malmquist Luenberger	Banks and NBFIs suffers more and cooperative and NGO are less effected

[17] The dependent variables are Return on Equity (ROE), Assets Growth, Lending Growth, and Portfolio at Risk (PAR). Independent variables are domestic economic conditions (real GDP growth), global market conditions (annual average percentage change of three indices, the S&P Index, the Morgan Stanley Capital International (MSCI) World Index, and the MSCI Emerging Markets Index), Lending rates, Funding costs, The (absolute) spread, The ratio of borrowers per staff, Operational cost per staff, The capital asset ratio, and Age.

[18] The dependent variables are MFI performance (OSS, GLP growth, PAR, WOR, NABs growth, and Loan size growth).
Independent variables are Country-level variables [Country governance measure (AWGI, Control of corruption, Government effectiveness, Regulatory quality, Rule of Law, Voice and accountability, Political stability and absence of violence), Country macroeconomic controls (GDP growth, GDP, and Credit)].

[19]Correlation between credit growth 2007 and change in growth 2007-9; Correlation between average credit growth p.a., 2004-7 and average PAR30 and NPL growth p.a., 2008-9; Correlation between competition and loan-portfolio quality in the microfinance sector, 2007-9.

	productivity index with the metafrontier concept	in the wake of 2008 global financial crisis.[20]

[20]Three input variables are total assets, operating expenses and number of employees. Four desirable output variables are Gross loan portfolio (GLP), financial revenue, average loan balance to GNP per capita (ALB) and number of active borrowers (ACTB); an undesirable output NPLs.

Table 3.2. Statistics summary

VARIABLES	N	mean	N	mean	N	mean	diff
	Total	Total	No global fin. crisi		Global fin.l crisis		
Borrow (10 million)	2,192	1.97	2,147	2	45	0.648	1.35**
		(5.84)		(5.90)		(1.33)	(0.880)
ret_assets (%)	2,269	1.096	2,206	1.09	63	1.309	-0.219
		(11.256)		(11.350)		(7.279)	(1.439)
Depth	2,442	0.362	2,379	0.356	63	0.59	-0.234***
		(0.519)		(0.503)		(0.890)	(0.066)
Dcrisis	2,192	0.0506	2,147	0.0307	45	1	-0.969***
		(0.219)		(0.173)		(0)	(0.026)
cap_asset	2,192	0.305	2,147	0.306	45	0.286	0.020
		(0.255)		(0.255)		(0.222)	(-0.038)
Age					45	1.512	-0.377***
						(0.808)	(0.121)
New	2,192	0.101	2,147	0.102	45	0.067	NA
		(0.302)		(0.303)		(0.252)	
Young	2,192	0.198	2,147	0.194	45	0.4	NA
		(0.399)		(0.396)		(0.495)	
Size	2,192	0.506	2,147	0.513	45	0.15	0.363*
		(1.524)		(1.539)		(0.26)	(0.230)
dep_totasset	2,192	0.164	2,147	0.162	45	0.249	-0.087**
		(0.259)		(0.257)		(0.335)	(0.039)

glp_totasset	2,192	0.775	2,147	0.776	45	0.767	0.009
		(0.162)		(0.162)		(0.138)	(0.024)
port_risk30	2,192	6.689	2,147	6.661	45	8.024	-0.014
		(13.252)		(13.183)		(16.338)	(0.020)
English	2,192	0.3	2,147	0.306	45	0	0.306***
		(0.458)		(0.461)		(0)	(0.069)
Regulated	2,192	56.2%	2,147	55.5%	45	88.9%	-0.334***
		(0.496)		(0.497)		(0.318)	(0.074)
legal status							
CU	2,192	9.4%	2,147	8.8%	45	40%	-0.312***
		(0.292)		(0.283)		(0.495)	(0.044)
NBFI	2,192	44.6%	2,148	44.5%	45	51.1%	-0.0663
		(0.497)		(0.497)		(0.506)	(0.075)
NGO	2,192	36.8%	2,149	37.4%	45	4.4%	0.330***
		(0.482)		(0.484)		(0.208)	(0.072)
Other	2,192	0.3%	2,150	0.3%	-	-	0.003
		(0.056)		(0.057)			(0.009)
Rural_Bank	2,192	3.9%	2,151	4%	-	-	0.040*
		(0.193)		(0.195)			(0.029)
EECA	2,192	15.3%	2,147	13.6%	45	1	-0.864***
		(0.36)		(0.342)		(0)	(0.051)
Acpi	2,192	122.7	2,147	121.9	45	160.6	-38.777***
		(22.05)		(21.49)		(13.41)	(3.217)
Gdp	2,192	5.373	2,147	5.265	45	10.52	-5.259***

		(6.594)		(6.516)		(8.167)	(0.987)
Cc	2,192	-0.415	2,147	-0.403	45	-1.013	0.610
		(0.285)		(0.274)		(0.092)	(.041***)
Banking roa	2,192	1.386	2,147	1.664	45	-11.91	13.574***
		(3.897)		(0.991)		(22.89)	(0.510)
financialtransparency	2,192	4.879	2,147	4.885	45	4.578	0.308**
		(1.057)		(1.06)		(0.499)	(0.159)

Note: Std. Dev. in parentheses

Table 3.3A. Estimates of financial sustainability

	Dependent variable: Return on asset (ROA)							
VARIABLES	FE	FE	FE	FE	RE	RE	RE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banking Crisis*Post 2008			-1.064	-1.193			-1.381	-1.502
			(1.740)	(1.749)			(1.655)	(1.675)
Banking Crisis					6.294**	5.637*	5.816**	5.251*
					(3.034)	(2.973)	(2.936)	(2.892)
Post 2008			-1.780***	-1.713***			-2.113***	-2.026***
			(0.598)	(0.593)			(0.581)	(0.572)
time since 2008		-0.782**		-0.753**		-0.740**		-0.692*
		(0.366)		(0.365)		(0.368)		(0.367)
MIF characteristics variables								
cap_asset	1.279	1.493	1.063	1.272	4.977	5.107*	4.851	4.976
	(6.577)	(6.492)	(6.646)	(6.566)	(3.053)	(3.011)	(3.072)	(3.031)

size	-0.123	-0.082	-0.081	-0.045	-0.078	-0.044	-0.039	-0.009
	(0.112)	(0.106)	(0.113)	(0.116)	(0.118)	(0.109)	(0.117)	(0.115)
New	-7.046**	-7.197**	-7.117**	-7.254**	-5.120***	-5.183***	-5.108***	-5.165***
	(2.945)	(2.966)	(2.934)	(2.955)	(1.853)	(1.862)	(1.848)	(1.858)
Young	0.738	0.642	0.527	0.444	0.652	0.616	0.500	0.472
	(0.676)	(0.659)	(0.677)	(0.666)	(0.611)	(0.598)	(0.606)	(0.597)
dep_totasset	-2.634	-1.430	-1.894	-0.763	-0.090	0.249	0.211	0.513
	(4.081)	(3.936)	(3.992)	(3.888)	(1.899)	(1.821)	(1.872)	(1.806)
glp_totasset	15.822***	15.528***	15.644***	15.355***	15.040***	14.883***	14.893***	14.739***
	(2.948)	(2.958)	(2.900)	(2.911)	(2.261)	(2.261)	(2.210)	(2.210)
english					6.611**	6.611**	8.153**	8.123**
					(3.231)	(3.223)	(3.258)	(3.249)
port_risk30	-2.356	-2.202	-2.466	-2.318	-2.533	-2.426	-2.644	-2.543
	(1.734)	(1.694)	(1.718)	(1.681)	(1.824)	(1.796)	(1.800)	(1.775)
regulated					-1.388	-1.421	-1.459	-1.486
					(0.911)	(0.913)	(0.908)	(0.911)

CU					-4.467*	-4.452*	-4.346*	-4.336*
					(2.381)	(2.374)	(2.396)	(2.393)
NBFI					-4.474*	-4.292*	-4.282*	-4.121
					(2.516)	(2.500)	(2.545)	(2.533)
NGO					-8.009***	-7.830***	-7.834***	-7.674***
					(2.967)	(2.934)	(2.982)	(2.953)
Other					-4.777	-4.576	-4.637	-4.461
					(3.573)	(3.492)	(3.639)	(3.562)
Rural_Bank					-2.445	-2.364	-2.175	-2.105
					(2.815)	(2.808)	(2.818)	(2.816)
EECA					3.086	3.217	4.385	4.499
					(3.379)	(3.393)	(3.485)	(3.498)
Country characteristics variables								
acpi	-0.007	0.025	0.031	0.060**	0.010	0.041	0.056**	0.083**
	(0.014)	(0.021)	(0.020)	(0.028)	(0.019)	(0.031)	(0.027)	(0.038)
gdp	-0.062	-0.015	-0.087	-0.040	-0.046	-0.001	-0.075	-0.030

	(0.141)	(0.143)	(0.148)	(0.150)	(0.121)	(0.120)	(0.129)	(0.129)
cc	2.989	4.064*	3.032	4.033	3.069	4.032*	3.026	3.889
	(2.153)	(2.358)	(2.312)	(2.508)	(2.196)	(2.438)	(2.311)	(2.533)
Financial system characteristics variables								
banking_roa	0.153*	0.152*	0.157**	0.155*	0.167**	0.164**	0.172**	0.169**
	(0.080)	(0.081)	(0.079)	(0.080)	(0.083)	(0.083)	(0.082)	(0.082)
financialtransparency	0.192	0.193	0.131	0.140	0.219	0.220	0.148	0.159
	(0.249)	(0.247)	(0.267)	(0.266)	(0.247)	(0.245)	(0.260)	(0.258)
Constant	-8.925**	-11.994***	-11.912***	-14.810***	-13.247***	-15.920***	-18.345***	-20.731***
	(4.451)	(3.962)	(4.277)	(3.930)	(4.039)	(4.134)	(4.475)	(4.719)
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.027	0.013	0.049	0.012
Observations	2,269	2,269	2,269	2,269	2,269	2,269	2,269	2,269

Number of id	662	662	662	662	662	662	662	662
MFI FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.0916	0.0969	0.0976	0.102				
Between R square					0.351	0.350	0.358	0.357

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Bank are the reference group of CU, NBFI, NGO, Other, and Rural Bank; Mature is the reference group if New and Young MFIs.

Table 3.4A. Estimates of outreach

VARIABLES	Dependent variable: Number of Active Borrowers (NAB)							
	FE	FE	FE	FE	RE	RE	RE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banking Crisis*Post 2008			-1.771***	-1.791***			-1.598***	-1.620***
			(0.297)	(0.293)			(0.269)	(0.267)
Banking Crisis					-1.070**	-1.167**	-0.682	-0.784*
					(0.485)	(0.491)	(0.468)	(0.470)
Post 2008			0.284***				0.257***	
			(0.064)				(0.066)	
time since 2008		-0.069**		-0.078**		-0.078**		-0.087**
		(0.035)		(0.033)		(0.036)		(0.034)
MIF characteristics variables								
cap_asset	-3.691***	-3.699***	-3.677***	-3.685***	-3.226***	-3.228***	-3.234***	-3.236***
	(0.334)	(0.335)	(0.337)	(0.337)	(0.521)	(0.523)	(0.514)	(0.515)
Size	0.209***	0.214***	0.182***	0.188***	0.254***	0.260***	0.229***	0.235***
	(0.042)	(0.043)	(0.038)	(0.038)	(0.050	(0.051)	(0.046)	(0.047)

					)			
New	-0.790***	-0.803***	-0.738***	-0.752***	-1.043***	-1.051***	-1.014***	-1.021***
	(0.171)	(0.171)	(0.164)	(0.163)	(0.135)	(0.134)	(0.132)	(0.131)
Young	-0.280***	-0.284***	-0.242**	-0.246**	-0.397***	-0.399***	-0.369***	-0.370***
	(0.099)	(0.099)	(0.096)	(0.096)	(0.085)	(0.085)	(0.084)	(0.084)
dep_totasset	-3.769***	-3.668***	-3.735***	-3.621***	-2.932***	-2.869***	-2.957***	-2.886***
	(0.487)	(0.487)	(0.420)	(0.415)	(0.322)	(0.323)	(0.295)	(0.293)
glp_totasset	0.599**	0.569**	0.547**	0.513**	0.867***	0.837***	0.803***	0.768***
	(0.244)	(0.245)	(0.239)	(0.239)	(0.245)	(0.246)	(0.239)	(0.240)
English					-1.870***	-1.837***	-1.824***	-1.788***
					(0.392)	(0.389)	(0.390)	(0.386)
port_risk30	-0.453**	-0.440**	-0.504***	-0.490***	-0.458**	-0.443**	-0.498***	-0.482***
	(0.178)	(0.174)	(0.187)	(0.183)	(0.182)	(0.178)	(0.187)	(0.183)
Regulated					0.233	0.223	0.246	0.236

	(0.173)	(0.173)	(0.174)	(0.174)
CU	-2.951***	-2.941***	-3.004***	-2.995***
	(0.391)	(0.391)	(0.386)	(0.385)
NBFI	-1.793***	-1.759***	-1.863***	-1.827***
	(0.301)	(0.304)	(0.299)	(0.301)
NGO	-3.240***	-3.209***	-3.305***	-3.271***
	(0.354)	(0.356)	(0.352)	(0.354)
Other	-3.217***	-3.149***	-3.295***	-3.220***
	(0.607)	(0.605)	(0.614)	(0.611)
Rural_Bank	-2.568***	-2.545***	-2.622***	-2.598***
	(0.436)	(0.436)	(0.436)	(0.436)
EECA	0.266	0.314	0.408	0.462
	(0.466)	(0.463)	(0.467)	(0.464)
Country characteristics variables				

Acpi	0.016***	0.019***	0.011***	0.015***	0.014***	0.017***	0.009***	0.013***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)
Gdp	0.068***	0.072***	0.079***	0.084***	0.057***	0.061***	0.067***	0.072***
	(0.016)	(0.016)	(0.017)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
Cc	-0.093	-0.029	-0.318	-0.247	-0.061	0.011	-0.278	-0.200
	(0.239)	(0.244)	(0.243)	(0.246)	(0.240)	(0.244)	(0.244)	(0.247)
Financial system characteristics variables								
banking_roa	0.004	0.004	0.003	0.002	0.008	0.008	0.006	0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Financialtransparency	-0.032	-0.031	0.039	0.040	-0.049	-0.048	0.019	0.021
	(0.043)	(0.043)	(0.044)	(0.044)	(0.042)	(0.042)	(0.043)	(0.043)
Constant	13.938***	13.658***	13.936***	13.622***	15.519***	15.189***	15.473***	15.112***
	(0.337)	(0.366)	(0.342)	(0.383)	(0.517)	(0.529)	(0.531)	(0.553)
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P value					0.000	0.000	0.000	0.000
Observations	2,192	2,192	2,192	2,192	2,192	2,192	2,192	2,192
Number of id	622	622	622	622	622	622	622	622

Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.523	0.526	0.547	0.550				
Between R square					0.497	0.498	0.490	0.492

Note: same as Table 3.3A

Table 3.5A. Estimates of depth

VARIABLES	Dependent variable: Average loan balance per borrower / GNI per capita (depth)							
	FE	FE	FE	FE	RE	RE	RE	RE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banking Crisis*Post 2008			-0.109	-0.102			-0.103	-0.096
			(0.210)	(0.210)			(0.192)	(0.192)
Banking Crisis					-0.067	-0.032	-0.061	-0.029
					(0.282)	(0.285)	(0.295)	(0.297)
Post 2008			-0.031**	-0.034**			-0.028*	-0.032**
			(0.014)	(0.014)			(0.014)	(0.014)
time since 2008		0.023**		0.023**		0.024**		0.024**
		(0.011)		(0.011)		(0.011)		(0.011)
MIF characteristics variables								
cap_asset	0.082	0.080	0.077	0.075	0.081	0.079	0.077	0.075
	(0.069)	(0.070)	(0.065)	(0.065)	(0.061)	(0.062)	(0.058)	(0.058)
size	0.032***	0.030***	0.032***	0.031***	0.032***	0.031***	0.032***	0.031***

	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
New	0.063	0.066	0.064	0.067	0.056	0.058	0.057	0.059
	(0.042)	(0.041)	(0.047)	(0.046)	(0.040)	(0.039)	(0.042)	(0.042)
Young	0.010	0.012	0.007	0.009	0.005	0.007	0.002	0.004
	(0.017)	(0.017)	(0.018)	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)
dep_totasset	0.126	0.094	0.138	0.106	0.100	0.077	0.106	0.084
	(0.102)	(0.099)	(0.103)	(0.101)	(0.102)	(0.101)	(0.103)	(0.101)
glp_totasset	0.118*	0.127**	0.109**	0.119**	0.079	0.087	0.070	0.080
	(0.061)	(0.061)	(0.055)	(0.055)	(0.056)	(0.056)	(0.051)	(0.050)
english					0.227	0.219	0.261*	0.255
					(0.160)	(0.159)	(0.157)	(0.156)
port_risk30	-0.015	-0.019	-0.019	-0.023	-0.013	-0.017	-0.017	-0.021
	(0.017)	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)	(0.015)	(0.015)
regulated					0.086*	0.088*	0.085*	0.087*
					(0.045)	(0.045)	(0.045)	(0.045)
CU					-0.419**	-0.422**	-0.418**	-0.420**

					(0.173)	(0.172)	(0.173)	(0.173)
NBFI					-0.289*	-0.300**	-0.285*	-0.296**
					(0.149)	(0.150)	(0.149)	(0.150)
NGO					-0.447***	-0.458***	-0.443***	-0.454***
					(0.153)	(0.154)	(0.154)	(0.155)
Other					-0.270	-0.282*	-0.269	-0.280
					(0.169)	(0.171)	(0.169)	(0.171)
Rural_Bank					-0.307*	-0.313*	-0.302*	-0.307*
					(0.174)	(0.175)	(0.174)	(0.175)
EECA					1.059***	1.045***	1.097***	1.083***
					(0.241)	(0.240)	(0.235)	(0.235)
Country characteristics variables								
acpi	-0.000	-0.001	0.001	-0.000	-0.000	-0.001	0.001	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
gdp	-0.003	-0.005	-0.003	-0.005	-0.003	-0.004	-0.002	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)

cc	0.023	0.006	0.005	-0.011	0.016	-0.001	-0.002	-0.019
	(0.070)	(0.071)	(0.056)	(0.058)	(0.069)	(0.070)	(0.056)	(0.058)
Financial system characteristics variables								
banking_roa	0.004**	0.004**	0.004**	0.004**	0.004**	0.004**	0.004**	0.004**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
financialtransparency	-0.032**	-0.033**	-0.030**	-0.031**	-0.032**	-0.033**	-0.029**	-0.031**
	(0.015)	(0.015)	(0.013)	(0.013)	(0.015)	(0.015)	(0.013)	(0.013)
Constant	0.382***	0.471***	0.302***	0.390***	0.163	0.258**	0.055	0.147
	(0.063)	(0.071)	(0.086)	(0.091)	(0.121)	(0.121)	(0.123)	(0.122)
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.073	0.039	0.067	0.048
Observations	2,442	2,442	2,442	2,442	2,442	2,442	2,442	2,442
Number of id	696	696	696	696	696	696	696	696
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.0427	0.0481	0.0467	0.0524				

Between R square	0.332	0.333	0.331	0.333

Note: same as Table 3.3A

Table 3.3B. Panel analysis: global crisis impact on sustainability in EECA

VARIABLES	(1) FE	(2) FE	(3) FE	(4) FE	(5) RE	(6) RE	(7) RE	(8) RE
	EECA Roa	EECA roa	EECA roa	EECA roa	EECA roa	EECA roa	EECA roa	EECA roa
Banking Crisis*Post 2008			-3.275	-2.296			-3.228	-2.167
			(3.434)	(3.310)			(3.171)	(3.150)
Banking Crisis					6.430	-3.235	-13.264***	-17.576***
					(10.486)	(4.563)	(4.877)	(4.913)
Post 2008			-5.008***	-5.592***			-5.152***	-5.743***
			(1.469)	(1.449)			(1.456)	(1.415)
time since 2008		-1.560		-1.893**		-1.706*		-2.012**
		(0.994)		(0.855)		(1.029)		(0.875)
MIF characteristics variables								
cap_asset	0.635	1.991	1.066	2.715	2.492	3.354	2.620	3.665

	(3.649)	(3.489)	(3.602)	(3.567)	(2.258)	(2.134)	(2.283)	(2.241)
size	0.266	0.164	0.118	0.016	0.226*	0.167	0.126	0.069
	(0.163)	(0.181)	(0.194)	(0.219)	(0.123)	(0.132)	(0.132)	(0.144)
New	-4.063	-3.956	-1.926	-1.775	-3.734**	-3.588**	-2.606	-2.378
	(2.628)	(2.576)	(2.522)	(2.514)	(1.705)	(1.691)	(1.628)	(1.647)
Young	1.132	0.934	1.577	1.295	0.988	0.848	1.088	0.886
	(1.262)	(1.185)	(1.210)	(1.101)	(0.926)	(0.885)	(0.874)	(0.825)
dep_totasset	-1.453	-0.805	-1.132	-0.305	-2.845*	-2.479	-2.369	-1.874
	(2.190)	(2.284)	(1.911)	(2.050)	(1.695)	(1.650)	(1.524)	(1.528)
glp_totasset	3.763	3.473	3.755	3.684	4.836	4.592	4.318	4.253
	(4.608)	(4.632)	(4.387)	(4.298)	(3.247)	(3.259)	(3.254)	(3.173)
port_risk30	-27.725***	-27.084***	-25.356***	-24.314***	-19.380***	-19.095***	-18.266***	-17.907***
	(9.288)	(9.157)	(9.118)	(9.082)	(6.983)	(6.830)	(6.926)	(6.797)
regulated					0.399	0.418	0.377	0.312
					(1.749)	(1.720)	(1.697)	(1.668)
CU					3.862**	3.785**	3.193**	3.077*

					(1.555)	(1.523)	(1.556)	(1.570)
NBFI					0.080	0.149	-0.095	0.007
					(1.588)	(1.584)	(1.615)	(1.617)
NGO					0.452	0.404	0.635	0.559
					(3.306)	(3.213)	(3.273)	(3.169)
Country characteristics variables								
acpi	0.013	0.106	0.186*	0.314**	0.005	0.105	0.171*	0.306**
	(0.058)	(0.101)	(0.095)	(0.123)	(0.059)	(0.104)	(0.090)	(0.121)
gdp	-0.224	-0.301	-0.644*	-0.853**	-0.102	-0.182	-0.525	-0.744**
	(0.265)	(0.272)	(0.362)	(0.386)	(0.251)	(0.261)	(0.345)	(0.373)
cc	5.151	12.342	6.451	15.401	4.716	12.692	5.666	15.327
	(9.654)	(12.238)	(8.724)	(10.187)	(10.052)	(12.728)	(8.984)	(10.517)
Financial system characteristics variables								
banking_roa	0.034	0.025	0.063**	0.055*	0.040	0.028	0.070*	0.059
	(0.030)	(0.031)	(0.031)	(0.032)	(0.039)	(0.039)	(0.040)	(0.039)
financialtransparency	0.555	0.685*	0.901	0.909	0.482	0.642*	0.900*	0.916

							(0.531)	(0.569)
	(0.405)	(0.379)	(0.551)	(0.579)	(0.420)	(0.365)		
Constant	0.664	-5.816	-16.963***	-25.575***	-5.984			
	(5.533)	(5.305)	(6.368)	(8.392)	(5.893)			
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
							-	-
P vlaue					-	-		
							384	384
Observations	384	384	384	384	384	384		
R-squared	0.172	0.199	0.237	0.275				
							134	134
Number of id	134	134	134	134	134	134		
							Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes		
within R square	0.172	0.199	0.237	0.275				
							0.153	0.163
Between R square					0.141	0.150		

Note: same as Table 3.3A

Table 3.4B. Panel analysis: global crisis impact on number of active borrowers in EECA

VARIABLES	(1) FE	(2) FE	(3) FE	(4) FE	(5) RE	(6) RE	(7) RE	(8) RE
	EECA Borrower	EECA borrower	EECA borrower	EECA borrower	EECA borrower	EECA borrower	EECA borrower	EECA borrower
Banking Crisis*Post 2008			-2.219***	-1.935***			-2.086***	-1.811***
			(0.485)	(0.444)			(0.460)	(0.428)
Banking Crisis					0.153	1.903	-1.310	1.295
					(1.786)	(1.899)	(0.850)	(1.845)
Post 2008			0.107	0.046			0.127	0.064
			(0.183)	(0.168)			(0.181)	(0.166)
time since 2008		-0.337***		-0.291***		-0.344***		-0.298***
		(0.066)		(0.060)		(0.066)		(0.060)
MIF characteristics variables								
cap_asset	-3.947***	-3.656***	-3.850***	-3.610***	-3.867***	-3.623***	-3.806***	-3.596***
	(0.458)	(0.437)	(0.405)	(0.391)	(0.410)	(0.390)	(0.372)	(0.357)
size	0.174***	0.150***	0.108**	0.095**	0.203***	0.181***	0.145**	0.132**
	(0.059)	(0.055)	(0.047)	(0.046)	(0.074)	(0.069)	(0.061)	(0.058)
New	-0.883***	-0.852***	-0.610**	-0.605**	-0.995***	-0.954***	-0.816***	-0.790***
	(0.283)	(0.262)	(0.302)	(0.281)	(0.228)	(0.210)	(0.247)	(0.229)
Young	-0.348**	-0.386***	-0.200	-0.250	-0.422***	-0.448***	-0.304**	-0.341**
	(0.160)	(0.144)	(0.165)	(0.151)	(0.149)	(0.132)	(0.153)	(0.138)
dep_totasset	-2.573***	-2.402***	-2.645***	-2.484***	-2.587***	-2.457***	-2.644***	-2.516***
	(0.527)	(0.519)	(0.278)	(0.291)	(0.381)	(0.384)	(0.254)	(0.259)
glp_totasset	0.179	0.137	-0.163	-0.155	0.066	0.022	-0.250	-0.247
	(0.790)	(0.729)	(0.758)	(0.719)	(0.719)	(0.666)	(0.703)	(0.665)
port_risk30	-0.326	-0.314	-0.666	-0.599	-0.927	-0.885	-0.969	-0.922
	(0.813)	(0.844)	(0.799)	(0.851)	(0.688)	(0.706)	(0.653)	(0.686)
regulated					0.757***	0.763***	0.798***	0.796***

					(0.265)	(0.269)	(0.255)	(0.260)
CU					-4.023***	-4.063***	-4.253***	-4.267***
					(0.490)	(0.500)	(0.499)	(0.508)
NBFI					-2.329***	-2.315***	-2.516***	-2.482***
					(0.433)	(0.432)	(0.453)	(0.448)
NGO					-2.802***	-2.790***	-2.889***	-2.867***
					(0.566)	(0.553)	(0.569)	(0.556)
Country characteristics variables								
acpi	0.016***	0.036***	0.017**	0.036***	0.015***	0.035***	0.014*	0.033***
	(0.006)	(0.007)	(0.008)	(0.009)	(0.006)	(0.007)	(0.008)	(0.008)
gdp	-0.101*	-0.119**	0.054	0.014	-0.091*	-0.110**	0.057	0.017
	(0.054)	(0.052)	(0.071)	(0.066)	(0.051)	(0.050)	(0.068)	(0.064)
cc	0.366	1.799**	0.261	1.528**	0.440	1.903**	0.292	1.594**
	(0.688)	(0.751)	(0.609)	(0.651)	(0.694)	(0.754)	(0.618)	(0.657)
Financial system characteristics variables								
banking_roa	0.000	-0.002	-0.000	-0.002	0.003	0.000	0.002	0.000
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)
financialtransparency	-0.028	-0.012	0.261**	0.238**	-0.045	-0.023	0.246**	0.225**
	(0.096)	(0.087)	(0.103)	(0.096)	(0.092)	(0.083)	(0.101)	(0.094)
Constant	15.253***	13.815***	13.748***	12.577***	17.884***	15.292***	17.350***	14.188***
	(0.910)	(0.998)	(1.022)	(1.091)	(1.918)	(2.140)	(1.162)	(2.033)
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					-	-	-	-
Observations	336	336	336	336	336	336	336	336
Number of id	118	118	118	118	118	118	118	118
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

within R square	0.608	0.656	0.659	0.693				
Between R square					0.726	0.730	0.723	0.727

Note: same as Table 3.3A

Table 3.5B. Panel analysis: global crisis impact on depth in EECA

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	FE	FE	FE	FE	RE	RE	RE	RE
	Depth	Depth	Depth	Depth	Depth	Depth	Depth	Depth
Banking Crisis*Post 2008			-0.214	-0.198			-0.292	-0.281
			(0.341)	(0.344)			(0.305)	(0.313)
Banking Crisis					0.797	0.887	0.776	0.862
					(0.571)	(0.689)	(0.538)	(0.701)
Post 2008			-0.083	-0.088			-0.085	-0.089
			(0.072)	(0.071)			(0.073)	(0.071)
time since 2008		-0.023		-0.023		-0.018		-0.015
		(0.065)		(0.064)		(0.062)		(0.061)
MIF characteristics variables								
cap_asset	0.493	0.511	0.505	0.522	0.391	0.403	0.401	0.411
	(0.377)	(0.402)	(0.382)	(0.403)	(0.320)	(0.338)	(0.321)	(0.337)

size	0.037	0.035	0.030	0.029	0.044**	0.043**	0.036**	0.036**
	(0.023)	(0.024)	(0.023)	(0.023)	(0.019)	(0.019)	(0.018)	(0.018)
New	0.217	0.218	0.271	0.270	0.266	0.267	0.316	0.316
	(0.221)	(0.222)	(0.266)	(0.266)	(0.210)	(0.212)	(0.237)	(0.237)
Young	-0.026	-0.029	-0.009	-0.013	-0.006	-0.008	0.010	0.008
	(0.060)	(0.062)	(0.054)	(0.058)	(0.063)	(0.065)	(0.058)	(0.061)
dep_totasset	-0.084	-0.073	-0.079	-0.069	-0.480	-0.473	-0.467	-0.461
	(0.245)	(0.266)	(0.248)	(0.267)	(0.355)	(0.365)	(0.358)	(0.366)
glp_totasset	0.482	0.477	0.435	0.434	0.364	0.361	0.299	0.299
	(0.404)	(0.413)	(0.352)	(0.358)	(0.368)	(0.375)	(0.328)	(0.332)
port_risk30	-0.925	-0.923	-0.921	-0.917	-0.785	-0.784	-0.767	-0.766
	(0.775)	(0.767)	(0.784)	(0.774)	(0.606)	(0.602)	(0.626)	(0.622)
regulated					0.166	0.167	0.177	0.177
					(0.147)	(0.147)	(0.150)	(0.150)
CU					-0.842*	-0.843*	-0.873*	-0.873*
					(0.475)	(0.476)	(0.481)	(0.482)

NBFI					-0.818*	-0.816*	-0.834*	-0.832*
					(0.444)	(0.446)	(0.444)	(0.447)
NGO					-1.278***	-1.278***	-1.275***	-1.275***
					(0.467)	(0.467)	(0.465)	(0.466)
Country characteristics variables								
acpi	-0.002	-0.000	0.001	0.003	-0.001	-0.000	0.002	0.003
	(0.002)	(0.005)	(0.005)	(0.006)	(0.002)	(0.004)	(0.005)	(0.005)
gdp	0.027*	0.026	0.030**	0.028**	0.027	0.026	0.034**	0.032**
	(0.016)	(0.016)	(0.015)	(0.013)	(0.018)	(0.018)	(0.016)	(0.015)
cc	0.370	0.475	0.373	0.477	0.380	0.462	0.372	0.443
	(0.351)	(0.576)	(0.335)	(0.550)	(0.317)	(0.521)	(0.299)	(0.498)
Financial system characteristics variables								
banking_roa	0.003	0.003	0.004	0.004	0.003	0.003	0.004	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)

financialtransparency	-0.032	-0.030	-0.003	-0.003	-0.034	-0.032	0.008	0.008
	(0.043)	(0.041)	(0.032)	(0.031)	(0.041)	(0.040)	(0.033)	(0.032)
Constant	0.680*	0.589	0.270	0.181	0.842	0.712	0.368	0.253
	(0.401)	(0.368)	(0.811)	(0.773)	(0.609)	(0.786)	(0.925)	(1.021)
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					-	-	-	-
Observations	405	405	405	405	405	405	405	405
R-squared	0.120	0.121	0.127	0.128				
Number of id	139	139	139	139	139	139	139	139
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within square	0.120	0.121	0.127	0.128				
Between R square					0.221	0.220	0.227	0.227

Note: same as Table 3.3A

Table 3.3C. Panel analysis: global crisis impact across legal status on ROA

VARIABLES	Dependent variable: return on asset (ROA)							
	Bank FE	Bank RE	CU FE	CU RE	NBFI FE	NBFI RE	NGO FE	NGO RE
Banking Crisis*Post 2008	0.772	6.828	-0.025	-0.158	3.021	2.730	-1.759	3.203
	(6.471)	(5.108)	(3.622)	(3.238)	(3.237)	(2.806)	(6.371)	(3.429)
Banking Crisis*Post 2008	1.169	7.119	0.107	-0.152	2.871	2.562	-1.364	3.044
(with time since 2008)	(6.590)	(5.195)	(3.418)	(3.061)	(3.232)	(2.795)	(6.111)	(3.368)
Test of overidentifying restrictions (FE VS RE)								
P vlaue		0.592		0.059		0.1794		0.020
Observations	113	113	258	258	975	975	826	826
Number of id	27	27	101	101	261	261	223	223
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.367		0.0965		0.164		0.141	
Between R square		0.948		0.264		0.213		0.642

Note: same as Table 3.3A

Table 3.4C. Panel analysis: global crisis impact across legal status on NAB

VARIABLES	Dependent variable: number of active borrowers (NAB)							
	Bank FE	Bank RE	CU FE	CU RE	NBFI FE	NBFI RE	NGO FE	NGO RE
Banking Crisis*Post 2008	-2.177***	-1.598**	-1.170**	-0.941*	-1.221***	-1.135***	-	0.719
	(0.548)	(0.776)	(0.560)	(0.495)	(0.273)	(0.324)	-	(0.804)
Banking Crisis*Post 2008	-2.146***	-1.602**	-1.158**	-0.978**	-1.280***	-1.205***	-	0.670
(with time since 2008)	(0.572)	(0.749)	(0.554)	(0.485)	(0.278)	(0.329)	-	(0.812)
Test of overidentifying restrictions (FE VS RE)								
P vlaue		0		0		0		0
Observations	109	109	207	207	978	978	806	806
Number of id	28	28	84	84	253	253	0.571	213
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	213	Yes
within R square	0.569		0.552		0.662		Yes	
Between R square		0.952		0.578		0.560	0.571	0.330

Note: same as Table 3.3A

Table 3.5C. Panel analysis: global crisis impact across legal status on Depth

VARIABLES	Dependent variable: Depth							
	Bank FE	Bank RE	CU FE	CU RE	NBFI FE	NBFI RE	NGO FE	NGO RE
Banking Crisis*Post 2008	0.140	-0.889	-0.016	-0.015	-0.543	-0.565	-0.202***	-0.110*
	(0.371)	(0.607)	(0.085)	(0.088)	(0.970)	(0.883)	(0.017)	(0.062)
Banking Crisis*Post 2008	0.058	-0.932	0.012	0.016	-0.539	-0.559	-0.207***	-0.113*
(with time since 2008)	(0.307)	(0.583)	(0.087)	(0.092)	(0.970)	(0.880)	(0.018)	(0.063)
Test of overidentifying restrictions (FE VS RE)								
P vlaue		-		0.524		0.241		0.000
Observations	115	115	285	285	1,030	1,030	884	884
Number of id	29	29	112	112	272	272	227	227
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.408		0.174		0.075		0.088	
Between R square		0.952		0.192		0.416		0.473

Note: same as Table 3.3A

Table 3.6. Panel analysis: global crisis impact using counterfactual model

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	FE	RE	FE	RE	FE	RE
	borrow	borrow	roa	roa	depth	depth
Banking Crisis		-0.308		7.482		0.113
		(0.600)		(8.514)		(0.461)
MIF characteristics variables						
cap_asset	-4.115***	-3.719***	-17.692	-5.013	0.067	0.081
	(0.427)	(0.359)	(15.658)	(7.300)	(0.077)	(0.070)
Size	0.124	0.378*	-1.684	-0.594	0.078***	0.106***
	(0.163)	(0.200)	(1.508)	(0.930)	(0.026)	(0.031)
New	-0.562**	-0.861***	-14.233	-11.043**	0.075**	0.075*
	(0.268)	(0.210)	(9.743)	(5.144)	(0.033)	(0.039)
Young	-0.142	-0.275***	-1.025	0.508	0.010	0.013
	(0.103)	(0.097)	(1.021)	(1.400)	(0.028)	(0.026)
dep_totasset	-4.012***	-3.006***	-17.126	-2.356	-0.188	0.115
	(0.747)	(0.458)	(11.393)	(4.643)	(0.280)	(0.175)
glp_totasset	0.298	0.496	8.239	12.117***	0.288**	0.224**
	(0.459)	(0.420)	(5.479)	(4.367)	(0.126)	(0.109)
English		9.311***		-31.764**		-0.457**
		(1.087)		(13.623)		(0.199)
port_risk30	-0.005	-0.011	-0.151	-0.141	-0.004**	-0.003
	(0.012)	(0.009)	(0.118)	(0.088)	(0.002)	(0.002)
Regulated		0.816*		-3.768*		0.093*

		(0.432)		(2.009)		(0.055)
CU		-2.756***		-3.147		-0.226
		(0.638)		(3.442)		(0.173)
NBFI		-1.418***		-1.039		0.037
		(0.485)		(2.988)		(0.167)
NGO		-2.594***		-7.052		-0.174
		(0.603)		(4.407)		(0.155)
Other		-1.449**		-1.192		0.421*
		(0.661)		(4.099)		(0.231)
Rural_Bank		-3.325***		-2.605		-0.154
		(0.740)		(4.250)		(0.246)
EECA		12.410***		-25.798*		0.431
		(1.046)		(13.361)		(0.301)
Country characteristics variables						
Acpi	0.046***	0.037***	0.184	0.273*	0.001	0.001
	(0.007)	(0.007)	(0.123)	(0.151)	(0.003)	(0.003)
Gdp	0.070	0.049	-1.340	-1.365*	-0.018	-0.013
	(0.062)	(0.063)	(0.882)	(0.728)	(0.022)	(0.022)
Cc	0.598***	0.488**	4.554	3.480	0.130	0.106
	(0.228)	(0.247)	(3.675)	(4.198)	(0.101)	(0.100)
Financial system characteristics variables						
banking roa	0.114**	0.088*	1.606	2.016	0.011	0.010
	(0.047)	(0.047)	(1.352)	(2.055)	(0.011)	(0.011)
financialtransparency	0.169**	0.172**	0.954	0.729	-0.034	-0.027

	(0.081)	(0.080)	(0.602)	(0.624)	(0.029)	(0.028)
Constant	10.585***		-13.104		0.269	0.272
	(0.888)		(10.647)		(0.227)	(0.329)
Diff	1.166***	-0.131*	0.803**	5.080 ***	0.035***	0.075***
	(0.068)	(0.099)	(0.470)	(0.432)	(0.014)	(0.013)
Ttest	17.055	-1.331	1.708	11.758	2.596	5.811
Test of overidentifying restrictions (FE VS RE)						
Sargan-Hansen statistic		57.634		10.271		24.667
P value		0.000		0.592		0.017
Observations	567	567	573	573	674	674
R-squared	0.672		0.232		0.130	
Number of id	273	273	279	279	328	328
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.672		0.232		0.130	
Between R square		0.615		0.471		0.355

Note: same as Table 3.3A

Appendix 1: Figures for Chapter 1

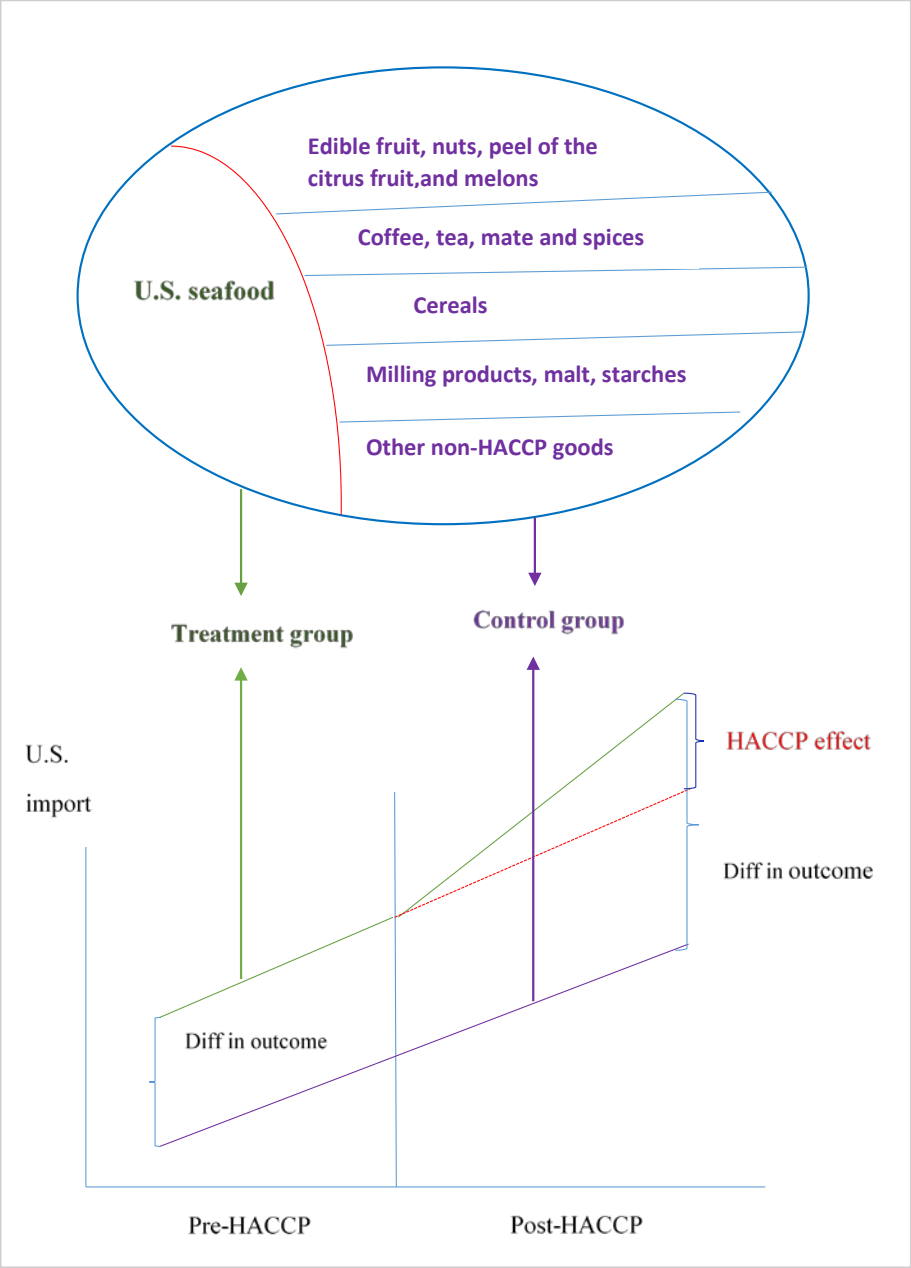


Figure 1A1. The graphical explanation of difference-in-difference estimation - U.S. non-HACCP commodities as the control

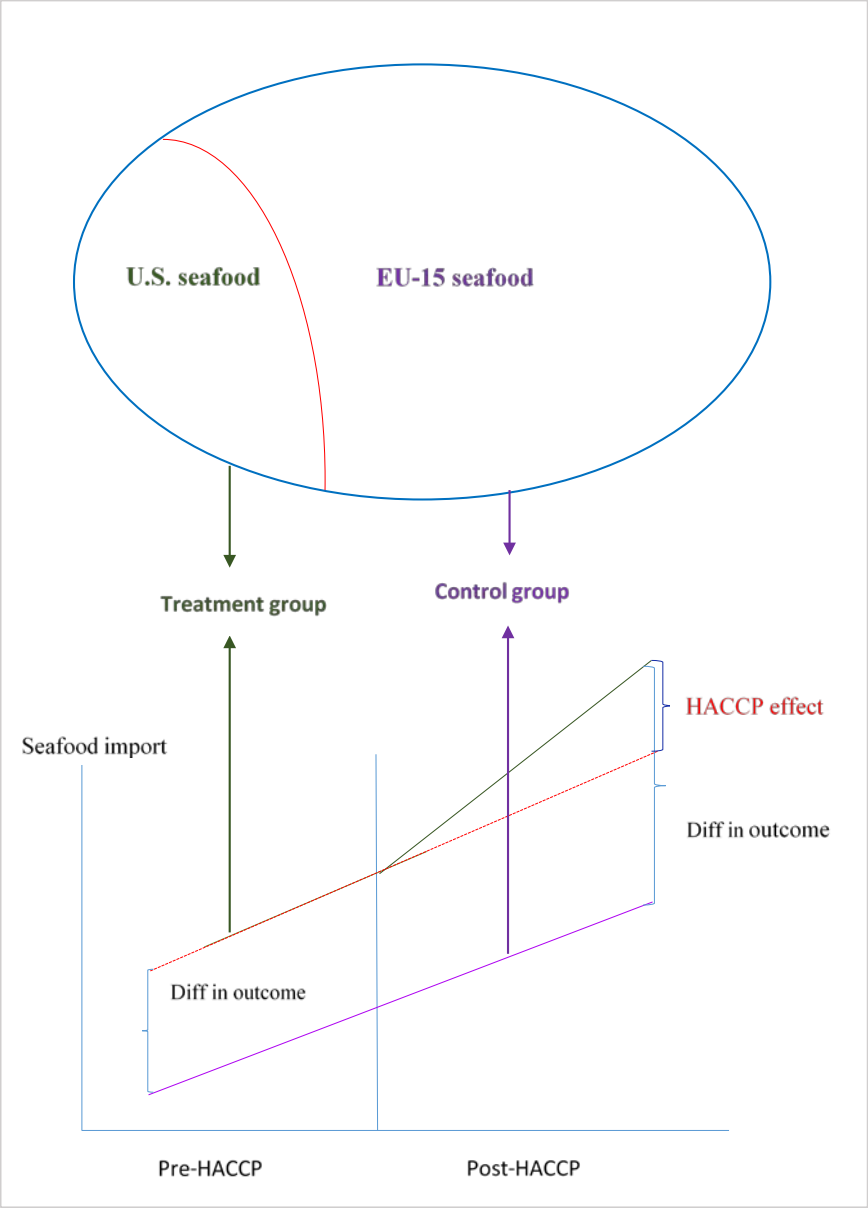
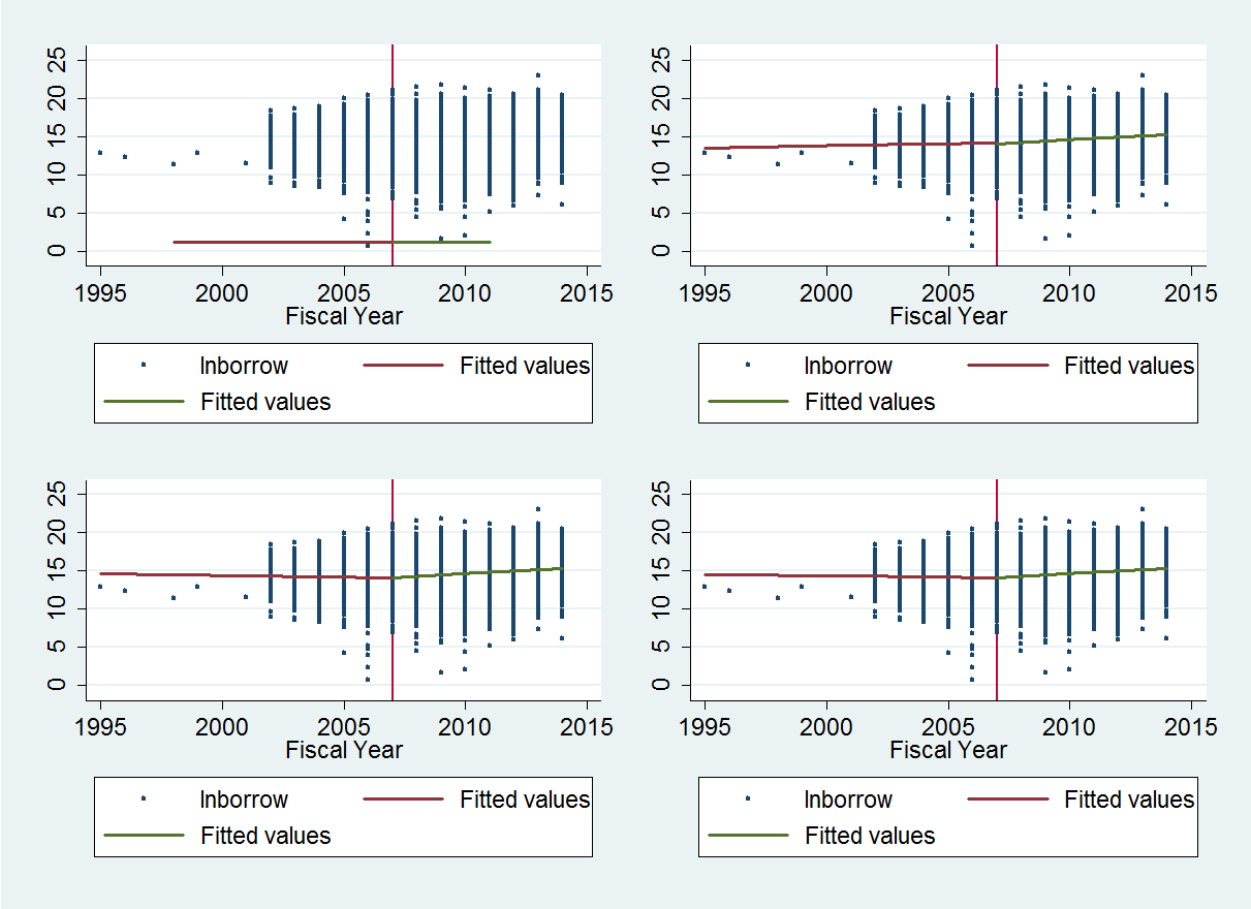


Figure 1A2. The graphical explanation of difference-in-difference estimation – EU-15 seafood as the control

Appendix 3: Tables and Figures for Chapter 3



Graph 3.1 Potential specification: Linear with same slope an intercept, Linear with different slope and intercept, Quadratic form with same slope and intercept, Quadratic form with different slope and intercept

Table 3A1. Variable Definitions

Dependent variables	
ret_assets	Return on assets; measures how well the MFI uses its total assets to generate returns
ln_borrow	Logarithm of the number of current borrowers, that is the number of individuals that currently have an outstanding loan balance with the MFI or are responsible for repaying any portion of the gross loan Portfolio.
depth	Average loan balance per borrower / GNI per capita
Independent variables	
MIF characteristics variables	
Banking Crisis*Post 2008	A dummy that equals one if MFI suffers from the global financial crisis
Banking Crisis	A dummy that equals one if the country suffers banking crisis
Post 2008	A dummy that equals one if year>2007
Time since 2008	A non-negative number equals current year-2008, 0 if negative
cap_asset	Ratio of capital to total assets
Age	categorized by the number of years since inception:
New	A dummy that equals one if MIF is New
Young	A dummy that equals one if MIF is Young
Size	The total assets of the MFI ($ 100 million). Total assets include all assets net of contra asset accounts such as the loan loss reserve and accumulated depreciation
dep_totasset	Ratio of saving to total assets
glp_totasset	Ratio of loans outstanding to total assets

port_risk30	Portfolio-at-risk > 30 days
English	Legal origin_English
Regulated	A dummy that equals one if MIF is regulated by a government regulatory agency
CU	A dummy that equals one if MIF is CU
NBFI	A dummy that equals one if MIF is NBFI
NGO	A dummy that equals one if MIF is NGO
Other	A dummy that equals one if MIF Other
Rural_Bank	A dummy that equals one if MIF is Rural Bank
EECA	A dummy that equals one if MIF is from Eastern Europe and Central Asia
Country characteristics variables	
Acpi	Average annualized consumer price index
Gdp	Logarithm of the total GDP ($100 billion)
Cc	Control Corruption
Financial system characteristics variables	
Roa	Return on assets of bank
financialtransparency	financial transparency

Table 3A2. Distribution of sample MFIs and banking crisis by region

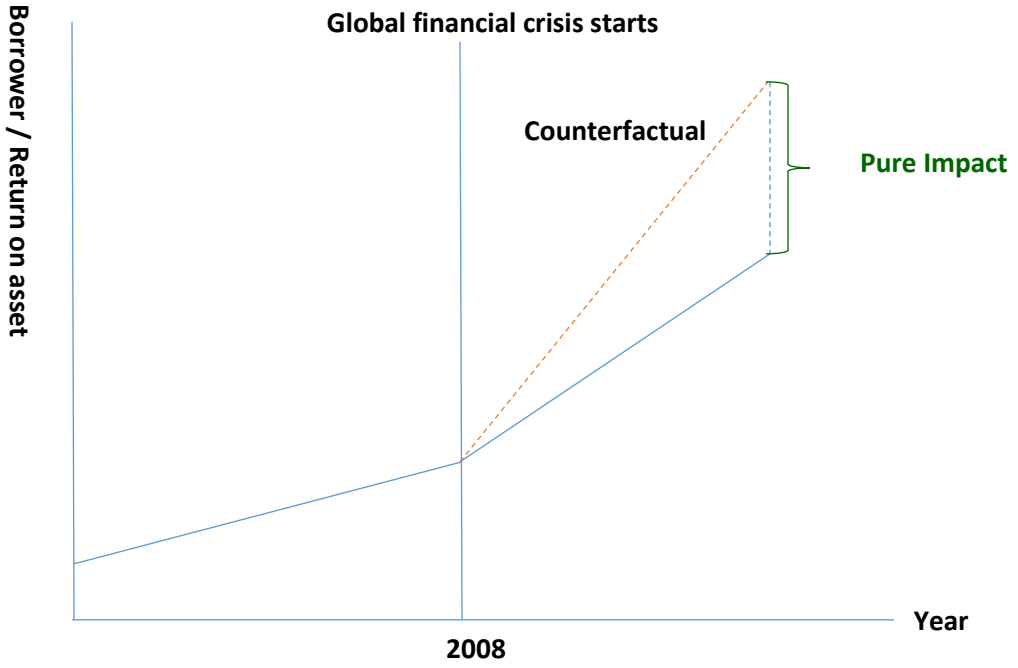
country distribution by region	No. MIFs	% of sample	No. crisis	% of sample
Africa	59	0.074	0	0
East Asia and the Pacific	48	0.051	0	0
Eastern Europe and Central Asia	118	0.153	111	1
Latin America and The Caribbean	233	0.436	0	0
Middle East and North Africa	29	0.064	0	0
South Asia	134	0.222	0	0
Total	621	1	111	1

Table A3. Distribution of sample MFIs and banking crisis by legal status

country distribution by legal status	No. MIFs	% of sample	No. crisis	% of sample
Bank	28	0.050	10	0.090
Credit Union / Cooperative	84	0.094	57	0.514
NBFI	253	0.446	40	0.360
NGO	213	0.368	4	0.036
Other	4	0.003	0	0
Rural Bank	40	0.039	0	0
Total	622	1	111	1

Table 3A4. Distribution of sample MFIs and banking crisis across country

Country	Pre-global financial crisis		Post-global financial crisis	
	MFI	banking crisis	MFI	banking crisis
Russia	38	66	21	26
Kazakhstan	0	0	13	19



Graph A3.2. Graphic explanation of Counterfactual model

Table 3A5. Panel analysis: global crisis impact on sustainability in Bank

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Bank FE	Bank FE	Bank FE	Bank FE	Bank RE	Bank RE	Bank RE	Bank RE
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
Banking Crisis*Post 2008			0.772	1.169			6.828	7.119
			(6.471)	(6.590)			(5.108)	(5.195)
Banking Crisis					-1.899	0.976	-2.009	0.587
					(7.470)	(6.189)	(7.475)	(6.290)
Post 2008			-1.985	-1.995			-2.613*	-2.388
			(1.282)	(1.308)			(1.461)	(1.503)
time since 2008		-0.838		-0.855		-1.190		-1.114
		(0.667)		(0.713)		(0.789)		(0.768)
MIF characteristics variables								
cap_asset	21.060*	20.228*	21.695*	20.930*	20.156*	19.654*	22.056**	21.565**
	(11.041)	(10.155)	(11.769)	(10.875)	(11.285)	(10.438)	(10.944)	(10.164)

size	-0.129	-0.069	-0.050	0.015	0.192	0.236	0.295	0.337*
	(0.100)	(0.116)	(0.120)	(0.153)	(0.185)	(0.182)	(0.196)	(0.199)
New	-5.121	-6.100	-6.192	-7.285	-10.966***	-11.475***	-11.239***	-11.685***
	(5.338)	(4.962)	(5.391)	(5.234)	(2.980)	(2.676)	(2.942)	(2.741)
Young	2.904	2.631	2.442	2.125	2.052	1.694	2.120	1.824
	(3.841)	(3.669)	(4.136)	(4.009)	(3.002)	(2.715)	(3.084)	(2.843)
dep_totasset	9.648*	9.965*	10.441*	10.655*	4.416	5.631	5.223	6.163
	(5.303)	(5.382)	(5.748)	(5.735)	(5.134)	(4.821)	(5.734)	(5.448)
glp_totasset	17.093	18.011	15.810	16.697	18.123**	19.678**	18.514**	19.917***
	(11.651)	(11.516)	(11.246)	(11.118)	(7.688)	(7.707)	(7.646)	(7.534)
english					-3.170	-10.547	-8.558	-15.483
					(13.163)	(12.481)	(11.774)	(11.650)
port_risk30	-0.170	-0.123	-0.128	-0.080	-0.122	-0.091	-0.100	-0.072
	(0.123)	(0.131)	(0.138)	(0.146)	(0.141)	(0.142)	(0.146)	(0.145)
regulated					-8.673	-10.015	-4.965	-5.761
					(9.256)	(9.605)	(9.459)	(9.995)

EECA					-1.756	-5.201	-4.311	-7.513
					(6.885)	(6.325)	(5.911)	(5.630)
Country characteristics variables								
acpi	-0.016	0.011	0.007	0.034	-0.042*	0.000	-0.015	0.020
	(0.018)	(0.025)	(0.017)	(0.027)	(0.024)	(0.032)	(0.027)	(0.032)
gdp	0.504	0.494	0.468	0.450	0.485	0.488	0.355	0.351
	(0.307)	(0.292)	(0.347)	(0.329)	(0.397)	(0.382)	(0.342)	(0.329)
cc	2.579	5.695	3.257	6.546	4.300	8.597	6.509	10.501*
	(5.620)	(4.576)	(4.899)	(4.359)	(7.302)	(6.655)	(6.320)	(5.895)
Financial system characteristics variables								
banking_roa	-0.141	-0.308	-0.445	-0.621	-0.579	-0.819	-1.038	-1.233*
	(0.642)	(0.687)	(0.701)	(0.767)	(0.618)	(0.676)	(0.661)	(0.722)
financialtransparency	-0.820	-0.673	-0.832	-0.702	-0.464	-0.331	-1.029	-0.918
	(0.778)	(0.728)	(0.966)	(0.928)	(0.850)	(0.809)	(1.041)	(1.028)
Constant	-10.693	-12.959	-11.175	-13.205				

	(9.695)	(9.900)	(9.385)	(9.459)				
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic		57.634		10.271		24.667		
P vlaue		0.000		0.592		0.017		
Observations	113	113	113	113	113	113	113	113
Number of id	27	27	27	27	27	27	27	27
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.356	0.365	0.367	0.376				
Between R square					0.942	0.944	0.948	0.950

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A6. Panel analysis: global crisis impact on sustainability in CU

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	CU FE	CU FE	CU FE	CU FE	CU RE	CU RE	CU RE	CU RE
Banking Crisis*Post 2008			-0.025	0.107			-0.158	-0.152
			(3.622)	(3.418)			(3.238)	(3.061)
Banking Crisis					-1.310	-5.131	-6.605	-6.609
					(5.081)	(4.849)	(6.691)	(7.207)
Post 2008			2.239**	2.321**			2.397**	2.399**
			(1.021)	(1.061)			(1.069)	(1.090)
time since 2008		-0.070		0.126		-0.218		0.001
		(0.617)		(0.615)		(0.611)		(0.603)
MIF characteristics variables								
cap_asset	-3.237	-3.241	-2.306	-2.304	-0.432	-0.405	0.024	0.033
	(7.052)	(7.084)	(7.284)	(7.297)	(4.012)	(3.990)	(4.089)	(4.051)
Size	0.100	0.133	-0.472	-0.547	-0.411	-0.316	-0.933	-0.936
	(0.606)	(0.567)	(0.684)	(0.701)	(0.568)	(0.486)	(0.666)	(0.609)
New	-0.532	-0.566	-0.893	-0.848	0.074	0.060	-0.153	-0.148
	(3.721)	(3.848)	(3.765)	(3.886)	(1.992)	(1.999)	(2.054)	(2.061)
Young	-0.112	-0.123	-0.420	-0.413	-0.242	-0.239	-0.383	-0.382
	(1.202)	(1.233)	(1.187)	(1.200)	(1.005)	(1.008)	(1.003)	(1.008)
dep_totasset	-0.508	-0.426	-0.219	-0.360	0.433	0.490	0.366	0.371

	(3.103)	(2.776)	(3.099)	(2.803)	(1.773)	(1.730)	(1.775)	(1.728)
glp_totasset	0.656	0.594	0.462	0.577	1.698	1.635	1.677	1.680
	(4.946)	(5.085)	(4.923)	(5.028)	(3.086)	(3.133)	(3.013)	(3.076)
English					0.540		-1.787	
					(2.062)		(7.065)	
port_risk30	-0.041	-0.040	-0.048	-0.048	-0.051**	-0.051**	-0.053**	-0.053**
	(0.031)	(0.032)	(0.034)	(0.034)	(0.024)	(0.024)	(0.023)	(0.023)
Regulated					0.923	0.927	0.880	0.883
					(1.830)	(1.830)	(1.886)	(1.873)
EECA					3.380	-0.072	5.842	5.846
					(3.759)	(7.125)	(9.927)	(11.351)
Country characteristics variables								
Acpi	-0.044	-0.040	-0.136	-0.148	-0.045	-0.031	-0.141**	-0.142
	(0.046)	(0.061)	(0.088)	(0.099)	(0.043)	(0.066)	(0.071)	(0.091)
Gdp	0.166	0.160	0.528	0.555	0.359	0.341	0.721*	0.723*
	(0.314)	(0.306)	(0.454)	(0.443)	(0.265)	(0.257)	(0.391)	(0.375)
Cc	-2.108	-1.907	-4.595	-5.062	1.049	1.716	-2.068	-2.053
	(4.426)	(5.356)	(4.367)	(5.559)	(4.860)	(6.000)	(4.299)	(5.728)
Financial system characteristics variables								
banking_roa	1.940	1.949	2.252	2.262	2.076	2.118	2.326	2.326
	(1.229)	(1.277)	(1.506)	(1.484)	(1.266)	(1.334)	(1.577)	(1.553)
financialtransparency	0.581	0.591	0.680	0.653*	0.723*	0.741*	0.842*	0.844**

	(0.420)	(0.413)	(0.457)	(0.392)	(0.398)	(0.397)	(0.466)	(0.421)
Constant	-0.125	-0.476	5.200	6.194	-6.351			
	(5.433)	(5.556)	(9.199)	(8.966)	(4.999)			
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P value					0.257	0.614	0.059	0.100
Observations	258	258	258	258	258	258	258	258
R-squared	0.079	0.079	0.096	0.097				
Number of id	101	101	101	101	101	101	101	101
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.0788	0.0789	0.0965	0.0967				
Between R square					0.258	0.261	0.264	0.265

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A7. Panel analysis: global crisis impact on sustainability in NBFI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	NBFI FE	NBFI FE	NBFI FE	NBFI FE	NBFI RE	NBFI RE	NBFI RE	NBFI RE
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
Banking Crisis*Post 2008			3.021	2.871			2.730	2.562
			(3.237)	(3.232)			(2.806)	(2.795)
Banking Crisis					1.768	1.552	0.865	0.706
					(5.397)	(5.361)	(5.409)	(5.403)
Post 2008			-1.707*	-1.777**			-1.980**	-1.976**
			(0.895)	(0.900)			(0.858)	(0.857)
time since 2008		-0.641*		-0.672**		-0.643**		-0.636**
		(0.329)		(0.335)		(0.312)		(0.313)
MIF characteristics variables								
cap_asset	9.159	9.180	9.220	9.239	8.354*	8.418*	8.485*	8.544*
	(6.881)	(6.873)	(6.891)	(6.884)	(4.677)	(4.692)	(4.682)	(4.699)

size	-0.014	0.055	0.181	0.260	0.039	0.101	0.219	0.278
	(0.344)	(0.357)	(0.380)	(0.396)	(0.260)	(0.270)	(0.286)	(0.297)
New	-6.289**	-6.275**	-6.340**	-6.329**	-4.265**	-4.207**	-4.226**	-4.166**
	(2.502)	(2.481)	(2.496)	(2.477)	(1.705)	(1.704)	(1.722)	(1.721)
Young	0.731	0.663	0.583	0.503	1.025	1.018	0.944	0.935
	(0.816)	(0.797)	(0.810)	(0.793)	(0.685)	(0.678)	(0.692)	(0.686)
dep_totasset	-0.362	1.801	0.672	2.981	0.558	1.285	0.894	1.615
	(7.224)	(7.336)	(6.896)	(7.029)	(3.028)	(3.049)	(2.956)	(2.990)
glp_totasset	18.461***	18.298***	18.929***	18.761***	16.512***	16.430***	16.878***	16.786***
	(5.554)	(5.568)	(5.460)	(5.473)	(4.532)	(4.549)	(4.474)	(4.492)
english					-6.199	-5.697	0.589	-7.693*
					(4.332)	(4.389)	(3.434)	(4.598)
port_risk30	-0.064	-0.063	-0.064	-0.063	-0.071	-0.070	-0.071	-0.070
	(0.051)	(0.051)	(0.051)	(0.051)	(0.053)	(0.053)	(0.053)	(0.052)
regulated					-0.764	-0.936	-0.925	-1.092
					(1.324)	(1.324)	(1.300)	(1.302)

EECA					-7.036	-6.497	-0.762	-9.003*
					(4.615)	(4.652)	(3.349)	(4.994)
Country characteristics variables								
acpi	-0.008	0.022	0.031	0.064	0.002	0.034	0.048	0.079*
	(0.027)	(0.034)	(0.041)	(0.047)	(0.025)	(0.032)	(0.035)	(0.042)
gdp	-0.240	-0.221	-0.328	-0.311	-0.153	-0.146	-0.258	-0.250
	(0.283)	(0.282)	(0.301)	(0.302)	(0.241)	(0.244)	(0.257)	(0.260)
cc	2.572	3.246	2.775	3.473	2.443	3.223	2.739	3.496
	(4.672)	(4.736)	(4.655)	(4.734)	(4.430)	(4.525)	(4.436)	(4.539)
Financial system characteristics variables								
banking_roa	0.079	0.075	0.085	0.081	0.079	0.075	0.088	0.084
	(0.057)	(0.057)	(0.058)	(0.058)	(0.055)	(0.055)	(0.056)	(0.056)
financialtransparency	-0.177	-0.157	-0.361	-0.342	-0.140	-0.101	-0.320	-0.278
	(0.329)	(0.334)	(0.335)	(0.344)	(0.327)	(0.327)	(0.335)	(0.337)
Constant	-10.833	-13.988**	-13.645*	-17.094**	-4.365	-7.559	-14.055**	-8.457
	(7.178)	(6.982)	(6.938)	(6.797)	(7.356)	(7.173)	(6.133)	(7.180)

Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.106	0.146	0.179	0.183
Observations	975	975	975	975	975	975	975	975
R-squared	0.159	0.162	0.164	0.169				
Number of id	261	261	261	261	261	261	261	261
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.159	0.162	0.164	0.169				
Between R square					0.207	0.207	0.213	0.212

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A8. Panel analysis: global crisis impact on sustainability in NGO

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	NGO FE	NGO FE	NGO FE	NGO FE	NGO RE	NGO RE	NGO RE	NGO RE
	ROA	ROA	ROA	ROA	ROA	ROA	ROA	ROA
Banking Crisis*Post 2008			-1.759	-1.364			3.203	3.044
			(6.371)	(6.111)			(3.429)	(3.368)
Banking Crisis					19.211***	18.221***	16.799***	15.877***
					(4.507)	(4.083)	(3.959)	(3.464)
Post 2008			-3.307***	-3.303***			-3.811***	-3.783***
			(1.141)	(1.156)			(1.088)	(1.097)
time since 2008		-1.188		-1.183		-1.109		-1.089
		(0.833)		(0.825)		(0.969)		(0.967)
MIF characteristics variables								
cap_asset	-7.850	-7.211	-8.590	-7.939	6.239*	6.464**	5.855*	6.072*
	(10.695)	(10.243)	(10.984)	(10.536)	(3.287)	(3.105)	(3.365)	(3.190)

size	-2.347	-2.276	-2.125	-2.051	-0.788	-0.770	-0.575	-0.558
	(1.676)	(1.627)	(1.647)	(1.599)	(0.767)	(0.758)	(0.765)	(0.758)
New	-8.499	-8.920	-8.618	-9.031	-10.316	-10.589	-10.136	-10.408
	(6.864)	(7.008)	(6.888)	(7.029)	(6.608)	(6.739)	(6.572)	(6.708)
Young	1.078	0.922	0.512	0.359	-0.157	-0.251	-0.530	-0.620
	(1.239)	(1.194)	(1.201)	(1.180)	(1.294)	(1.243)	(1.256)	(1.215)
dep_totasset	-23.762*	-24.969*	-23.083	-24.272	-9.173	-9.659	-8.771	-9.257
	(14.282)	(14.899)	(14.740)	(15.354)	(6.362)	(6.649)	(6.493)	(6.774)
glp_totasset	18.844***	18.135***	17.971***	17.268***	17.421***	17.153***	16.928***	16.668***
	(3.986)	(3.789)	(3.878)	(3.739)	(3.311)	(3.212)	(3.223)	(3.139)
english					7.850**	12.091**	-3.284	9.672***
					(3.183)	(4.771)	(4.751)	(3.585)
port_risk30	-0.053	-0.048	-0.051	-0.045	-0.075***	-0.073***	-0.075***	-0.072***
	(0.036)	(0.034)	(0.036)	(0.034)	(0.024)	(0.023)	(0.024)	(0.024)
regulated					-1.082	-0.977	-1.414	-1.308
					(1.348)	(1.347)	(1.345)	(1.344)

EECA					-15.626***	-11.928***	-12.828***	-16.083***
					(2.047)	(2.805)	(2.431)	(2.144)
Country characteristics variables								
acpi	-0.004	0.043	0.063*	0.110**	0.048	0.091	0.126**	0.168**
	(0.024)	(0.038)	(0.037)	(0.055)	(0.035)	(0.067)	(0.052)	(0.083)
gdp	0.183	0.311	0.200	0.327	-0.119	-0.001	-0.106	0.009
	(0.229)	(0.272)	(0.231)	(0.275)	(0.173)	(0.181)	(0.170)	(0.178)
cc	-2.448	-1.392	-2.631	-1.560	-0.030	0.957	0.028	0.989
	(2.884)	(2.948)	(3.007)	(3.050)	(2.779)	(3.225)	(2.810)	(3.266)
Financial system characteristics variables								
banking_roa	0.520	0.534	0.538	0.552	0.724	0.739	0.750	0.764
	(0.568)	(0.594)	(0.574)	(0.600)	(0.764)	(0.791)	(0.774)	(0.801)
financialtransparency	0.829	0.633	0.456	0.258	1.171**	1.002	0.657	0.496
	(0.559)	(0.605)	(0.560)	(0.613)	(0.560)	(0.625)	(0.574)	(0.646)
Constant	-	-	-	-	-	-	-	-

	15.010***	18.677***	18.555***	22.184***	22.001***	28.858***	28.984***	28.792***
	(5.711)	(4.781)	(5.129)	(4.559)	(4.279)	(7.524)	(6.044)	(6.453)
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.027	0.026	0.020	0.004
Observations	826	826	826	826	826	826	826	826
Number of id	223	223	223	223	223	223	223	223
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.128	0.136	0.141	0.149				
Between R square					0.632	0.629	0.642	0.639

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A9. Panel analysis: global crisis impact on outreach in Bank

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Bank FE	Bank FE	Bank FE	Bank FE	Bank RE	Bank RE	Bank RE	Bank RE
Banking Crisis*Post 2008			-2.177***	-2.146***			-1.598**	-1.602**
			(0.548)	(0.572)			(0.776)	(0.749)
Banking Crisis					-1.163	-0.679	-1.064	-0.573
					(1.270)	(1.173)	(1.145)	(1.040)
Post 2008			0.224	0.229			0.042	0.080
			(0.213)	(0.206)			(0.222)	(0.206)
time since 2008		-0.115		-0.108		-0.235*		-0.241**
		(0.108)		(0.106)		(0.126)		(0.119)
MIF characteristics variables								
cap_asset	-2.417*	-2.436*	-2.848*	-2.862*	-3.762**	-3.833***	-3.882**	-3.968***
	(1.296)	(1.223)	(1.570)	(1.488)	(1.515)	(1.392)	(1.615)	(1.475)

size	0.116***	0.125***	0.087***	0.095***	0.213***	0.221***	0.198***	0.205***
	(0.020)	(0.027)	(0.018)	(0.025)	(0.036)	(0.031)	(0.040)	(0.035)
New	-0.743**	-0.897**	-0.224	-0.374	-0.955***	-1.068***	-0.980***	-1.095***
	(0.269)	(0.364)	(0.233)	(0.328)	(0.269)	(0.302)	(0.272)	(0.290)
Young	0.079	0.113	0.506**	0.532*	-0.091	-0.067	-0.151	-0.129
	(0.342)	(0.359)	(0.238)	(0.263)	(0.751)	(0.722)	(0.790)	(0.757)
dep_totasset	-3.641***	-3.526***	-2.649***	-2.560***	-4.178***	-3.872***	-3.856***	-3.573***
	(0.602)	(0.601)	(0.603)	(0.620)	(0.870)	(0.881)	(0.947)	(0.942)
glp_totasset	-0.145	-0.086	0.184	0.237	0.043	0.218	-0.032	0.131
	(0.915)	(0.948)	(0.870)	(0.909)	(0.782)	(0.781)	(0.865)	(0.865)
english					-3.498***	-2.935***	-3.298***	-2.739***
					(0.774)	(0.626)	(0.732)	(0.635)
port_risk30	0.006	0.007	-0.003	-0.002	0.039**	0.044***	0.037*	0.042**
	(0.014)	(0.013)	(0.017)	(0.017)	(0.019)	(0.017)	(0.021)	(0.019)
EECA					0.285	-0.321	0.755	0.149
					(1.039)	(1.007)	(0.948)	(0.950)

Country characteristics variables								
acpi	0.009**	0.013**	0.006	0.009	-0.001	0.008	-0.000	0.009
	(0.004)	(0.006)	(0.004)	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)
gdp	0.089*	0.090*	0.152***	0.151***	0.046	0.049	0.079	0.082
	(0.045)	(0.045)	(0.018)	(0.019)	(0.070)	(0.072)	(0.059)	(0.060)
cc	0.179	0.585	-0.587	-0.200	0.078	0.878	-0.363	0.440
	(0.541)	(0.538)	(0.392)	(0.452)	(0.825)	(0.778)	(0.696)	(0.669)
Financial system characteristics variables								
banking_roa	-0.089	-0.117	-0.049	-0.075	-0.157*	-0.202**	-0.141	-0.184*
	(0.101)	(0.104)	(0.120)	(0.125)	(0.092)	(0.089)	(0.099)	(0.100)
financialtransparency	0.156	0.160	0.228**	0.230***	0.186	0.195*	0.288**	0.300***
	(0.124)	(0.111)	(0.093)	(0.082)	(0.141)	(0.113)	(0.134)	(0.107)
Constant	17.062***	16.808***	15.884***	15.671***	19.050***	18.728***	17.651***	17.361***
	(1.320)	(1.277)	(0.994)	(1.057)	(1.286)	(1.336)	(1.143)	(1.306)
Test of overidentifying restrictions (FE VS								

RE)								
Sargan-Hansen statistic								
P vlaue					0.000	0.000	0.000	0.000
Observations	109	109	109	109	109	109	109	109
R-squared	0.562	0.569	0.613	0.619				
Number of id	28	28	28	28	28	28	28	28
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.562	0.569	0.613	0.619				
Between R square					0.950	0.949	0.952	0.952

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A10. Panel analysis: global crisis impact on outreach in CU

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	CU FE	CU FE	CU FE	CU FE	CU RE	CU RE	CU RE	CU RE
	borrower	borrower	borrower	borrower	borrower	borrower	borrower	borrower
Banking Crisis*Post 2008			-1.170**	-1.158**			-0.941*	-0.978**
			(0.560)	(0.554)			(0.495)	(0.485)
Banking Crisis					-1.533	-0.587	-0.856	-0.772
					(1.111)	(1.100)	(1.090)	(1.112)
Post 2008			0.049	0.056			0.120	0.102
			(0.300)	(0.357)			(0.271)	(0.318)
time since 2008		0.026		0.010		-0.012		-0.030
		(0.099)		(0.122)		(0.112)		(0.125)
MIF characteristics variables								
cap_asset	-4.356***	-4.344***	-4.100***	-4.094***	-3.736***	-3.741***	-3.531***	-3.550***
	(0.436)	(0.430)	(0.435)	(0.451)	(0.494)	(0.484)	(0.457)	(0.458)

size	0.432***	0.419***	0.379**	0.373**	0.514***	0.518***	0.477***	0.489***
	(0.164)	(0.156)	(0.158)	(0.177)	(0.159)	(0.156)	(0.157)	(0.168)
New	-1.056*	-1.040*	-1.017*	-1.012*	-0.715*	-0.718*	-0.741*	-0.749*
	(0.610)	(0.593)	(0.608)	(0.601)	(0.409)	(0.402)	(0.402)	(0.400)
Young	-0.444	-0.443	-0.392	-0.392	-0.187	-0.186	-0.168	-0.167
	(0.450)	(0.445)	(0.465)	(0.467)	(0.310)	(0.313)	(0.313)	(0.320)
dep_totasset	-3.223***	-3.243***	-3.136***	-3.143***	-3.096***	-3.091***	-3.062***	-3.050***
	(0.623)	(0.615)	(0.569)	(0.540)	(0.461)	(0.453)	(0.439)	(0.423)
glp_totasset	0.900	0.912	0.937	0.942	0.569	0.568	0.489	0.486
	(0.619)	(0.614)	(0.610)	(0.603)	(0.654)	(0.657)	(0.643)	(0.643)
english					0.335	0.324		14.058***
					(0.481)	(0.531)		(1.497)
port_risk30	0.003	0.003	-0.002	-0.002	-0.004	-0.004	-0.007*	-0.007*
	(0.005)	(0.005)	(0.007)	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)
regulated					0.217	0.217	0.143	0.142
					(0.352)	(0.353)	(0.362)	(0.363)

EECA					0.936	-0.006	14.811***	14.558***
					(0.757)	(0.821)	(1.654)	(2.006)
Country characteristics variables								
acpi	0.003	0.002	0.012	0.011	0.008	0.009	0.012	0.015
	(0.008)	(0.009)	(0.013)	(0.021)	(0.008)	(0.010)	(0.014)	(0.021)
gdp	-0.034	-0.031	-0.048	-0.045	-0.041	-0.042	-0.048	-0.054
	(0.074)	(0.070)	(0.070)	(0.076)	(0.057)	(0.055)	(0.058)	(0.062)
cc	1.062*	0.994	1.087*	1.053	0.561	0.598	0.433	0.557
	(0.561)	(0.609)	(0.649)	(0.894)	(0.587)	(0.696)	(0.713)	(0.989)
Financial system characteristics variables								
banking_roa	0.281**	0.280**	0.170	0.172	0.222	0.223	0.116	0.113
	(0.139)	(0.140)	(0.137)	(0.137)	(0.141)	(0.142)	(0.142)	(0.140)
financialtransparency	-0.040	-0.042	0.067	0.066	-0.115	-0.114	-0.020	-0.014
	(0.129)	(0.126)	(0.127)	(0.117)	(0.119)	(0.116)	(0.123)	(0.114)
Constant	15.181***	15.316***	13.906***	13.986***	14.893***	14.840***		
	(0.997)	(1.019)	(1.056)	(1.523)	(0.951)	(0.910)		

Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.000	0.000	0.000	0.000
Observations	207	207	207	207	207	207	207	207
Number of id	84	84	84	84	84	84	84	84
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.531	0.532	0.552	0.552				
Between R square					0.578	0.579	0.578	0.579

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A11. Panel analysis: global crisis impact on outreach in NBFI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	NBFI FE	NBFI FE	NBFI FE	NBFI FE	NBFI RE	NBFI RE	NBFI RE	NBFI RE
	borrower	borrower	borrower	borrower	borrower	borrower	borrower	borrower
Banking Crisis*Post 2008			-1.221***	-1.280***			-1.135***	-1.205***
			(0.273)	(0.278)			(0.324)	(0.329)
Banking Crisis					-1.072*	-1.133*	-0.798	-0.842
					(0.646)	(0.660)	(0.584)	(0.594)
Post 2008			0.313***	0.301***			0.226**	0.220**
			(0.083)	(0.083)			(0.088)	(0.087)
time since 2008		-0.123**		-0.123**		-0.146***		-0.149***
		(0.049)		(0.048)		(0.050)		(0.050)
MIF characteristics variables								
cap_asset	-3.272***	-3.285***	-3.288***	-3.302***	-3.712***	-3.710***	-3.736***	-3.734***

	(0.553)	(0.553)	(0.568)	(0.569)	(0.503)	(0.504)	(0.517)	(0.519)
size	0.298***	0.311***	0.253***	0.266***	0.369***	0.382***	0.335***	0.349***
	(0.052)	(0.048)	(0.051)	(0.047)	(0.054)	(0.050)	(0.053)	(0.048)
New	-0.805***	-0.799***	-0.792***	-0.787***	-1.175***	-1.153***	-1.173***	-1.150***
	(0.193)	(0.188)	(0.190)	(0.184)	(0.158)	(0.152)	(0.156)	(0.151)
Young	-0.394***	-0.400***	-0.382***	-0.390***	-0.547***	-0.545***	-0.547***	-0.546***
	(0.096)	(0.097)	(0.093)	(0.092)	(0.091)	(0.090)	(0.090)	(0.089)
dep_totasset	-4.090***	-3.679***	-4.288***	-3.871***	-3.132***	-2.874***	-3.215***	-2.948***
	(0.804)	(0.850)	(0.819)	(0.855)	(0.580)	(0.601)	(0.587)	(0.606)
glp_totasset	1.138***	1.110***	1.003**	0.971**	1.173***	1.136***	1.078***	1.035***
	(0.401)	(0.399)	(0.409)	(0.406)	(0.382)	(0.380)	(0.387)	(0.385)
english					1.034	-3.056***	1.302	1.323
					(0.877)	(0.501)	(0.881)	(0.893)
port_risk30	-0.005***	-0.004***	-0.005***	-0.005***	-0.004**	-0.004**	-0.004**	-0.004**

	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
regulated					0.815***	0.762**	0.840***	0.786***
					(0.296)	(0.299)	(0.299)	(0.302)
EECA					3.459***	-0.613	3.801***	3.842***
					(0.911)	(0.490)	(0.922)	(0.936)
Country characteristics variables								
acpi	0.015***	0.021***	0.009*	0.015***	0.009**	0.016***	0.004	0.012**
	(0.004)	(0.005)	(0.005)	(0.006)	(0.004)	(0.005)	(0.005)	(0.006)
gdp	0.117***	0.119***	0.137***	0.139***	0.134***	0.134***	0.149***	0.149***
	(0.031)	(0.031)	(0.032)	(0.032)	(0.031)	(0.031)	(0.032)	(0.032)
cc	0.904**	1.009***	0.813**	0.913**	0.771*	0.910**	0.675*	0.812**
	(0.375)	(0.375)	(0.379)	(0.373)	(0.399)	(0.398)	(0.402)	(0.396)
Financial system characteristics variables								
banking roa	0.002	0.001	0.001	0.000	0.004	0.003	0.003	0.002
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
financialtransparency	0.006	0.015	0.049	0.059	-0.041	-0.027	-0.005	0.012

	(0.053)	(0.053)	(0.055)	(0.053)	(0.058)	(0.055)	(0.061)	(0.057)
Constant	14.037***	13.397***	14.475***	13.808***	10.544***	14.005***	10.482***	9.799***
	(0.545)	(0.603)	(0.590)	(0.661)	(0.950)	(0.752)	(0.945)	(0.986)
Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.000	0.000	0.000	0.000
Observations	978	978	978	978	978	978	978	978
Number of id	253	253	253	253	253	253	253	253
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.648	0.654	0.662	0.668				
Between R square					0.567	0.573	0.560	0.567

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A12. Panel analysis: global crisis impact on outreach in NGO

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	NGO FE	NGO FE	NGO FE	NGO FE	Bank RE	Bank RE	Bank RE	Bank RE
	borrower	borrower	borrower	borrower	borrower	borrower	borrower	borrower
Banking Crisis*Post 2008							0.719	0.670
							(0.804)	(0.812)
Banking Crisis					2.235***	2.204**	2.283***	2.253***
					(0.856)	(0.857)	(0.853)	(0.855)
Post 2008			0.187*	0.185*			0.217**	0.215**
			(0.096)	(0.097)			(0.107)	(0.109)
time since 2008		-0.070		-0.069		-0.059		-0.058
		(0.052)		(0.052)		(0.057)		(0.057)
MIF characteristics variables								
cap_asset	-4.207***	-4.203***	-4.170***	-4.167***	-2.284***	-2.283***	-2.262***	-2.260***
	(0.385)	(0.386)	(0.378)	(0.378)	(0.859)	(0.861)	(0.853)	(0.854)
size	0.438***	0.437***	0.424***	0.424**	0.921***	0.918***	0.903***	0.901***

	(0.167)	(0.168)	(0.162)	(0.164)	(0.285)	(0.286)	(0.280)	(0.281)
New	-0.573*	-0.592**	-0.546*	-0.565*	-0.827***	-0.841***	-0.805***	-0.820***
	(0.293)	(0.291)	(0.289)	(0.288)	(0.271)	(0.271)	(0.268)	(0.268)
Young	-0.078	-0.083	-0.046	-0.051	-0.218	-0.221	-0.186	-0.189
	(0.194)	(0.194)	(0.190)	(0.189)	(0.162)	(0.162)	(0.159)	(0.159)
dep_totasset	-1.928*	-1.995*	-1.963*	-2.028*	-2.012**	-2.048**	-2.046**	-2.081**
	(1.057)	(1.056)	(1.080)	(1.073)	(0.831)	(0.828)	(0.846)	(0.839)
glp_totasset	-0.304	-0.342	-0.252	-0.289	0.373	0.344	0.418	0.389
	(0.333)	(0.333)	(0.329)	(0.330)	(0.361)	(0.363)	(0.358)	(0.361)
english					0.438	-0.331	0.369	-0.929***
					(1.035)	(0.566)	(1.019)	(0.291)
port_risk30	-0.007*	-0.007*	-0.007*	-0.007*	-0.007**	-0.007**	-0.007**	-0.007**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
regulated					-0.460*	-0.460*	-0.447*	-0.446*
					(0.266)	(0.266)	(0.266)	(0.266)
EECA					-4.335***	-3.675***	-4.361***	-4.301***

					(0.370)	(0.660)	(0.374)	(0.375)
Country characteristics variables								
acpi	0.017***	0.020***	0.013***	0.016***	0.015***	0.018***	0.011***	0.013**
	(0.003)	(0.004)	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)	(0.005)
gdp	0.059***	0.066***	0.059***	0.066***	0.028	0.034	0.028	0.034
	(0.018)	(0.018)	(0.018)	(0.018)	(0.020)	(0.021)	(0.020)	(0.021)
cc	-0.915***	-0.865***	-0.927***	-0.878**	-0.656*	-0.615*	-0.667*	-0.627*
	(0.337)	(0.329)	(0.347)	(0.339)	(0.364)	(0.357)	(0.377)	(0.371)
Financial system characteristics variables								
banking_roa	0.014	0.014	0.013	0.014	0.016*	0.017*	0.016*	0.016
	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)
financialtransparency	-0.069	-0.079	-0.044	-0.054	-0.108	-0.116*	-0.078	-0.086
	(0.063)	(0.065)	(0.066)	(0.069)	(0.066)	(0.069)	(0.068)	(0.071)
Constant	13.655***	13.427***	13.827***	13.602***	15.039***	14.228***	15.256***	15.046***
	(0.456)	(0.517)	(0.472)	(0.547)	(0.948)	(0.632)	(0.943)	(0.980)

Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.000	0.000	0.000	0.000
Observations	806	806	806	806	806	806	806	806
R-squared	0.567	0.570	0.571	0.573				
Number of id	213	213	213	213	213	213	213	213
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.567	0.570	0.571	0.573				
Between R square					0.329	0.327	0.330	0.329

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A13. Panel analysis: global crisis impact on depth in Bank

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Bank FE	Bank FE	Bank FE	Bank FE	Bank RE	Bank RE	Bank RE	Bank RE
	Depth	depth	depth	depth	depth	depth	depth	depth
Banking Crisis*Post 2008			0.140	0.058			-0.889	-0.932
			(0.371)	(0.307)			(0.607)	(0.583)
Banking Crisis					0.753	0.331	0.798	0.384
					(0.817)	(0.843)	(0.803)	(0.824)
Post 2008			0.014	0.017			0.071	0.034
			(0.115)	(0.106)			(0.203)	(0.198)
time since 2008		0.201***		0.201***		0.179**		0.181**
		(0.066)		(0.066)		(0.090)		(0.088)
MIF characteristics variables								
cap_asset	-0.481	-0.302	-0.460	-0.297	-0.630	-0.542	-0.754	-0.660
	(0.374)	(0.313)	(0.400)	(0.351)	(0.499)	(0.492)	(0.460)	(0.472)

size	0.019**	0.006	0.020*	0.006	0.067***	0.061**	0.057**	0.052*
	(0.009)	(0.013)	(0.011)	(0.015)	(0.026)	(0.030)	(0.026)	(0.029)
New	-0.093	0.128	-0.118	0.122	1.421***	1.497***	1.419***	1.494***
	(0.380)	(0.426)	(0.404)	(0.448)	(0.420)	(0.408)	(0.410)	(0.402)
Young	0.277	0.328	0.266	0.326	1.116**	1.161***	1.086**	1.127***
	(0.225)	(0.251)	(0.239)	(0.263)	(0.441)	(0.443)	(0.425)	(0.428)
dep_totasset	-0.121	-0.205	-0.169	-0.231	0.829	0.652	0.898*	0.753
	(0.546)	(0.507)	(0.524)	(0.515)	(0.507)	(0.489)	(0.503)	(0.507)
glp_totasset	1.371*	1.127*	1.366*	1.129*	2.311***	2.096***	2.308***	2.104***
	(0.719)	(0.566)	(0.726)	(0.574)	(0.698)	(0.661)	(0.716)	(0.682)
english					-0.307	0.784	1.376***	1.374
					(1.515)	(1.385)	(0.463)	(1.584)
port_risk30	0.021*	0.011	0.021*	0.010	0.013	0.009	0.012	0.007
	(0.012)	(0.010)	(0.012)	(0.010)	(0.010)	(0.010)	(0.011)	(0.010)
EECA					0.121	0.626	0.372	0.880
					(0.748)	(0.722)	(0.854)	(0.783)

Country characteristics variables								
acpi	0.008***	0.001	0.007**	0.001	0.001	-0.005	0.002	-0.004
	(0.003)	(0.002)	(0.003)	(0.002)	(0.004)	(0.004)	(0.004)	(0.005)
gdp	-0.027**	-0.026*	-0.030*	-0.027*	-0.018	-0.018	0.001	0.001
	(0.013)	(0.013)	(0.015)	(0.015)	(0.024)	(0.022)	(0.023)	(0.022)
cc	1.048*	0.324	1.087*	0.339	0.688	0.047	0.475	-0.169
	(0.536)	(0.346)	(0.582)	(0.357)	(0.737)	(0.677)	(0.844)	(0.753)
Financial system characteristics variables								
banking_roa	-0.022	0.019	-0.022	0.021	-0.092	-0.056	-0.075	-0.042
	(0.039)	(0.043)	(0.041)	(0.046)	(0.071)	(0.084)	(0.081)	(0.093)
financialtransparency	-0.200*	-0.229***	-0.207*	-0.232***	-0.343***	-0.359***	-0.282**	-0.297***
	(0.105)	(0.078)	(0.110)	(0.080)	(0.113)	(0.097)	(0.133)	(0.110)
Constant	0.602	1.154***	0.713	1.208**	0.133	0.316	-0.573	-0.471
	(0.525)	(0.353)	(0.691)	(0.490)	(1.070)	(0.935)	(1.438)	(1.213)

Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					-	-	-	-
Observations	115	115	115	115	115	115	115	115
Number of id	29	29	29	29	29	29	29	29
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.408	0.486	0.408	0.486				
Between R square					0.947	0.945	0.952	0.949

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A14. Panel analysis: global crisis impact on depth in CU

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	CU FE	CU FE	CU FE	CU FE	CU RE	CU RE	CU RE	CU RE
	Depth	depth	depth	depth	depth	depth	depth	depth
Banking Crisis*Post 2008			-0.016	0.012			-0.015	0.016
			(0.085)	(0.087)			(0.088)	(0.092)
Banking Crisis					0.088	-0.017	-2.645***	0.009
					(0.359)	(0.359)	(0.266)	(0.385)
Post 2008			-0.038	-0.020			-0.035	-0.015
			(0.035)	(0.035)			(0.036)	(0.037)
time since 2008		0.033**		0.032**		0.034**		0.033**
		(0.016)		(0.016)		(0.016)		(0.016)
MIF characteristics variables								
cap_asset	-0.073	-0.062	-0.087	-0.075	-0.043	-0.033	-0.055	-0.044
	(0.074)	(0.074)	(0.075)	(0.075)	(0.076)	(0.076)	(0.076)	(0.077)

size	0.055***	0.040***	0.064***	0.046**	0.054***	0.039**	0.063***	0.044**
	(0.013)	(0.015)	(0.016)	(0.018)	(0.013)	(0.015)	(0.016)	(0.018)
New	0.114	0.130	0.118	0.131	0.088	0.104	0.092	0.104
	(0.092)	(0.082)	(0.092)	(0.084)	(0.091)	(0.082)	(0.092)	(0.083)
Young	0.079	0.082	0.083	0.083	0.067	0.069	0.070	0.070
	(0.060)	(0.057)	(0.061)	(0.059)	(0.059)	(0.057)	(0.060)	(0.058)
dep_totasset	0.071	0.042	0.067	0.040	0.021	-0.006	0.017	-0.009
	(0.086)	(0.077)	(0.084)	(0.076)	(0.090)	(0.083)	(0.089)	(0.083)
glp_totasset	0.182	0.197*	0.185	0.200*	0.156	0.172	0.158	0.174
	(0.113)	(0.113)	(0.113)	(0.114)	(0.111)	(0.111)	(0.112)	(0.112)
english					0.106	-0.493***	-0.537***	0.149
					(0.197)	(0.130)	(0.133)	(0.210)
port_risk30	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
regulated					0.174	0.173	0.173	0.175
					(0.121)	(0.121)	(0.121)	(0.121)

EECA					0.273	-0.315	2.454***	0.321
					(0.264)	(0.260)	(0.172)	(0.284)
Country characteristics variables								
acpi	-0.001	-0.003*	0.001	-0.002	-0.001	-0.003*	0.001	-0.002
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
gdp	0.013	0.015*	0.006	0.012	0.013	0.015*	0.007	0.013
	(0.008)	(0.008)	(0.011)	(0.011)	(0.009)	(0.008)	(0.011)	(0.012)
cc	0.040	-0.061	0.083	-0.037	0.071	-0.036	0.112	-0.018
	(0.141)	(0.144)	(0.124)	(0.121)	(0.148)	(0.149)	(0.131)	(0.127)
Financial system characteristics variables								
banking_roa	0.053**	0.052*	0.048	0.052	0.058**	0.057**	0.054	0.058
	(0.026)	(0.027)	(0.033)	(0.034)	(0.028)	(0.028)	(0.035)	(0.036)
financialtransparency	-0.000	-0.006	-0.000	-0.008	-0.002	-0.008	-0.002	-0.010
	(0.013)	(0.014)	(0.013)	(0.015)	(0.014)	(0.015)	(0.014)	(0.016)
Constant	0.325*	0.479**	0.203	0.433*	-0.125	0.676***	0.352	-0.006
	(0.182)	(0.214)	(0.181)	(0.220)	(0.175)	(0.211)	(0.217)	(0.228)

Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue	-	-	-	-	0.338	0.253	0.524	0.364
Observations	285	285	285	285	285	285	285	285
R-squared	0.168	0.192	0.174	0.194				
Number of id	112	112	112	112	112	112	112	112
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.168	0.192	0.174	0.194				
Between R square					0.193	0.196	0.192	0.195

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A15. Panel analysis: global crisis impact on depth in NBFI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	NBFI FE	NBFI FE	NBFI FE	NBFI FE	NBFI RE	NBFI RE	NBFI RE	NBFI RE
	Depth	depth	depth	depth	depth	depth	depth	depth
Banking Crisis*Post 2008			-0.543	-0.539			-0.565	-0.559
			(0.970)	(0.970)			(0.883)	(0.880)
Banking Crisis					0.218	0.227	0.407	0.412
					(0.532)	(0.535)	(0.760)	(0.761)
Post 2008			-0.035	-0.035			-0.024	-0.024
			(0.029)	(0.029)			(0.031)	(0.032)
time since 2008		0.013		0.010		0.017		0.015
		(0.019)		(0.019)		(0.019)		(0.019)
MIF characteristics variables								
cap_asset	0.248	0.250	0.239*	0.241*	0.216	0.216*	0.208*	0.208*
	(0.158)	(0.158)	(0.134)	(0.134)	(0.132)	(0.131)	(0.113)	(0.112)

size	0.016*	0.015	0.015	0.013	0.017**	0.016*	0.015*	0.013*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.007)	(0.008)
New	0.097	0.097	0.093	0.093	0.077	0.075	0.078	0.077
	(0.072)	(0.072)	(0.069)	(0.068)	(0.066)	(0.066)	(0.066)	(0.066)
Young	-0.012	-0.011	-0.025	-0.024	-0.016	-0.016	-0.026	-0.026
	(0.033)	(0.033)	(0.042)	(0.042)	(0.032)	(0.032)	(0.038)	(0.038)
dep_totasset	0.388**	0.350**	0.410**	0.378**	0.459***	0.431***	0.467***	0.442***
	(0.162)	(0.167)	(0.161)	(0.172)	(0.151)	(0.147)	(0.149)	(0.148)
glp_totasset	0.198	0.202	0.160*	0.164*	0.112	0.114	0.075	0.076
	(0.124)	(0.124)	(0.095)	(0.093)	(0.111)	(0.112)	(0.087)	(0.087)
english					0.215	-0.701	-0.716*	0.187
					(0.238)	(0.428)	(0.425)	(0.246)
l_port_risk30	-0.000	-0.000	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
regulated					0.137	0.144	0.138	0.144
					(0.118)	(0.118)	(0.118)	(0.118)

EECA					1.171***	0.250	0.254	1.152***
					(0.372)	(0.508)	(0.507)	(0.386)
Country characteristics variables								
acpi	-0.002	-0.002	-0.001	-0.001	-0.002	-0.003	-0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
gdp	0.015	0.015	0.015	0.015	0.018	0.017	0.018	0.018
	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
cc	0.183	0.171	0.143	0.133	0.120	0.100	0.075	0.057
	(0.186)	(0.193)	(0.145)	(0.158)	(0.186)	(0.196)	(0.151)	(0.165)
banking roa	0.005**	0.005**	0.005**	0.005**	0.005*	0.005*	0.005*	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
financialtransparency	-0.052	-0.053	-0.043	-0.044	-0.056	-0.057	-0.045	-0.046
	(0.036)	(0.037)	(0.029)	(0.029)	(0.037)	(0.037)	(0.030)	(0.031)
Constant	0.535***	0.596***	0.419**	0.470***	0.123	1.109**	0.934**	0.096
	(0.170)	(0.180)	(0.172)	(0.181)	(0.228)	(0.440)	(0.465)	(0.297)

Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.113	0.0733	0.2408	0.1997
Observations	1,030	1,030	1,030	1,030	1,030	1,030	1,030	1,030
R-squared	0.057	0.058	0.075	0.076				
Number of id	272	272	272	272	272	272	272	272
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within square	0.0574	0.0584	0.0751	0.0758				
Between R square					0.410	0.412	0.416	0.419

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3A16. Panel analysis: global crisis impact on depth in NGO

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	NGO FE	NGO FE	NGO FE	NGO FE	NGO RE	NGO RE	NGO RE	NGO RE
	Depth	depth	depth	depth	depth	depth	depth	depth
Banking Crisis*Post 2008			-0.202***	-0.207***			-0.110*	-0.113*
			(0.017)	(0.018)			(0.062)	(0.063)
Banking Crisis					0.287	0.304	0.304	0.322
					(0.318)	(0.327)	(0.343)	(0.353)
Post 2008			-0.014	-0.015			-0.015	-0.016
			(0.011)	(0.011)			(0.011)	(0.011)
time since 2008		0.016***		0.016***		0.014***		0.015***
		(0.005)		(0.005)		(0.005)		(0.005)
MIF characteristics variables								
cap_asset	0.012	0.006	0.005	-0.002	0.025	0.020	0.021	0.017
	(0.029)	(0.029)	(0.026)	(0.026)	(0.027)	(0.027)	(0.026)	(0.025)
size	0.043***	0.042***	0.043***	0.042***	0.043***	0.042***	0.043***	0.043***

	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
New	-0.009	-0.006	-0.013	-0.010	-0.018	-0.015	-0.021	-0.018
	(0.022)	(0.021)	(0.021)	(0.020)	(0.017)	(0.017)	(0.016)	(0.016)
Young	-0.004	-0.003	-0.007	-0.006	-0.010	-0.008	-0.013	-0.011
	(0.017)	(0.016)	(0.016)	(0.016)	(0.014)	(0.014)	(0.013)	(0.013)
dep_totasset	-0.036	-0.023	-0.042	-0.029	-0.008	0.001	-0.008	-0.000
	(0.080)	(0.077)	(0.079)	(0.076)	(0.073)	(0.071)	(0.073)	(0.071)
glp_totasset	0.020	0.025	0.016	0.022	0.028	0.032	0.026	0.030
	(0.034)	(0.035)	(0.034)	(0.034)	(0.034)	(0.035)	(0.034)	(0.035)
english					-0.067*	-0.071*	0.204**	-0.397***
					(0.039)	(0.039)	(0.085)	(0.103)
port_risk30	-0.000	-0.000	-0.000	-0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
regulated					0.030*	0.029*	0.030*	0.029
					(0.017)	(0.018)	(0.017)	(0.018)
EECA					0.559***	0.561***	0.563***	-0.052**

					(0.016)	(0.016)	(0.014)	(0.026)
Country characteristics variables								
acpi	-0.001*	-0.001***	-0.000	-0.001*	-0.001*	-0.001***	-0.000	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
gdp	-0.004	-0.005	-0.003	-0.005	-0.004	-0.005	-0.003	-0.005
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
cc	-0.061*	-0.069**	-0.071**	-0.079**	-0.066*	-0.073**	-0.072**	-0.079**
	(0.034)	(0.035)	(0.032)	(0.032)	(0.034)	(0.034)	(0.033)	(0.032)
Financial system characteristics variables								
banking_roa	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
financialtransparency	-0.004	-0.001	-0.004	-0.001	-0.004	-0.002	-0.005	-0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Constant	0.220***	0.271***	0.196***	0.248***	0.075*	0.113***	0.054	0.707***
	(0.039)	(0.040)	(0.041)	(0.044)	(0.043)	(0.041)	(0.045)	(0.044)

Test of overidentifying restrictions (FE VS RE)								
Sargan-Hansen statistic								
P vlaue					0.000	0.000	0.000	0.000
Observations	884	884	884	884	884	884	884	884
Number of id	227	227	227	227	227	227	227	227
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
within R square	0.073	0.093	0.088	0.110	-	-	-	-
Between R square	-	-	-	-	0.480	0.476	0.473	0.469

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1