Alma Mater Studiorum – Università di Bologna

DOTTORATO DI RICERCA IN

ECONOMIA

Ciclo 28

Settore Concorsuale: 13/A1

Settore Scientifico Disciplinare: SECS-P/01

THE ESSAYS IN INTERNATIONAL TRADE AND FINANCE

Presentata da: Marta Magdalena Paczos

Coordinatore Dottorato **Supervisore**

Vincenzo Denicolò **Paolo Manasse**

Esame finale anno 2017

Contents

1 Financial Deregulation and Capital Flows **5**

1.1 Introduction 6
1.2 Literature Review 7
1.3 Data and Estimation Strategy 10
1.4 Main Results 16
1.5 FDI, debt and portfolio equity flows 24
1.6 Complementary reforms 26
1.7 Conclusion 30
Bibliography 32
1.8 Appendix 35

2 Heterogeneous Firms, Product Quality and Reshoring **54**

2.1 Introduction and literature review 55
2.2 The US Reshorers: a brief view 57
2.3 Static Model 59
2.4 Dynamic Model 64
2.5 Conclusions 74
Bibliography 75
2.6 Appendix 77

3 Export Upgrade and GVCs Participation **81**

3.1 Introduction 82
3.2 Data and empirical strategy 85
3.3 Results 92
3.4 Conclusion 107
Bibliography 108
3.5 Appendix 110

Introduction

This thesis consists of three papers studying the impact of globalization in the fields of international trade and finance.

The first chapter studies the how the financial liberalization affects the decisions of both domestic and foreign investors. It provides the first evidence on the gross capital flows reactions to the financial sector deregulation. In a panel of 91 countries between 1980 and 2005 I identify the major financial sector reforms and apply *difference-in-differences* estimation method to assess their impact on the gross capital flows. I establish four new stylized facts. First, the financial sector reform is associated with an average increase of approx. $0.03pp$ in both gross capital inflows and outflows. Second, the dynamic reaction of gross capital flows is J-shaped: immediately after the financial sector reform both inflows and outflows decrease, and in the medium and long term they stabilize at a higher than the pre-liberalization levels. Third, the analysis of the disaggregated flows reveals that the short term dynamics is governed solely by the debt flows, while the long term dynamics are driven by all of the capital flows components: debt, portfolio equity and direct investment. Finally, I find that only a complex deregulation is successful. Reforming both banking competition and banking supervision leads to a positive and long-lasting effect whereas reforming banking competition or banking supervision in isolation displays no or negligible impact. The results are robust to a wide range of robustness checks.

In the second chapter we address the question of a firm's production location and product quality choice. We develop a novel theory to explain the recent phenomenon of reshoring, *i.e.* firms moving back their previously offshored business activities. Thanks to the access to a unique survey of American reshoring firms, we firstly provide the evidence for the importance of the quality and innovation behind the reshoring decision. Next, building on Antoniades (2015) we develop a dynamic heterogeneous firms model with quality choice and offshoring. In the dynamic setting quality choice plays an important role as the production location decision entails a tradeoff between payroll and quality-related costs. In equilibrium reshoring decision arises as some firms initially offshore, exploit the increase in profits due to lower wages and finally return to the domestic country in order to further increase the quality. Moreover, the model delivers an equilibrium sorting of firms: the most productive

firms will never offshore, the least productive firms will always offshore and the firms with an intermediate productivity decide to reshore. This paper is a joint work with Barbara Bratta.

The third chapter provides the new evidence suggesting that a more intensive integration into global production networks (GVCs) via forward linkages offers a potential for the increase in the quality of exports, in particular for the developing economies. I relate the sector-level GVCs participation indicators derived from the international OECD Input-Output Tables to the data on the unit values of exports at the product-exporter level. The sample consists of 63 economies between 2000 and 2011. We find a strong association between the export prices and GVCs forward participation, in particular for the developing countries. In the most conservative specifications a 1% increase in the forward GVCs participation leads to a 0.08% increase in the export unit values, which corresponds to an increase of 22.6% over the studied period. We document also a less robust negative relationship between the GVCs backward participation and unit values of exports. The findings suggest that the driver behind the quality-improving role of the forward linkages are the exports to the rich markets and technologically advanced sectors.

Acknowledgments

I am very grateful to many people without whom I would not be able to complete this thesis. I want to thank to my supervisor Paolo Manasse for his invaluable advice, research guidance and many helpful discussions. I am thankful to all the faculty and staff of the Economics Department at the University of Bologna for all the constructive research feedback and advice as well as the administrative support and flexibility. I want to thank to Gianmarco I.P. Ottaviano who invited me for the visiting period at the London School of Economics for being always available for feedback and discussion. I am particularly grateful to all my fellow PhDs for the mutual support and sharing together both the happy and the difficult moments on our PhD track. Last but not least, I want to thank to my beloved husband and our two lovely daughters for their love, joyfulness and the constant support.

Chapter 1

Financial Deregulation and Capital Flows

Abstract

This paper provides the first evidence on gross capital flows reactions to the financial sector deregulation. In the panel of 91 countries between 1980 and 2005 we identify financial sector reforms and apply *difference-in-differences* method to assess their impact on gross capital flows. We establish four new stylized facts: i) Financial sector reform is associated with an average increase of approx. $0.03pp$ in both gross capital inflows and outflows. ii) The dynamic reaction of gross capital flows is J-shaped: immediately after the financial sector liberalization both inflows and outflows decrease, and in the medium and long term they stabilize at higher than the pre-liberalization levels. iii) Analysis of the disaggregated flows reveals that these short term dynamics are governed solely by the debt flows, while long term dynamics are driven by all: debt, portfolio equity and direct investment flows. iv) Only a complex deregulation is successful. Reforming both banking competition and banking supervision leads to positive and long-lasting effects whereas reforming banking competition or banking supervision in isolation leads to negligible effects. The results are robust to a wide range of robustness checks.[1]

Keywords: Financial liberalization, Financial sector deregulation, International capital flows
JEL Classification: G28, F21, F32

[1]We would like to thank to Laura Bottazzi, Matteo Cervellati, Julian diGiovanni, Paolo Manasse, Filippo Taddei, Fabrizio Zilibotti and the participants of Brixen Workshop in International Trade and Finance 2014, RCEA Growth and Development Workshop in Rimini 2015, Annual Congress of European Economic Association 2016 in Geneva and internal seminars at University of Bologna for constructive comments.

1.1 Introduction

The world economy over the past three decades has become vastly financially integrated. Since early 1990*s* we have observed a massive increase in the private capital flows, both on the assets and liabilities side (Gopinath et al. (2014)). This observation is a worldwide phenomenon: Lane (2012) reports that the *de facto* financial integration measured as a sum of cross-border assets and liabilities (scaled by annual GDP) increased in the period $1980-2007$ by 370% for the advanced and by and 40% for the emerging economies. Alongside the increasing financial integration many countries experienced an unprecedented progress in the financial development. Trends towards the financial deregulation and privatization in the banking industry potentially could have had an important impact on the behavior of domestic and foreign investors, and on the volume and composition of the capital inflows and outflows. However, the empirical studies of this topic are limited.

The aim of this paper is to study the impact of the financial sector deregulation on gross capital flow positions, focusing solely on the *de jure* reforms. In the study we use detailed financial sector development indicators developed by Abiad et al. (2010) to identify the countries that underwent a permanent and complex *legal* deregulation in the banking sector between 1980 and 2005. Abiad et al. (2010) analyze seven main aspects of the financial sector deregulation: credit controls, directed credit, interest rate controls, banking sector entry, privatization, banking supervision and securities market. Each component is scored on $0-3$ scale, where 0 relates to financially repressed areas and score of 2 and above describes the financially liberalized ones. Any major variability in the index is necessarily linked to legal regulations that have been undertaken by the government or the central bank. We identify the major reform episodes in a country as the years in which it has reached liberalized status for all of the seven components. Excluding the countries which have reverted financial reforms, we construct the dummy variable representing a permanent banking deregulation. Next, we run *difference-in-differences* estimation and analyze the within evolution of the annual capital inflows and outflows before and after the liberalization year. To control for capital flows persistence we employ the dynamic panel estimation techniques. We study the impact of the reform for disaggregated capital flows: debt, portfolio equity and direct investment. In addition, we construct pulse dummies, which allow to control for short, medium and long term impact of the reform. Last but not least, we disaggregate the reform dummy into minor reforms, which we label as the banking competition liberalization and the strengthening of banking supervision, and investigate the cross-effect of those gradual reforms.

First, we find that the banking sector deregulation is associated with an average increase of $0.03pp$ in both capital inflows and outflows as compared to countries that did not undergo any reform. Second, the dynamic response of the capital flows to the financial reform is J-shaped:

immediately after the liberalization both inflows and outflows decrease, and in the medium and long term they stabilize at higher than pre-liberalization levels. On average, within the first three years after the reform we observe decreases in capital inflows and outflows, all driven only by debt component. The long term increases arise within 5 or more years after the reform and involve all components: debt, portfolio equity and direct investment flows. Third, the deregulatory reforms implemented partially and only in the selected areas of the banking activity lead to a negligible impact on the capital flows. Countries that deregulate competition in the financial sector without strengthening the banking supervision or *vice versa* observe on average no effect, neither for capital inflows, nor for the outflows. Therefore we find a strong complementarity among the liberalization efforts, suggesting that only a complex reforms affect the capital flows.

1.2 Literature Review

Theoretical models of the capital flows often stress the importance of the financial development and financial market imperfections. Early work in this area focused on addressing the Lucas Paradox (Lucas (1990)). Gertler and Rogoff (1990) and by Boyd and Smith (1997) show that the capital inflows can be lower than the neoclassical model predictions by emphasizing the role of contractual frictions in the form of limited pledgeability on the domestic credit market. In a similar manner Matsuyama (2005) provides an intuition that in a financially underdeveloped economy a large pool of the entrepreneurs with low individual wealth can give rise to the agency problems, ultimately resulting in a reduced *net* capital inflows. On the other hand, Mendoza et al. (2009) develop a model where uncertainty and asymmetries of information in the financial markets can lead to *net* capital outflows. Given the risk that financial intermediaries will misallocate a part of the investment income without the lenders knowing, the residents make higher precautionary savings. Capital outflows from the developing (*i.e.* financially underdeveloped) countries can therefore be explained by the surplus supply of the savings due to the incompleteness of the domestic financial markets[2]. However, more recently Martin and Ventura (2015) and Matsuyama (2014) show theoretically (via different mechanisms) that a reduction in the severity of the contracting frictions on the financial market can potentially have an ambiguous effects on the capital flows, with a successful financial reform leading even to the capital outflows. Summing up, the theory does not point to a unique effect of the improvements in financial development on the capital flows. To our best knowledge, this paper is the first empirical attempt to asses those reactions empirically by focusing on the financial sector reforms.

The positive impact of the financial development on the economic growth is generally con-

[2]Similar ideas are developed in Hubbard (2006) and Prasad et al. (2006).

firmed in the literature (see Levine (2005) for a comprehensive overview), yet the statement that the financial development influences the direction of the capital flows has been hard to corroborate empirically. Most of the studies on the capital flows and financial development borrow the methodology from cross-sectional growth regressions, including financial development proxies as controls. Fernndez-Arias and Hausmann (2000) analyze average capital inflows in a large sample of countries for years $1996 - 1998$. They find that the total volume of capital inflows is positively related to the country's degree of the financial development as measured by the private credit to GDP. Reinhardt et al. (2013a) revisit the Lucas Paradox empirically, highlighting the role of the financial openness. They regress five-year averages of the current account to GDP over the period 1982-2006 on the financial openness indicators and a set of controls, finding negative and significant impact of the private credit to GDP. On the other hand, Gruber and Kamin (2009) using 4-year period averages regress current account to GDP on various measures of financial development for 60 countries over period 1982-2003, and find them at most weakly significant. Alfaro et al. (2008) explain empirically the Lucas Paradox by highlighting the role of the institutions. They run a series of cross-country regressions for (the dependent variable is the net capital inflows per capita, averaged over the whole sample period) and find no significant impact of the financial development on the direction of capital flows. In this paper we depart from the cross-country regression setting for a number of reasons. First, the policy questions implied by the theoretical literature call for a dynamic verification of the effects of the financial sector development. If financial reforms result in the reductions in financial frictions severity, a suitable empirical setting should study the changes in the capital flows in the years following the reform rather than focus on the long-term correlations. Second, an unified cross-country correlations approach can lead to the overlooking of interesting dynamic patterns in the capital flows reactions to the financial reforms. To provide support for this intuition, Figure 1.1 plots the evolution of the average time-demeaned gross capital inflows to GDP for the countries that underwent a non-reverted complex financial deregulation. There is an interesting dynamics involved: the capital inflows fall in the first 3 years post-reform and next they stabilize at a higher than the pre-reform level, suggesting that there can be a significant transitional reaction of the capital flows[3]. Therefore, relying solely on the long term averages of foreign assets and liabilities would overlook this information, whereas the dynamic empirical specification adopted here allows us to identify short, medium and long term associations between the capital flows and the financial deregulation.

In addition, recent empirical contributions (Kraay et al. (2005), Gourinchas and Rey (2007), Broner et al. (2013)) emphasize the importance of the distinction between gross and net capital flows. As Broner et al. (2013) state:*"[...] understanding the behavior of gross capital*

[3]An analogous plot for the capital outflows is presented in the Appendix (Figure 1.4).

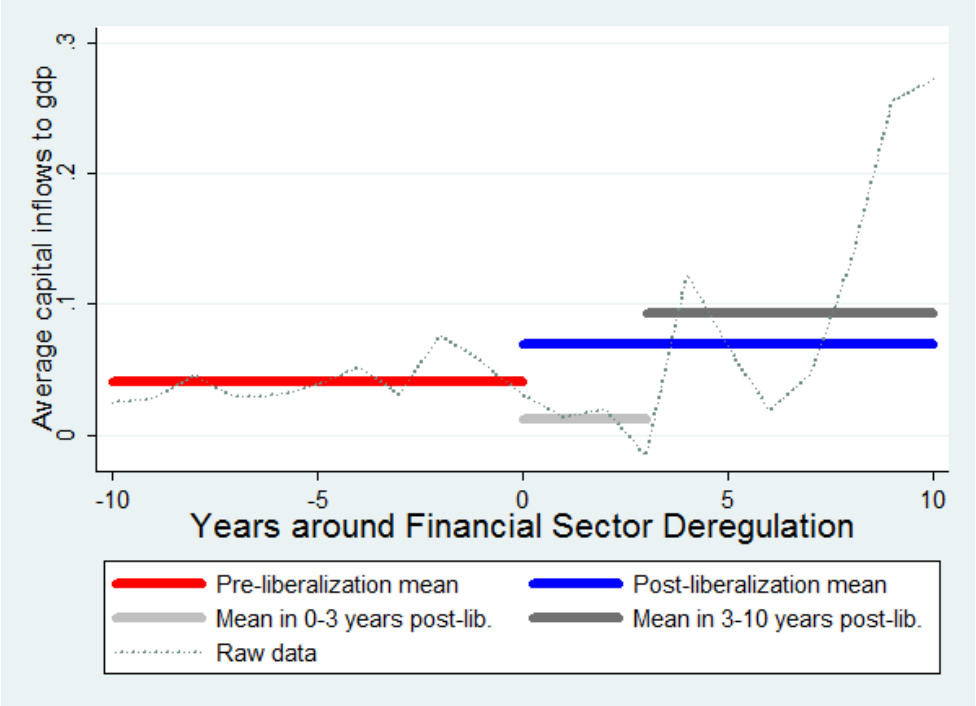


Figure 1.1: The average time-demeaned capital inflow to GDP (country gross inflow minus the average gross inflow for given year) in the ten years before and after a financial sector deregulation reform. See the Appendix for details on the reformed countries.

flows seems crucial, especially given that capital flows by foreign and domestic agents have become very important and are likely driven by different factors.". In all the regressions we would study the gross capital inflows and outflows separately[4].

Last but not least, this paper is related methodologically to the body of the literature that applies *difference-in-differences* estimation in the macroeconomic framework. Some examples include Slaughter (2001) studying trade liberalization impact on GDP growth, Persson and Tabellini (2006) who explore democratization and GDP growth, Levchenko et al. (2009) investigating the financial liberalization effects for the sector-level outcomes. To the best of our knowledge this is the first paper that looks at the impact of the financial deregulation on the international capital flows. The empirical strategy adopted here follows directly after Papaioannou and Siourounis (2008), a study of the before-after within effects of democratization on GDP growth.

The reminder of this article is structured as follows: the next section describes the data and the estimation approach. Section 1.4 reports the main results, section 1.5 presents the results for the disaggregated capital flows. In section 1.6 we analyze the effect of the partial reforms. Finally, section 1.7 concludes.

[4]Where relevant, we presnet also the regressions with net capital inflows as a robustness check.

1.3 Data and Estimation Strategy

1.3.1 Financial Reforms

The data on the financial deregulation comes from the International Monetary Fund's (IMF) *A New Database of Financial Reforms* (Abiad et al. (2010)). It covers in detail 91 economies in years $1980-2005$. This dataset provides a detailed information about the intensity of the state intervention into various aspects of the domestic financial sector. Detailed Financial Liberalization Indices (FLI) cover main 7 areas: credit controls, directed credit, interest rate controls, banking sector entry, privatization, banking supervision and securities market. Importantly, the database captures changes only due to a purely legal origin, which in the liberalization terminology should be classified as *de jure* changes. That is, any major variability in the index is necessarily linked to the legal regulations undertook by the government or by the national central bank. Some example coding questions are: *Does the government allow the entry of new domestic banks? To what extent does the government allow foreign banks to enter into a domestic market?* (banking sector entry), *Are both deposit rates and lending rates are set by the government or subject to ceiling/floor?* (interest rate controls), *Are there minimum amounts of credit that must be channeled to certain sectors?* (credit controls).

Within each country the level of the financial market freedom is scored from 0 to 5 with higher scores standing for less state intervention. The final score is normalized to a $0-3$ scale. Countries with the scores equal to 1 or less are labeled by the IMF as (partially or largely) financially repressed, whereas the economies with the scores equal to 2 or higher are referred to as (partially or largely) financially liberalized. In the baseline approach we follow the IMF classification. We create the financial reform dummy that takes value one if a country reaches a sufficiently high score for each sub-component of the FLI (equal or exceed 2) in **each** of 7 index components. In detail, this classification results in coding a country as financially deregulated if each of the following conditions holds:

- **Credit Controls:** the reserve requirements for the commercial banks are less than 10% of the deposits
- **Directed Credit:** the mandatory credit allocations to certain sectors are eliminated or do not exist and the banks do not have to supply credits at the subsidized rates
- **Interest Rate Controls:** the deposit rates and the lending rates are freed but the other rates can be subject to a band
- **Banking Sector Entry:** there are no serious restrictions on foreign and domestic bank entry, neither on the extent of branching or/and on the range of the financial

activities

- **Privatization:** the most banks are privately owned and/or the percentage of the public bank assets does not exceed 25%
- **Securities Market:** the securities market is developed and supported by a set of policies (tax exemptions, introduction of medium and long-term government bonds in order to build the benchmark of a yield curve, policies to develop corporate bond and equity markets, or the introduction of a primary dealer system to develop government security markets) and the foreign equity ownership is allowed
- **Banking Supervision:** Basel CAR is in force and an objective supervisory agency is clearly defined and an adequate legal framework to resolve banking problems is provided; and all banks without any exceptions are under supervision

When any of those conditions is violated, the country would be classified as not financially liberalized[5]. Moreover, we need to make sure that the deregulation periods we identify are permanent and there are no reform reversals. It turns out that the financial reforms are of a persistent nature and once in force they are very unlikely to be reversed[6]. In our data sample there are only three incidences of reform reversals that took place in two countries: Nigeria and Bolivia (see Table 1.11 in the Appendix for the details). In the robustness checks we exclude those countries from the analysis, which, however, does not alter the main findings neither qualitatively, nor quantitatively. Having adopted the financial reform definition described above, we identify 31 countries that underwent financial deregulation in the sample[7], with the majority of developed economies liberalizing through late $80s$ and developing economies liberalizing during late $90s$ (see Figure 1.2).

1.3.2 Capital Flows

The data source for the gross capital flows is the updated and extended version of the *The external wealth of nations. Mark II* database introduced in Lane and Milesi-Ferretti (2007) (LMF). It covers the stocks of foreign assets and liabilities for over 100 economies. We focus on the period $1980-2005$ and in order to match the sample coverage for the financial reforms data we select 91 (developed and developing) countries. Gross capital flows are obtained as country annual differences in the liabilities or assets, divided by the GDP and expressed in constant 2005 USD. The major advantages of the LMF dataset are its wide country coverage

[5]See robustness checks of sensitivity of results to control group composition.
[6]See Abiad et al. (2010) for similar conclusions.
[7]Detailed list in Table 1.12 the Appendix.

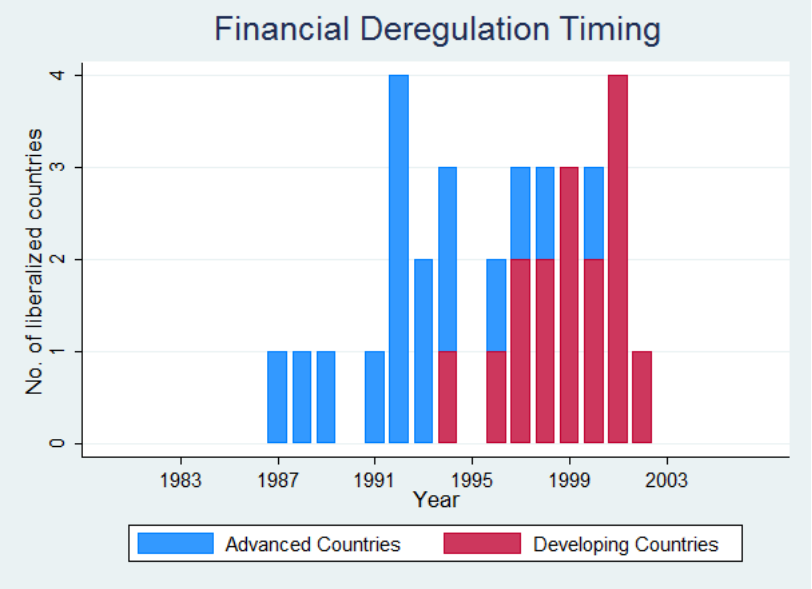


Figure 1.2: Financial Reform Events

as well as the methodology behind the construction of the capital stocks. In contrast to the widely used source on capital flows data, the IMF Financial Database, Lane and Milesi-Ferretti (2007) in the construction of assets stocks use the market prices as opposed to the nominal prices. As a consequence, their capital stocks series take into account the valuation effects, *i.e.* changes in the capital stock due to the capital gains and losses, which happen to be of a non-negligible size for the majority of the economies (Gopinath et al. (2014)).

1.3.3 Other Control Variables

All the control variables are exhaustively described in section 1.4.2. Summary statistics for the financial reform measures, capital flows and all the control regressors are presented in Table 3.14 below.

1.3.4 Estimation Strategy

The methodology applied is a standard *difference-in-difference* estimation. The baseline specifications reads:

$$cflow_{it} = \phi_t + \alpha_i + \beta FREFORM_{it} + \Gamma' X_{it} + \epsilon_{it} \tag{1.3.1}$$

where $cflow_{it}$ are respectively capital inflows or outflows, ϕ_t stands for the year fixed effects, α_i are the country fixed effects, X_{it} includes a vector of the relevant controls and β is the coefficient of interest. The variable $FREFORM$ takes value 1 in the year of the financial

Table 1.1: Summary statistics

Variable; source	*mean*	*sd*	*min*	*max*	*N*
The External Wealth of Nations Dataset; Lane and Milesi-Ferretti (2007)					
C.Inflows (total) to GDP	.076	.220	-1.231	4.133	2191
C.Outflows (total) to GDP	.070	.214	-1.061	3.960	2191
C.Outflows (debt) to GDP	.036	.136	-.949	2.350	2192
C.Outflows (debt) to GDP	.036	.136	-.949	2.350	2192
C.Inflows (FDI) to GDP	.025	.085	-.540	2.188	2194
C.Outflows (FDI) to GDP	.012	.059	-.269	1.679	2192
C.Inflows (equity) to GDP	.013	.068	-.589	1.113	2182
C.Outflows (equity) to GDP	.010	.048	-.169	.887	2167
IMF Financial Reform Database (IMF Fin. Reform); Abiad and Detragiche (2010)					
Financial Reform Index (normalized), 0 to 1	.562	.285	0	1	2220
Dir. credit and reserve requirements	1.738	1.105	0	3	2220
Credit controld and agg. credit ceilings	2.267	1.322	0	3	2220
Int'l rate controls	2.101	1.202	0	3	2220
Entry barriers	2.046	1.095	0	3	2220
Banking Supervision	.992	.991	0	3	2220
Privatization	1.337	1.194	0	3	2220
Security Markets	1.682	1.086	0	3	2220
Control variables					
GDP *per capita*; PWT, WB WDI	9752.778	8671.715	365.182	36906.75	2243
Fin. Openness; Chinn and Ito (2006)	.217	1.579	-1.864	2.439	2158
Fin. Openness normalized; Chinn and Ito (2006)	.484	.367	0	1	2158
Priv. credit to GDP; WB FD	44.489	38.773	.465	198.054	2010
Trade Openness; Quinn (1997), IMF Stat's	.689	.274	.125	1	2253
Trade volume to GDP; WB WDI, IMF Stat's	82.027	102.316	10.482	1375.661	2190
Ex. rate regime; Ilzetzki and Reinhart (2004)	2.513	1.203	1	4	2116
Capital Acc. Controls; Quinn (1997)	.634	.283	.125	1	2193
Int'l capital flow controls; IMF Fin.Reform	1.872	1.097	0	3	2246
Freedom House Index; Freedom House	6.642	3.109	.250	10	2180
ICRG Composite Index; The PRS Group	68.136	13.492	25.375	95.417	1889

PWT: Penn World Tables; WB WDI: World Bank Development Indicators; WB FD: World Bank Financial Development Database; IMF Stat's: International Monetary Fund Statistics; ICRG: International Country Risk Guide.

deregulation reform and remains 1 forever. Therefore β identifies the average annual effect of the financial reform on the capital flows as compared to the general patterns of capital flows in the countries that did not undergo a large-scale reform.
The past values of capital inflows and outflows are likely drivers of their current levels. In order to account for that, we would also estimate a variant of specification (1.3.1) including lags of the dependent variable:

$$cflow_{it} = \phi_t + \alpha_i + \delta cflow_{it-1} + \beta FREFORM_{it} + \Gamma' X_{it} + \epsilon_{it} \tag{1.3.2}$$

The specification (1.3.2) is subject to the dynamic panel data bias, even in the unlikely case when all of the control regressors are uncorrelated with fixed effects and strictly exogenous. To account for that we estimate (1.3.2) with a Blundell-Bond system-GMM methods.[8]
The *difference-in-difference* (D-in-D) approach as presented in (1.3.1) and (1.3.2) relies on a couple of assumptions. First, for establishing the causality, the *timing* of the financial reform should be random across the countries. This assumption may appear restrictive, as one can imagine that the financial sector reforms materialize, for instance, as an outcome of a prolonged wave of increased capital inflows or outflows. How this possibility can affect the estimates remains however unclear. If indeed the financial deregulation reforms happen at the onset of a period of the increased capital inflows, then the estimates are biased upwards. On the other hand, if in the anticipation of the financial reforms foreign investors increase their investments, then the estimates are biased downwards. To diagnose this possibility in addition to specification (1.3.1) we also estimate a specification accounting for the time-varying effects of financial deregulation:

$$cflow_{it} = \phi_t + \alpha_i + \sum_{j=1}^{5} \beta^j D_{it}^j + \Gamma' X_{it} + \epsilon_{it} \tag{1.3.3}$$

Equation (1.3.3) is a flexible model that includes lags and leads of the financial reform dummy. We define 5 *pulse* variables, D_{it}^j, which would capture the anticipation effects as well as any dynamics in the post-reform period. In chronological order: $D_{it}^1 = 1$ in fifth to third year before the reform and $D_{it}^2 = 1$ in second and first year before the reform, $D_{it}^3 = 1$ in the year of the reform and in two following years, $D_{it}^4 = 1$ in third and fourth year after the reform and, finally, $D_{it}^5 = 1$ in fifth or further years after the reform. The estimated

[8] As Blundell et al. (2000) and Blundell and Bond (1998) show in the context of dynamic panel data models, for a highly persistent processes past changes may be predictive of the current levels, while the past levels are weak IVs for the current changes. In those cases the system GMM estimator has much greater precision in estimating the autoregressive parameters than a difference GMM one. Given that $cflow_{it}$ in the analyzed period have documented to be of a relatively high persistence, we resort to system GMM while estimating (1.3.2).

effect should be interpreted in reference to capital flows levels prior to five years before the major deregulation.

As already mentioned, this approach allows also to investigate the time dynamics of the effect of the reform. In detail, the effect of the D-in-D estimate from specification (1.3.1) is capturing the permanent impact of the financial deregulation. In other words, D-in-D is comparing the post-liberalization capital flows averages with their pre-reform counterparts between treated and control countries. In principle, the mean estimate could admit a very different time dynamics behind. For instance, a large-scale deregulation in the financial sector could trigger large positive effects right on impact and minor or negligible effects afterwards, or inversely - on impact the capital flows could react negatively and only after a couple of periods after the changes had been implemented positive effects materialize. Both of those scenarios could lead to the same mean post-reform estimate. The flexible specification provides insight into the dynamics of post-reform scenario.

Last but not least, the critical requirement for establishing causality within the D-in-D framework is the assumption of the parallel trend, *i.e.* we should observe the same dynamics governing both the control and the treated group in the pre-treatment period. Specification (1.3.3) provides itself a test for any violations of the parallel trend assumption. As additional robustness checks we conduct a couple of placebo tests and include also the country-specific time trends on top of the country and year fixed effects (reported in section 1.4.3). Finally, an implicit assumption is that conditional on country and year fixed effects, the reform dummy should be uncorrelated with other time-varying factors (included in the error, ϵ_{it}). To address this issue, we control for the time-varying observable factors that potentially affect the capital flows levels and for the regional trends.

Apart from the identification assumptions, the reader should bear in mind that given the coding rule of the financial reform dummy[9], any minor changes in the financial sector regulation that had happened before the large-scale deregulation are automatically disregarded. Certainly, *a priori*, there is no reason to think that those changes do not influence the patterns of capital flows. In order to investigate the potential impact of the minor deregulatory efforts on the capital flows, I split the main financial reform dummy and analyze the effects of the more disaggregated indices. This is discussed in section 1.6.

[9]A country is coded as the permanent reformer if all of the considered FLI components reach sufficiently high levels.

1.4 Main Results

1.4.1 Baseline Results

Tables 1.2 and 1.3 combine the baseline estimation results of the specifications (1.3.1) to (1.3.3) run *without* control variables, both for the capital inflows and outflows[10]. In Col. (1) we present the basic OLS estimates, whereas in Col. (2) we additionally control for the year fixed effects. Col. (3) − (5) report difference-in-differences (DD) estimates (*i.e.* including year and country fixed effects) with the last two columns additionally controlling for the lagged values of capital flows. Finally, in Col. (6) − (7) we report the outcomes of the estimation of the flexible specification from Eq.(1.3.3).[11]

Overall, the impact of financial reform is positive both for the outflows and inflows, and significant. The countries that underwent a complex deregulation in the banking sector at time t have seen an unconditional increase of $0.065pp$ and $0.047pp$ in gross capital inflows and outflows with respect to the countries that did not undergo the reforms until that time (based on the most conservative estimates; Col.(5)). Controlling for the country and year fixed effects, as well as the inclusion of the lagged values of the dependent variable decreases the magnitude of the coefficient, which falls from 0.209 in the OLS specification to 0.097 in the baseline D-in-D. However, interestingly, the GMM estimation results in an increase of the $FREFORM$ coefficient (from 0.045 to 0.064 for the inflows and from 0.035 t 0.047 for the outflows; Col. (4) − (5)), which suggests a downward bias in the dynamic specification. In Col. (5) − (6) we investigate the time dynamics of the financial deregulation. First, we see that the data does not suggest any serious violations of the parallel trend assumption. In the case of capital inflows, in the pre-reform period we see only a weakly significant (at 10% level) positive impact between 2 to 1 year prior to the reform. This could suggest some anticipatory shocks preceding the reform. In the case of capital outflows the anticipatory effects lose significance when system GMM estimation is applied. Second, we learn that the reform does not bring any significant results immediately and the major positive increases driving the mean estimates, symmetrically for the capital inflows and outflows, arise in the longer term. Interestingly, in the first 2 years after the reform capital flows fall by $0.08pp$ and start to increase monotonically afterwards. This J-shaped pattern is common both to

[10] Table 1.13 in the Appendix presents the results for the net capital inflows. Overall, there is no statistically significant impact of the reform on the net capital inflows. However, there is a weakly significant (at 10% level) impact of the reform in the period up to 2 years before and until 2 years after the reform, equal to $0.025pp$ and $0.028pp$ (resp.) increase in the net inflows. We find similar weakly significant anticipatory effect for both inflows and outflows, which however disappears in the specification with a full set of country-level controls.

[11] Col. (5) and (7), in contrast to Col.(4) and (6), respectively, are estimated with Blundell-Bond system-GMM methods, correcting for the dynamic panel data bias.

Table 1.2: Financial Reform and Capital Inflows

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.209***	0.172***	0.0969**	0.0448***	0.0644***		
	(.0518)	(.0514)	(.0448)	(.0152)	(.017)		
Before Financial Liberalization:							
5 to 3 years						0.00728	0.000745
						(.00775)	(.00484)
2 to 1 year						0.0298*	0.0165*
						(.0172)	(.00918)
After Financial Liberalization:							
0 to 2 years						-0.0169*	-0.0177*
						(.0126)	(.0107)
3 to 4 years						0.0592*	0.0432*
						(.03)	(.0213)
5+ years						0.0957***	0.0882***
						(.0235)	(.0266)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No	No	No
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	2318	2318	2318	2227	2227	2227	2227
Countries	91	91	91	91	91	91	91
R2-adj.	.12	.2	.38	.57	.58	.57	.58
No. of instruments					55		58
AR-1/AR-2 p-values					.012 / .43		.01 / .16
Hansen J p-value					.41		.45

Dep. var: gross capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) and (7) split the outcome of col. (4) and (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

capital outflows and inflows, and absent in the case of net capital inflows (See Table 1.13 in the Appendix).

1.4.2 Conditional Results

In this section we present the estimation results of specifications from Eq.(1.3.1)-(1.3.3), with a rich set of control variables. Firstly, in order to net off the effect of the reform from the other possible determinants of capital flows related to the financial sector, we control for the level of financial openness in each country, measured by the Chinn-Ito index (Chinn and Ito (2006)). The index summarizes the level of capital account openness based on the restrictions on the cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). Additionally, we control explicitly for the country-level capital account restrictions based on the IMF Financial Development Database. To account for the trade intensity and trade volumes impact on capital flows, we include as regressors trade volume to GDP (calculated as total

Table 1.3: Financial Reform and Capital Outflows

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.204***	0.170***	0.0920**	0.0354***	0.0466***		
	(.0545)	(.0545)	(.0446)	(.0132)	(.0139)		
Before Financial Liberalization:							
5 to 3 years						-0.000891	-0.0101
						(.00531)	(.00916)
2 to 1 year						0.0276*	-0.00668
						(.0165)	(.0143)
After Financial Liberalization:							
0 to 2 years						-0.0464***	-0.0341***
						(.0191)	(.0121)
3 to 4 years						0.0301	0.0199
						(.0246)	(.0271)
5+ years						0.0878***	0.0599***
						(.0239)	(.0154)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No	No	No
Lagged $cflow$	No	No	Yes	Yes	Yes	Yes	Yes
Observations	2318	2318	2318	2227	2227	2227	2227
Countries	91	91	91	91	91	91	91
R2-adj.	.12	.19	.44	.65	.68	.66	.68
No. of instruments					55		58
AR-1 / AR-2 p-values					.042 / .18		.045/ .56
Hansen J p-value					.37		.89

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) and (7) split the outcome of col. (4) and (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

exports plus total imports over GDP) as well as an index of trade openness. Trade openness is a summary measure of the severity of both explicit and implicit tariffs, and other non-tariff trade restrictions. We also control for the country level of development proxied by log of GDP *per capita*. Trade variables and the other macroeconomic statistics come from the IMF Statistics and World Bank World Development Indicators or Penn World Tables. Alfaro et al. (2008) stress the importance of the institutional quality as the main driver behind the decisions of foreign as well as the domestic investors. To account for the role of institutional framework we introduce a Composite Index based on International Country Risk Guide data (ICRG). The IRCG Composite Index from the PBS Group[12] is the sum of the indices of investment profile, government stability, internal and external conflict, corruption, non-militarized politics, protection from religious tensions, law and order, protection from ethnic tensions, democratic accountability, and bureaucratic quality. This index can take

[12]The PRS Group is the former group of editors and analysts from "International Reports", where in 1980 they have developed a statistical model to assess countries' risk based on a given country forecast of its financial, economic and political risks.

values from 0 to 100 for each country, where a higher score means a lower risk. Moreover, the recent literature suggests (Magud et al. (2014)) that the exchange rate regime can impact the volume and frequencies of capital flows. We thus control for the exchange rate regime based on an updated classification from Ilzetzki and Reinhart (2004). The classification ranges from 1 to 4, with 4 standing for the fully free exchange rate regime. Summary statistics for all those variables are reported in section 1.3.3.

Table 1.4: Financial Reform and Capital Inflows

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.118***	0.0932**	0.0243**	0.0121*	0.0348***		
	(.0415)	(.0415)	(.0109)	(.0101)	(.0128)		
Before Financial Liberalization:							
5 to 3 years						0.0120	0.0130
						(.0113)	(.00813)
2 to 1 year						0.00924	0.00878
						(.0163)	(.0124)
After Financial Liberalization:							
0 to 2 years						-0.0265**	-0.0242***
						(.0112)	(.00808)
3 to 4 years						0.00418	0.00800
						(.0263)	(.0238)
5+ years						0.0406**	0.0801***
						(.0169)	(.0255)
Fin. Openness	0.0102**	0.00807	0.0156**	0.00845**	0.00496*	0.00853**	0.00795***
	(.00495)	(.00489)	(.00753)	(.00391)	(.00278)	(.00394)	(.00282)
Cap. Ctrls (IMF)	-0.00220	-0.00658	-0.0106	-0.00443	-0.00298	-0.00266	-0.00287
	(.00671)	(.00723)	(.00967)	(.00435)	(.00322)	(.00416)	(.00338)
Ex. Rate Regime	-0.0214**	-0.0188*	-0.0117*	-0.00470	-0.00754**	-0.00465	-0.00695**
	(.00988)	(.00974)	(.00671)	(.00396)	(.00303)	(.0038)	(.003)
ICRG Composite	0.0224**	0.0257***	0.000628	-0.000183	0.0101***	-0.000915	0.00987**
	(.00891)	(.00938)	(.00813)	(.00464)	(.00365)	(.00451)	(.00387)
Trade volume to gdp	0.000295	0.000247	0.00185**	0.000980***	0.000143	0.000904***	0.000161
	(.000229)	(.0002)	(.000868)	(.000326)	(.000109)	(.000324)	(.000109)
Trade Openness	-0.0189	-0.0172	-0.0167	-0.00917	-0.00879	0.0000474	-0.00855
	(.0262)	(.0268)	(.039)	(.0231)	(.0141)	(.0213)	(.0144)
ln GDP p.c.	0.0202***	0.0229***	0.149*	0.0792**	0.0150***	0.0805**	0.0190***
	(.00598)	(.00644)	(.0861)	(.0356)	(.00461)	(.034)	(.0052)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1742	1742	1742	1741	1741	1741	1741
Countries	84	84	84	84	84	84	84
R2-adj.	.23	.32	.57	.68	.70	.68	.70
No. of instruments					60		64
AR-1/AR-2 p-values					.0013 / .98		.0014 / .97
Hansen J p-value					.69		.63

Dep. var: gross capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

On average, net off all the other capital inflow determinants, the financial sector reform results in an increase of 0.035*pp* in capital inflows (Table 1.4, Col.(5)). The effect for the capital outflows is almost identical - an increase of 0.031*pp* (Table 1.4, Col.(5)). Regarding the dynamic response of capital flows to financial reform, we find a corroboration of the J-shaped response present in the unconditional results. On impact, within the first 2 years of the reform we see a drop of 0.024*pp* in inflows and 0.017*pp* in outflows (Col. (7)). The coefficients describing the period of 3 to 4 years after the reform are positive, yet not significant. The main positive effect from the mean estimate is driven by the capital flows increases arriving mostly from the long term gains, starting from 5 years after the reform and onward (0.08*pp* for inflows and 0.052*pp* for outflows; Col. (7)).

A significant role of any of the pulse dummies from the pre-reform period would point to a potential violation to common trend assumption or a presence of confounding factors affecting both the capital flows and financial reforms, and as such posing a threat to the causal inference. None of those pulse dummies remains significant, neither for the inflows, nor for the outflows. We further inspect the possible violations to parallel trend assumption via a set of placebo tests in section 1.4.3.

In the light of the recent research on the gross capital flows those symmetric results do not come as a surprise. Broner et al. (2013) document a number of stylized facts regarding the behavior of gross capital inflows and outflows. They find that the total gross inflows and outflows are highly correlated and tend to comove, both under regular economic conditions as well as in crisis times.[13]

As for the controls, as expected capital flows are positively correlated with financial openness ($Fin.Openness$), which is in line with the recent empirical studies of capital flows (Reinhardt et al. (2013b)). Interestingly, controls of the explicit capital account ($Cap.Ctrls(IMF)$) are not significant. Trade volume is generally positively related to capital flows, yet it is significant in 3 out of 7 specifications. We find the trade openness to be negatively correlated with capital flows, reflecting the notion that both tariff and non-tariff barriers to trade act as a deterrent for capital inflows and outflows. Interestingly, trade openness coefficients are of a greater magnitude and more significant for the capital outflows. Both flows are strongly and positively correlated with log of the GDP *per capita*, suggesting the richer economies are more attractive for foreign investors as well as the domestic investors in richer economies locate more funds abroad.[14] The lower institutional risk, the higher both capital flows as

[13]Broner et al. (2013) find also a more heterogeneous behavior in the components of capital flows, which is also in line with the results of the section 1.5 of this paper.

[14]The results for net capital inflows are presented in Table 1.14. As in the case of unconditional regression, we do not find any impact of financial reform on net capital inflows. Perhaps surprisingly, we find only a weak corroboration of the Lucas paradox: the log of the GDP *per capita* correlates positively with net capital inflows, however it is weakly significant (at 10% level) only in 2 out of 7 specifications.

Table 1.5: Financial Reform and Capital Outflows

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.122***	0.0981**	0.0259	0.0154*	0.0310***		
	(.0432)	(.0436)	(.0191)	(.0092)	(.0108)		
Before Financial Liberalization:							
5 to 3 years						-0.0141	0.0132
						(.00999)	(.0661)
2 to 1 year						0.0179	0.0175
						(.0129)	(.0197)
After Financial Liberalization:							
0 to 2 years						-0.0223**	-0.0169**
						(.00977)	(.00671)
3 to 4 years						-0.00219	0.00315
						(.0175)	(.0197)
5+ years						0.0404***	0.0523***
						(.0133)	(.0159)
Fin. Openness	0.0104**	0.00904*	0.0106	0.00455	0.00283	0.00489*	0.00545***
	(.00487)	(.00463)	(.00682)	(.00279)	(.00173)	(.00279)	(.00182)
Cap. Ctrls (IMF)	-0.00567	-0.0113*	-0.0126	-0.00505	-0.00360	-0.00349	-0.00351
	(.00599)	(.00648)	(.00912)	(.00364)	(.00224)	(.00331)	(.00241)
Ex. Rate Regime	-0.0161	-0.0139	-0.00295	0.00140	-0.00227	0.00158	-0.00168
	(.0104)	(.0103)	(.00586)	(.00266)	(.00238)	(.00243)	(.00228)
ICRG Composite	0.0214**	0.0234**	-0.000943	-0.000345	0.00678**	-0.00122	0.00649**
	(.00903)	(.00939)	(.00701)	(.00359)	(.00318)	(.00342)	(.00321)
Trade volume to gdp	0.000228	0.000181	0.00149*	0.000643**	0.0000803	0.000570**	0.0000948
	(.000254)	(.000225)	(.00082)	(.000254)	(.0000809)	(.000247)	(.0000793)
Trade Openness	-0.0343	-0.0354	-0.0596*	-0.0317**	-0.0181**	-0.0237*	-0.0173*
	(.0259)	(.0246)	(.0322)	(.0153)	(.00868)	(.0134)	(.0092)
ln GDP p.c.	0.0232***	0.0273***	0.111	0.0478*	0.0118***	0.0494*	0.0149***
	(.00637)	(.00687)	(.0789)	(.0272)	(.00313)	(.0259)	(.00363)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1742	1742	1742	1741	1741	1741	1741
Countries	84	84	84	84	84	84	84
R2-adj.	.23	.3	.61	.75	.81	.75	.80
No. of instruments					60		64
AR-1 / AR-2 p-values					.016 / .39		.016 / .39
Hansen J p-value					.23		.16

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

ICRGComposite variable enters the regression with positive and significant sign. Exchange rate regime (EER; *Ex.RateRegime*) coefficient is negative, suggesting more capital flowing in and out of the economies with a more rigid ERR. However, it is only significant for capital inflows.

1.4.3 Sensitivity checks

In order to test the sensitivity of the results described in the sections above, we run a number of robustness checks. First, as capital flow surges and sudden stops has been associated with credit cycles, we enrich the specifications by controlling for the financial sector depth proxied by private credit to GDP (data from World Bank Financial Development Database). Results can be found in 1.15 and 1.19 in the Appendix. Although the coefficient on the private credit is positive and significant both for capital inflows and outflows, it does not alter neither the mean impact of the reform, nor its dynamic pattern.[15] Also, as suggested by Gourinchas and Jeanne (2013) we control not only for the levles of GDP *per capita*, but also for the GDP growth rates (data from the World Bank World Development Indicators; results in Tables 1.16 and 1.20 in the Appendix). Again, we find no changes to the mean and time-varying coefficients of the financial reform. Finally, we also exchange the institutional quality variable, *ICRGComposite*, for the Freedom House Index (FH Index) that is measuring the quality of democratic institutions. Freedom House Index ranges from 0 to 10, with a higher value representing a higher quality of the institutions. In the empirical studies of the effects of the democracy this variable is typically the least preferred among all the measures of the quality of the democracy (as compared to Polity IV or the Goldman dataset), as it is the most *contaminated* with the pooled information on the overall condition of the all institutions within a country. However, this drawback acts to our advantage as the overall quality of the institutions is precisely what we want to control for. The inclusion of the $FHIndex$ does not change the sign, neither the significance of the $FREFORM$ coefficients, nor the capital flows dynamic patterns after the reform.

The main results remain robust to dropping from the sample countries that are hosts to large financial centers such as United States and United Kingdom, Switzerland, Hong Kong and Singapore as well as to the exclusion of China (Tables 1.15 - 1.22 in the Appendix).

Finally, we conduct two placebo experiments in order to search for any violations to the parallel trend assumption. For each country that has witnessed a financial reform, we lag the actual reform year by 5 and 7 years, respectively. The results are reported in the first four columns of Table 1.6 below. Any significant estimates in the lagged-reform specifications

[15] This remians true even for the specifications where private credit to GDP is traeted as endogenous and instrumented for in the system-GMM estimation.

Table 1.6: Identification assumption tests

	[Placebo 1]		[Placebo 2]		[Ctry-specific time trends]	
CAPITAL INFLOWS	(1)	(2)	(3)	(4)	(5)	(6)
FREFORM	0.0488	0.0117	0.0468	0.0115	0.0594**	0.0255***
	(.044)	(.0665)	(.0432)	(.0574)	(.025)	(.0029)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1874	1414	1874	1414	2212	1741
Countries	91	82	91	82	91	84
R2-adj.	.52	.78	.42	.68	.79	.87
No. of instruments	55	59	55	59	55	59
AR-1 / AR-2 p-values	.0013 / .78	.0027 / .73	.00042 / .75	.00065 / .75	.011 / .43	.00068 / .89
Hansen J p-value	0.12	0.93	0.11	0.91	0.67	0.3
CAPITAL OUTFLOWS						
FREFORM	0.0368	0.00386	0.0362	0.00622	0.036**	0.031**
	(.0342)	(.00466)	(0.0337)	(.00409)	(.017)	(.0108)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes	No	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1874	1414	1874	1414	2212	1741
Countries	91	82	91	82	91	84
R2-adj.	.51	.76	.45	.63	.80	.91
No. of instruments	55	59	55	59	55	59
AR-1 / AR-2 p-values	0.000034 / 0.5	.00014 / 0.54	0.000034 / 0.49	.00015 / 0.54	.031 / .29	.0047 /.41
Hansen J p-value	0.29	.27	0.25	.24	.62	.66

Dep. var: gross capital inflows/outflows to GDP in constant 2005 USD. In [Placebo 1] specifications $FREFROM$ dummy is lagged by 5 years across the reformed countries, in [Placebo 2] $FREFROM$ dummy is lagged by 7 years. In [Ctry-specific time trends] specifications country-specific time trends are included. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country * level. $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

would suggest that the capital flows trends had been different for the treated and the control group already before the reform took place or/and that there exist confounding factors affecting both the financial reforms and capital flows undermining any casual conclusions. We find that the lagged reform estimates are not significant neither for the capital inflows, nor for the outflows. This is true both for the unconditional specifications (Col.(1) and (3)) as well as for the specifications with full set of controls (Col.(2) and (4)). In the last two columns we additionally include the country-specific time trends. This would account not only for the fact that some countries may attract more inflows than the others on average, but also for the fact that in some economies capital flows may exhibit also different time trends. Controlling for time trends does not change the results neither qualitatively, not quantitatively, both for the inflows and the outflows (Col.(5) and .(6)).

1.5 FDI, debt and portfolio equity flows

The LMF data allows for splitting gross capital flows into three composition categories: debt flows, portfolio equity and direct investment (FDI). Using this classification, we re-estimate (1.3.1)-(1.3.3) with an aim to investigate potentially differential impact of financial liberalization on different capital flows components as well as in order to determine the driving flows components behind the dynamic patterns documented in the previous sections. For the sake of clarity of the exposition, we report only the outcomes of the most conservative system-GMM coefficients. Table 1.7 summarizes the results for both capital outflows and inflows.

We find the previously identified positive effect of the financial reform on the capital inflows is present only for the debt and portfolio equity flows, with no effect for FDI. Countries that have undergone financial liberalization face on average $0.02pp$ and $0.012pp$ higher inflows of debt and portfolio equity, respectively (Col. (3) and (5)). Dynamic patterns from the previous section are confirmed: the positive mean effect is driven by the long term impact of the reform, arising approximately 5 years after a large scale deregulation. However, the initial drop in gross total capital flows is entirely due to debt flows, the short and mid-term coefficient for portfolio equity remain insignificant (but positive). On the other hand, financial reform increases all of the capital outflows components on average (lower panel, Table 1.7), with the largest impact on the gross outward FDI (FDI coefficient is equal to 0.0831 as opposed to 0.016 and 0.011 for debt and portfolio equity). As in the case of the outflows, all positive impact materializes in the long-term, from 5 years after the reform. Similarly to the inflows behavior, it is the debt outflows component driving the drop in total outflows in the first two years after the reform. In all but one of the specifications the pre-reform dummies are insignificant, suggesting no violations of the parallel trend assumption. It is only in the case of debt inflows that we find statistically significant anticipatory negative effect of the financial reform, which then carries on up until the first 2 years after the liberalization. The results from Table 1.7 also suggest that the total gross capital flows reaction patterns in the short term are not driven by substitution between various types of assets. Indeed, at the same time when the debt flows fall in the initial years after the large-scale financial liberalization, the coefficients on both portfolio equity and direct investment remain positive, yet not significant.

In Tables 1.23 and 1.24 in the Appendix we present the full estimation results for all the components of the capital flows. Additionally, in Table 1.25 we document the regression coefficients for the net inflows split by components.

It is possible that a financial reform increases the domestic supply of credit and therefore, the home residents begin to substitute the foreign debt with its domestic (now more available) counterpart, which leads to the fall in the foreign debt inflows. On the other hand, the

Table 1.7: Financial Reform and Capital Inflows: FDI, debt and equity flows

CAPITAL INFLOWS						
	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREFORM	0.00674		0.0199**		0.0120**	
	(.00454)		(.00845)		(.00559)	
Before Financial Liberalization:						
5 to 3 years		0.00266		0.0106		0.0487
		(.00213)		(.01606)		(.0231)
2 to 1 year		0.00929		-0.0203***		0.0300
		(.00946)		(.0075)		(.0469)
After Financial Liberalization:						
0 to 2 years		0.000394		-0.0206***		0.0260
		(.00346)		(.00486)		(.0448)
3 to 4 years		0.0140		-0.0150		0.0113
		(.0131)		(.0129)		(.0829)
5+ years		0.00133		0.0535***		0.0418***
		(.00192)		(.00604)		(.00758)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1733	1733
Countries	84	84	84	84	84	84
R2-adj.	.4	.4	.59	.59	.43	.43
No. of instruments	60	64	60	64	60	64
AR-1 / AR-2 p-values	.00051/ .69	.00051 / .87	.00048 / .43	.00059 / .28	.023 / .29	.023 /.44
Hansen J p-value	.30	.15	.31	.25	.56	.23
CAPITAL OUTFLOWS						
FREFORM	0.0831***		0.0159**		0.0116***	
	(.00255)		(.00739)		(.00378)	
Before Financial Liberalization:						
5 to 3 years		0.00305		0.00876		0.00405
		(.0147)		(.0425)		(.0197)
2 to 1 year		0.00350		0.0160		-0.0218
		(.0191)		(.0685)		(.0285)
After Financial Liberalization:						
0 to 2 years		0.0495		-0.0117**		0.0490
		(.0446)		(.00504)		(.0349)
3 to 4 years		0.0236		-0.00925		0.0476
		(.0823)		(.0148)		(.0597)
5+ years		0.0417***		0.0491**		0.0407**
		(.0017)		(.00353)		(.00123)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1717	1717
Countries	84	84	84	84	84	84
R2-adj.	0.53	0.53	0.69	0.69	0.5	0.49
No. of instruments	60	64	60	64	60	64
AR-1 / AR-2 p-values	.0029 / .89	.0032 / .87	.022 / .95	.023 / .94	.041 / .38	.041 / .38
Hansen J p-value	.47	.62	.13	.28	.17	.19

Dep. var: gross capital inflows/outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (2), (4), (6) split the outcome of col. (1), (3), (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

explanation for the the fall in debt outflows is more demanding. It could be lead by an increase in the uncertainty brought about by the large-scale reforms. The lending capacities of domestic residents can be reduced in the first years after the reforms, causing a transitional fall in the debt outflows. Alternatively, the explanation could be based on the theory recently developed by Martin and Ventura (2015). Assuming that in the reforming economy there are relatively symmetric pools of low productivity firms and high productivity firms, we would observe that after the liberalization the unproductive firms exit the market and free resources for the high productivity firms. If the newly available funds are entirely absorbed by the demand from the surviving firms, the interest rate increases and debt outflows fall in response. However, this effect is temporary and once the reform-induced resource reallocation takes place, the capital outflows begin to increase again. In the long run, the financial reforms materialize in the form of more solid, grown and international banking system and increased credibility of local financial institutions. This both facilitates more exchange on international markets within domestic investors (long term increases in gross outflows) and increases the attractiveness of the country for the foreign investors (long term increases in gross inflows).

1.6 Complementary reforms

The liberalization of the financial sector usually comprises a package of numerous reforms and countries can differ in the pace, the order and the intensity of their implementation. Some countries start the liberalization efforts by limiting the state intervention in credit regulations, some others instead decide to strengthen the financial supervision bodies or turn to freeing and developing the securities. So far, in the analysis presented in the previous sections we have treated all those reforms equally. However, in principle, there is no reason why the reforms adopted in distinct areas of the financial sector should have an identical impact on the incentives of the foreign and domestic investors. Martin and Taddei (2013) in their recent theoretical contribution point to the fact that if we want to understand the relationship between capital flows and the condition of the financial sector, we should be very specific about the type of frictions we address. In detail, they show that a reduction in the financial frictions can lead to a very different reactions of the capital flows depending whether we reduce the adverse selection or limited pledgeability problems.

In Figure 1.3 we plot the evolution of Financial Liberalization Index by its components. A pattern that clearly emerges is that the reforms within securities markets and banking supervision importantly lagged behind the liberalization efforts in the remaining areas.

Motivated by those both theoretical and empirical considerations, we want to separate the reforms aimed at increasing competition as opposed to the reforms strengthening the supervision and transparency. Is more competition in the banking sector complementary to

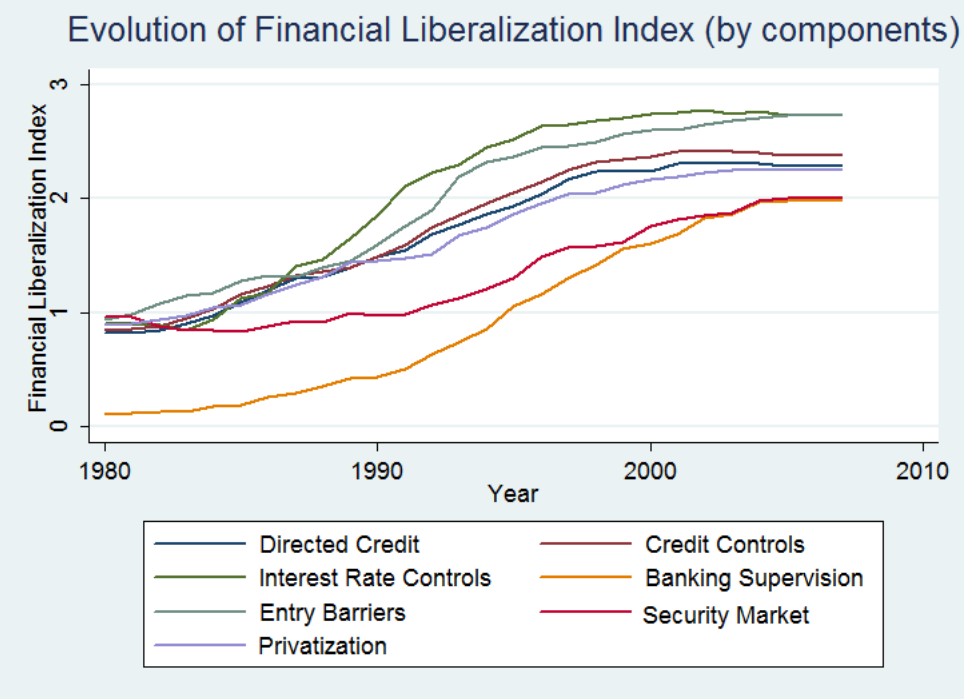


Figure 1.3: Financial Liberalization Index components: cross-country averages.

improving the legal supervision powers over the banking industry? Are the effects of freeing competition, opening to foreign financial companies and strengthening the supervisory network purely additive? Or maybe a strong banking transparency fosters the positive effects of increasing competition? Is liberalization in the banking competition without strengthening a supervisory network beneficial for capital flows? These are the type of questions we will try to address in this section.

As previously, in the reform coding we rely on The New Database of Financial Reforms. However now, we will consider the sub-indices in the areas of credit controls, directed credit, interest rate controls, banking sector entry and privatization as the ones describing financial competition. Respectively, sub-indices measuring banking supervision and securities market would jointly describe the financial transparency. We split the sample into countries that underwent both transparency and competition reforms, the countries that underwent only one of those reforms and the countries that did not undergo any reforms whatsoever (the baseline reference group).[16]

[16]According to the coarse codification of reforms applied in the previous sections we have identified 32 countries that have undergone a major financial deregulation. In a finer codification applied in this section we additionally identify further 32 countries that have undergone a banking competition reform and 6 that have reformed banking supervision. The control group consists of 14 countries. In principle, one would want to focus on each of the FLI indices separately, however such an approach would not be feasible within the adopted difference-in-differences framework as it would critically reduce the number of observations in the control group.

We estimate the following modification of the baseline Eq.(1.3.2):

$$cflow_{it} = \phi_t + \alpha_i + \delta cflow_{it-1} + \beta_1 FREF\ Superv_{it} + \beta_2 FREF\ Compet_{it} + \\ + \beta_3 FREF\ Superv_{it} + \times FREF\ Compet_{it} + \Gamma' X_{it} + \epsilon_{it} \tag{1.6.1}$$

where $FREF\ Compet$ equals 1 in the countries that underwent only the competition reforms, $FREF\ Superv$ equals 1 in the countries that underwent only the supervision reforms and the interaction term between $FREF\ Compet$ and $FREF\ Superv$, which equals 1 in the countries that underwent both the reforms after the second reform was launched. Therefore β_1 captures the impact on capital flows in the countries that have undergone a competition

Table 1.8: Financial Reform and Capital Flows: Transparency and Competition

	Total Capital Inflows		Total Capital Outflows	
	(1)	(2)	(3)	(4)
FREF Compet.	-0.00175	-0.00665	-0.00275	-0.00478
	(.0072)	(.00792)	(.0031)	(.00376)
FREF Superv.	0.0291***	-0.00199	0.0253**	0.00444
	(.0107)	(.014)	(.0101)	(.0161)
FREF Compet. x FREF Superv.		0.0406***		0.0271**
		(.0109)		(.0104)
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741
Countries	84	84	84	84
R2-adj.	.64	.64	.72	.72
No. of instruments	61	62	61	62
AR-1 / AR-2 p-values	.0014 / .89	.0013 / .89	.016 / .4	.016 / .4
Hansen J p-value	.66	.64	.11	.12
Wald p-value		.023		.073

Dep. var: gross capital inflows/outflows to GDP in constant 2005 USD. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order auto-correlated disturbances in the first differences equations. Joint sign. p-value is the p-value of the Wald test for the joint significance of $FREFcompet$, $FREFsuperv$ and $FREFCompet.xFREFSuperv$. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

reform at time t in comparison to countries that did not undergo any competition reforms until that time. Analagously, β_2 describes the effect for the countries that have undergone a supervision reform. Finally, β_3 stands for the impact for the countries both strengthening the supervision and improving the competition in the banking sector.

In Table 1.8 we report the estimates for the total capital inflows and outflows[17]. In Col.

[17]In Table 1.26 in the Appendix we report full estimation results.

(1) and (3) we present the baseline difference-in-differences estimates, whereas in Col.(2) and (4) we include also the interaction term. If considered alone, a reform in banking competition has no significant impact neither on the gross inflows, not on the outflows. In contrast, an improvement in the regulatory framework is found to have a positive effect, symmetrical for the inflows and outflows ($0.03pp$ increase for the inflows and $0.025pp$ increase for the outflows). However, once we add the interaction term it enters the regressions with a positive and significant sign, whereas the coefficient on banking supervision loses significance (Col.(2) and (4)). This means that any positive effects that were attributed to banking supervision reforms in the specifications without the interaction are in reality due to the positive effects in countries whose banking sectors have experienced an improvement *both* in the competition and in the regulatory framework[18]. Such a result suggests a very strong complementarity between liberalization of different aspects of the financial sector: if countries forgo competition reform or supervision reforms in isolation, the impact on capital flows is negligible. The magnitude of the effect is comparable to the baseline estimates from section 1.4: a complex financial sector liberalization causes an increase of $0.04pp$ in the capital inflows and an increase of $0.027pp$ in the capital outflows across the reforming countries as compared to the control group. In Tables 1.9 and 1.10 we report the estimation results

Table 1.9: Financial Reform and Capital Inflows: Transparency and Competition, all components

	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREF Compet.	0.00209	0.00182	-0.00413	-0.00821	0.0279*	-0.00506
	(.00206)	(.00214)	(.00619)	(.00656)	(.0169)	(.00588)
FREF Superv.	0.00923**	0.00777	0.0153**	-0.00461	0.00793*	-0.00523
	(.00423)	(.00533)	(.0069)	(.0117)	(.00469)	(.00559)
FREF Compet. x FREF Superv.		0.00196		0.0461***		0.0270**
		(.00734)		(.0145)		(.0101)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1733	1733
Countries	84	84	84	84	84	84
R2-adj.	.40	.40	.59	.59	.43	.43
No. of instruments	61	62	61	62	61	62
AR-1 / AR-2 p-values	.0046 / .85	.0047 / .84	.0061 /.42	.0006 / .44	.026 / .29	.025 / .29
Hansen J p-value	.35	.36	.4	.44	.21	.21
Wald p-value		.037		.045		.086

Dep. var: gross capital inflows to GDP in constant 2005 USD. Hansen J reports the p-value for the null hypothesis of instruments validity. AR-1/AR-2 are the p-values for first and second order auto-correlated disturbances in the first differences equations. Wald p-value is the p-value of the Wald test for the joint significance of $FREFcompet$, $FREFsuperv$ and $FREFCompet.xFREFSuperv$. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

[18]Note that this specification does not require that reforms are implemented at the same time, neither it tells anything on the specific ordering of the reforms.

for the disaggregated inflows and outflows[19]. We find that only a complex liberalization has a significant impact on debt and portfolio equity flows (Col.(4) and (6)), whereas the interaction term is not significant for the direct investment flows. In all of the specifications the coefficient on the banking supervision is positive and significant, yet it loses significance upon controlling for the interaction. As far as the outflows are concerned, they exhibit a very similar patterns to the inflows, yet with positive and significant coefficients of the interaction term for all of the flow components.[20]

Table 1.10: Financial Reform and Capital Outflows: Transparency and Competition

	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREF Compet.	0.00390	-0.00131	-0.00182	-0.00392	0.000491	-0.00183
	(.0768)	(.000814)	(.00206)	(.0025)	(.000925)	(.0014)
FREF Superv.	0.0690***	0.00997	0.0132**	0.00313	0.00713**	-0.00346
	(.00247)	(.0314)	(.00617)	(.0101)	(.00308)	(.00328)
FREF Compet. x FREF Superv.		0.0758***		0.0131**		0.0138**
		(.00423)		(.00624)		(.00562)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1717	1717
Countries	84	84	84	84	84	84
R2-adj.	.53	.53	.69	.69	.49	.49
No. of instruments	61	62	61	62	61	62
AR-1 / AR-2 p-values	.0044 / .86	.0045 / .85	.019 / .94	.019 / .94	.039 / .34	.038 / .34
Hansen J p-value	.73	.74	.16	.15	.77	.76
Wald p-value		.04		.094		.033

Dep. var: gross capital outflows to GDP in constant 2005 USD. Hansen J reports the p-value for the null hypothesis of instruments validity. AR-1/AR-2 are the p-values for first and second order auto-correlated disturbances in the first differences equations. Wald p-value is the p-value of the Wald test for the joint significance of $FREFcompet$, $FREFsuperv$ and $FREFCompet.xFREFSuperv$. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

1.7 Conclusion

The relationship between financial development and national financial positions has been frequently addressed in the economic literature. Although there is a well-established theoretical literature stressing a myriad of mechanisms through which financial sector advancements affect the capital flows, the empirical literature lacks a relevant event-analysis of the impact of the financial sector reforms on the variations in country's flows of foreign liabilities and assets. This paper presents the first attempt to assess the effect of a large-scale financial sector deregulation reform on the capital flows. We analyze the impact of a permanent financial liberalization in the banking industry on the gross capital inflows and outflows. In

[19] As before, full estimation results can be found in the Appendix Tables 1.27 and 1.28.

[20] Note that this is in line with the results from section 1.5.

contrast to the previous literature, we depart from a cross-country setting and exploit the within country variation of capital flows following the reform episodes. The results point to increases of $0.035pp$ to $0.031pp$ in the average capital inflows and outflows following a complex and permanent deregulation. However, we find that the dynamic impact of the reform is uneven: on impact both capital inflows and outflows fall and the positive effects arise only after $4-5$ or more years after the liberalization. Further analysis reveals that the initial fall is driven by the debt component of inflows and outflows, whereas the long term increases are observed in all of the capital flow components: debt, portfolio equity and direct investment. This short term dynamics can be fueled by the substitution effects between domestic and foreign financing. Upon financial reform the access to credit increases and some of the domestic residents who had been financing their activity abroad now turn to domestic resources (decrease in debt inflow). A plausible explanation for the short term increase in the outflows is the theory recently developed by Martin and Ventura (2015). Suppose that the deregulating economy is characterized by a relatively symmetric pools of low productivity firms and high productivity firms. The unproductive firms exit the market and the freed financial resources are absorbed by high productivity firms. Since the newly available funds are entirely absorbed by the demand of the surviving firms, the interest rate increases and the debt outflows fall in response. However, this effect is temporary and once the reform-induced reallocation takes place, the capital outflows begin to increase again as observed in the regression results. In the long term, the financial reform improves the financial institutions. This, in turn, ameliorates the country's attractiveness and credibility for the foreign investors (increase in long-term inflows of portfolio equity and debt flows). On the other hand, the development of national financial institutions facilitates their further international presence and leads to the increases in all types of capital outflows (debt, portfolio equity and direct investment). Additionally, the results point to a strong complementary nature of the financial deregulation efforts. We find that the national financial system is highly inter-connected and that an improvement in the banking competition alone did not bring any impact for the capital flows unless it was accompanied by the strengthening in the banking supervision, and *vice versa*.

One should bear in mind that an individual country experience of the financial deregulation can deviate from the means, hence an extra caution should be applied for any policy recommendations. We leave the theoretical explanation of the mechanisms behind the reported dynamics of the capital flows after a financial deregulation for the future research agenda.

Bibliography

ABIAD, A., E. DETRAGIACHE, AND T. TRESSEL (2010): "A New Database of Financial Reforms," *IMF Staff Papers*, 57, 281–302.

ALFARO, L., S. KALEMLI-OZCAN, AND V. VOLOSOVYCH (2008): "Why Doesn't Capital Flow from Rich to Poor Countries? An Empirical Investigation," *The Review of Economics and Statistics*, 90, 347–368.

BLUNDELL, R. AND S. BOND (1998): "Initial conditions and moment restrictions in dynamic panel data models," *Journal of Econometrics*, 87, 115–143.

BLUNDELL, R., S. BOND, AND F. WINDMEIJER (2000): "Estimation in dynamic panel data models: improving on the performance of the standard GMM estimator," IFS Working Papers W00/12, Institute for Fiscal Studies.

BOYD, J. H. AND B. D. SMITH (1997): "Capital Market Imperfections, International Credit Markets, and Nonconvergence," *Journal of Economic Theory*, 73, 335 – 364.

BRONER, F., T. DIDIER, A. ERCE, AND S. L. SCHMUKLER (2013): "Gross capital flows: Dynamics and crises," *Journal of Monetary Economics*, 60, 113–133.

CHINN, M. D. AND H. ITO (2006): "What matters for financial development? Capital controls, institutions, and interactions," *Journal of Development Economics*, 81, 163–192.

FERNNDEZ-ARIAS, E. AND R. HAUSMANN (2000): "Foreign direct investment: good cholesterol?" *Inter-American Development Bank, Working Paper*.

GERTLER, M. AND K. ROGOFF (1990): "North-South lending and endogenous domestic capital market inefficiencies," *Journal of Monetary Economics*, 26, 245 – 266.

GOPINATH, G., E. HELPMAN, AND K. ROGOFF, eds. (2014): *Handbook of International Economics, Vol. 4*, Amsterdam: Elsevier.

GOURINCHAS, P.-O. AND O. JEANNE (2013): "Capital Flows to Developing Countries: The Allocation Puzzle," *The Review of Economic Studies*, 80, 1484–1515.

GOURINCHAS, P.-O. AND H. REY (2007): "International Financial Adjustment," *Journal of Political Economy*, 115, 665–703.

GRUBER, J. AND S. KAMIN (2009): "Do Differences in Financial Development Explain the Global Pattern of Current Account Imbalances?" *Review of International Economics*, 17, 667–688.

Hubbard, R. G. (2006): "The U.S. current account deficit and public policy," *Journal of Policy Modeling*, 28, 665 – 671.

Ilzetzki, E. O. and C. M. Reinhart (2004): "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *Quarterly Journal of Economics*, 119, 1–48.

Kraay, A., N. Loayza, L. Servn, and J. Ventura (2005): "Country Portfolios," *Journal of the European Economic Association*, 3, 914–945.

Lane, P. R. (2012): "Financial Globalisation and the Crisis," *BIS Working Papers 397*.

Lane, P. R. and G. M. Milesi-Ferretti (2007): "The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 19702004," *Journal of International Economics*, 73, 223 – 250.

Levchenko, A. A., R. Rancire, and M. Thoenig (2009): "Growth and risk at the industry level: The real effects of financial liberalization," *Journal of Development Economics*, 89, 210–222.

Levine, R. (2005): "Chapter 12 Finance and Growth: Theory and Evidence," Elsevier, vol. 1 of *Handbook of Economic Growth*, 865 – 934.

Lucas, Robert E., J. (1990): "Why Doesn't Capital Flow from Rich to Poor Countries?" *The American Economic Review*, 80, pp. 92–96.

Magud, N. E., C. M. Reinhart, and E. R. Vesperoni (2014): "Capital Inflows, Exchange Rate Flexibility and Credit Booms," *Review of Development Economics*, 18, 415–430.

Martin, A. and F. Taddei (2013): "International capital flows and credit market imperfections: A tale of two frictions," *Journal of International Economics*, 89, 441–452.

Martin, A. and J. Ventura (2015): "Financial Reforms and Capital Flows: Insights from General Equilibrium," in *Economic Policies in Emerging-Market Economies Festschrift in Honor of Vittorio Corbo*, ed. by R. J. Caballero and K. Schmidt-Hebbel, Central Bank of Chile, vol. 21 of *Central Banking, Analysis, and Economic Policies Book Series*, chap. 7, 109–137.

Matsuyama, K. (2005): "Credit Market Imperfections And Patterns Of International Trade And Capital Flows," *Journal of the European Economic Association*, 3, 714–723.

——— (2014): "Institution-Induced Productivity Differences and Patterns of Iinternational Capital Flows," *Journal of the European Economic Association*, 12, 1–24.

MENDOZA, E. G., V. QUADRINI, AND J. V. RIOS-RULL (2009): "Financial Integration, Financial Development, and Global Imbalances," *Journal of Political Economy*, 117, pp. 371–416.

PAPAIOANNOU, E. AND G. SIOUROUNIS (2008): "Democratisation and Growth," *Economic Journal*, 118, 1520–1551.

PERSSON, T. AND G. TABELLINI (2006): "Democracy and Development: The Devil in the Details," *American Economic Review*, 96, 319–324.

PRASAD, E., R. G. RAJAN, AND A. SUBRAMANIAN (2006): "Patterns of international capital flows and their implications for economic development," *The New Economic Geography: Effects and Policy Implications, The Federal Reserve Bank of Kansas City.*

REINHARDT, D., L. A. RICCI, AND T. TRESSEL (2013a): "International capital flows and development: Financial openness matters," *Journal of International Economics*, 91, 235 – 251.

——— (2013b): "International capital flows and development: Financial openness matters," *Journal of International Economics*, 91, 235 – 251.

SLAUGHTER, M. J. (2001): "Trade liberalization and per capita income convergence: a difference-in-differences analysis," *Journal of International Economics*, 55, 203 – 228.

1.8 Appendix

1.8.1 Tables and Figures

Table 1.11: Financial Liberalization Reversals

country	year	Fin.Liberalization Index (FLI) component	FLI value after the reversal	FLI value before the reversal
Nigeria	2001	directed credit	2.0	3.0
Nigeria	2001	credit controls	2.25	3.00
Bolivia	2000	banking supervision	1.0	2.0

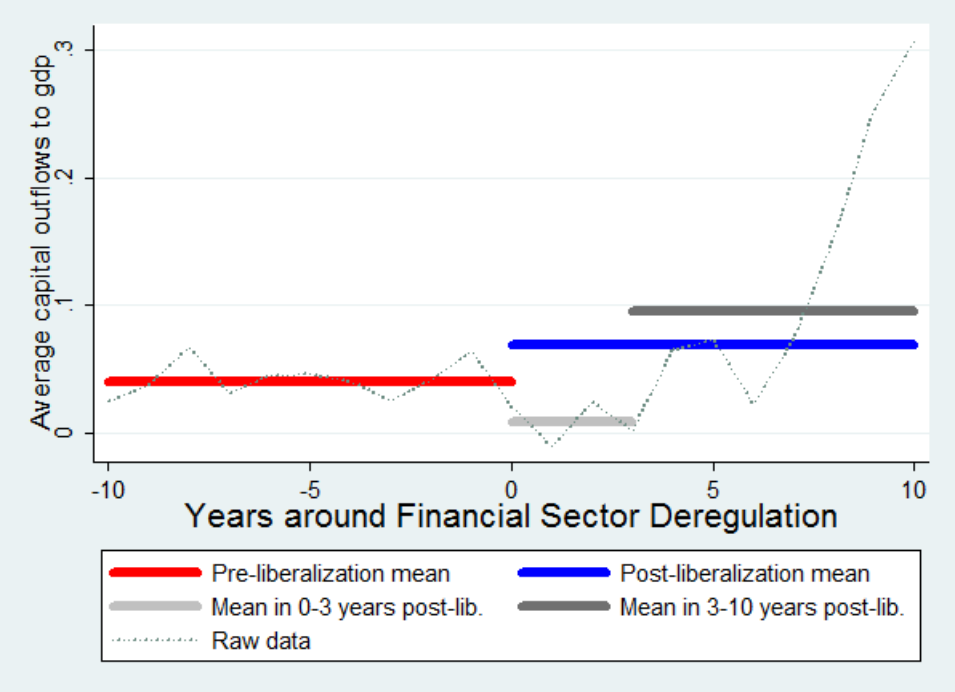


Figure 1.4: Average gross capital flows (to GDP) around the financial reform.

Table 1.12: List of Identified Reform Episodes

No.	Year of deregulation	Country
1	1987	Great Britain
2	1988	Denmark
3	1989	New Zealand
4	1991	Sweden
5	1992	Belgium
6	1992	Canada
7	1992	Spain
8	1992	Netherlands
9	1993	France
10	1993	Ireland
11	1994	Australia
12	1994	Switzerland
13	1994	Hong Kong
14	1996	Peru
15	1996	United States
16	1997	Chile
17	1997	Georgia
18	1997	Italy
19	1998	Bolivia
20	1998	Estonia
21	1998	Japan
22	1999	Latvia
23	1999	Nigeria
24	1999	Singapore
25	2000	Israel
26	2000	Jordan
27	2000	South Africa
28	2001	Czech Republic
29	2001	Hungary
30	2001	Lithuania
31	2001	Mexico
32	2002	Tanzania

1.8.2 Regression Appendix

Table 1.13: Financial Reforms and Net Capital Inflows: Unconditional Results

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	-0.00875	-0.000187	0.0193	0.0141	0.00489		
	(.0117)	(.0125)	(.0126)	(.0107)	(.00908)		
Before Financial Liberalization:							
5 to 3 years						0.00873	0.0104
						(.0131)	(.0132)
2 to 1 year						0.0236*	0.0248*
						(.0129)	(.0146)
After Financial Liberalization:							
0 to 2 years						0.0207*	0.0275**
						(.0121)	(.0135)
3 to 4 years						0.0323	0.0437
						(.0287)	(.0324)
5+ years						0.0168	0.0199
						(.0154)	(.0159)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Controls	No	No	No	No	No	No	No
Lagged $cflow$	No	No	Yes	Yes	Yes	Yes	Yes
Observations	2318	2318	2318	2227	2227	2227	2227
Countries	91	91	91	91	91	91	91
R2-adj.	.00021	.014	.11	.13	.15	.13	.15
No. of instruments					55		58
AR-1/AR-2 p-values					.019 / .96		.012 / .42
Hansen J p-value					.68		.47

Dep. var: net (inflows-outflows) capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated distur--bances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.14: Financial Reforms and Net Capital Inflows

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	-0.00240	0.00172	0.00134	-0.000563	0.0000819		
	(.0123)	(.013)	(.013)	(.011)	(.0103)		
Before Financial Liberalization:							
5 to 3 years						0.0111	0.00988
						(.0103)	(.00966)
2 to 1 year						0.0196*	0.0211**
						(.011)	(.0105)
After Financial Liberalization:							
0 to 2 years						0.0126	0.0132
						(.0122)	(.0109)
3 to 4 years						0.0153	0.0157
						(.0257)	(.0225)
5+ years						-0.000158	0.00368
						(.0153)	(.00715)
Trade Openness	0.00547	0.0117	0.0192	0.0156	0.00699	0.0139	0.00656
	(.0177)	(.0182)	(.025)	(.0228)	(.0149)	(.0231)	(.0151)
Fin. Openness	0.00188	0.000717	0.00542	0.00508	0.00141	0.00473	0.000902
	(.00275)	(.00283)	(.00484)	(.00404)	(.00278)	(.00407)	(.00269)
Cap. Ctrls (IMF)	-0.00247	0.000981	-0.00326	-0.00185	0.000950	-0.00231	0.000701
	(.00675)	(.00677)	(.00753)	(.00531)	(.00468)	(.00528)	(.00469)
Ex. Rate Regime	-0.00972**	-0.00938**	-0.0153***	-0.0129***	-0.00934***	-0.0131***	-0.00944***
	(.00448)	(.00438)	(.00547)	(.00435)	(.00347)	(.00441)	(.00344)
ICRG Composite	-0.00861	-0.00648	-0.00661	-0.00533	-0.00475	-0.00494	-0.00460
	(.00797)	(.00743)	(.00953)	(.00791)	(.00616)	(.00784)	(.00607)
Trade volume to gdp	0.0000566	0.0000647	0.000359*	0.000304*	0.0000554*	0.000332*	0.0000522
	(.0000437)	(.0000416)	(.0002)	(.000178)	(.0000328)	(.000174)	(.0000323)
ln GDP p.c.	0.00344	-0.000118	0.106	0.0911*	0.000792	0.0908*	0.000483
	(.00911)	(.00866)	(.0648)	(.0532)	(.0082)	(.0529)	(.00848)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1742	1742	1742	1741	1741	1741	1741
Countries	84	84	84	84	84	84	84
R2-adj.	.03	.045	.11	.14	.21	.14	.18
No. of instruments					60		64
AR-1 /AR-2 p-values					.055/ .52		.055/ .53
Hansen J p-value					.25		.24

Dep. var: gross capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.15: Financial Reform and Capital Inflows: Robustness 1, excl. UK and US

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.106***	0.0820**	0.0142*	0.0280**	0.0298**		
	(.04)	(.0401)	(.0125)	(.0121)	(.013)		
Before Financial Liberalization:							
5 to 3 years						0.00960	-0.00801
						(.0124)	(.00814)
2 to 1 year						0.0130	0.00821
						(.017)	(.0127)
After Financial Liberalization:							
0 to 2 years						-0.0281**	-0.0206**
						(.0121)	(.00867)
3 to 4 years						0.00458	0.0138
						(.0285)	(.0263)
5+ years						0.0339*	0.0563***
						(.0174)	(.00904)
Trade Openness	0.0313	0.0242	-0.0130	-0.00373	0.00982	0.00488	0.0147
	(.0376)	(.0377)	(.0371)	(.0235)	(.0175)	(.022)	(.018)
Fin. Openness	0.00364	0.00248	0.0164**	0.00875**	0.00269	0.00940**	0.00519
	(.00621)	(.0061)	(.00747)	(.00411)	(.00333)	(.00395)	(.00316)
Cap. Ctrls (IMF)	-0.00400	-0.00729	-0.00367	-0.00161	-0.00322	-0.000275	-0.00279
	(.00736)	(.00786)	(.00833)	(.0044)	(.00368)	(.00425)	(.0038)
Priv. credit to gdp	0.000922**	0.000897**	0.00183**	0.000970***	0.000486***	0.000892***	0.000570***
	(.000442)	(.000409)	(.000859)	(.000315)	(.000172)	(.000325)	(.000189)
Ex. Rate Regime	-0.0211**	-0.0185*	-0.00909	-0.00341	-0.00743**	-0.00324	-0.00691**
	(.0103)	(.0101)	(.00668)	(.00416)	(.00313)	(.00402)	(.00304)
ICRG Composite	0.0149*	0.0176**	-0.00283	-0.00177	0.00691*	-0.00250	0.00586
	(.00818)	(.00847)	(.00885)	(.00522)	(.00386)	(.00502)	(.00395)
Trade volume to gdp	0.000295	0.000249	0.00161**	0.000859***	0.000146	0.000796**	0.000164
	(.000216)	(.000188)	(.000749)	(.000303)	(.000105)	(.000306)	(.000104)
ln GDP p.c.	0.00745	0.0110	0.0960	0.0531	0.00766*	0.0570	0.0101**
	(.0077)	(.00717)	(.0794)	(.0381)	(.00428)	(.0356)	(.00457)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1623	1623	1623	1623	1623	1623	1623
Countries	82	82	82	82	82	82	82
R2-adj.	.25	.34	.59	.69	.71	.69	.71
No. of instruments					61		65
AR-1/AR-2 p-values					.0024 / .93		.0025 / .97
Hansen J p-value					.28		.16

Dep. var: gross capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.16: Financial Reform and Capital Inflows: Robustness 2, excl. China

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.117***	0.0935**	0.0249**	0.0123*	0.0347***		
	(.041)	(.0415)	(.0213)	(.0107)	(.00901)		
Before Financial Liberalization:							
5 to 3 years						-0.0116	0.0132
						(.0113)	(.00826)
2 to 1 year						0.00909	0.00884
						(.0163)	(.0125)
After Financial Liberalization:							
0 to 2 years						-0.0262**	-0.0244***
						(.0113)	(.00807)
3 to 4 years						0.00474	0.00769
						(.0266)	(.0237)
5+ years						0.0410**	0.0775***
						(.017)	(.00861)
Trade Openness	-0.0124	-0.0145	-0.0179	-0.00961	-0.00832	-0.000370	-0.00816
	(.0271)	(.0278)	(.0394)	(.0234)	(.0146)	(.0216)	(.0148)
Fin. Openness	0.0104**	0.00822*	0.0157**	0.00850**	0.00497*	0.00857**	0.00796***
	(.00485)	(.00479)	(.00765)	(.00396)	(.00274)	(.004)	(.00278)
Cap. Ctrls (IMF)	-0.00357	-0.00710	-0.00978	-0.00417	-0.00315	-0.00240	-0.00302
	(.00681)	(.00753)	(.00936)	(.0043)	(.00329)	(.00412)	(.00346)
Ex. Rate Regime	-0.0218**	-0.0190*	-0.0118*	-0.00474	-0.00752**	-0.00469	-0.00694**
	(.00997)	(.0099)	(.00682)	(.00398)	(.00304)	(.00382)	(.00301)
ICRG Composite	0.0207**	0.0249***	0.00221	0.000361	0.00982***	-0.000367	0.00957***
	(.00835)	(.0088)	(.00888)	(.00487)	(.00351)	(.00473)	(.00371)
GDP growth	0.00348**	0.00152	-0.00154	-0.000530	0.000325	-0.000538	0.000299
	(.00173)	(.00177)	(.00139)	(.000874)	(.00083)	(.000853)	(.00083)
Trade volume to gdp	0.000277	0.000241	0.00186**	0.000985***	0.000141	0.000908***	0.000160
	(.000225)	(.000197)	(.000873)	(.000327)	(.000109)	(.000326)	(.000109)
ln GDP p.c.	0.0232***	0.0241***	0.150*	0.0796**	0.0154***	0.0808**	0.0193***
	(.00649)	(.00679)	(.0869)	(.0359)	(.00444)	(.0343)	(.00508)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Countries					83		83
R2-adj.	.23	.32	.58	.68		.68	
R2					.64		
R3							.64
Observations	1718	1718	1718	1717	1717	1717	1717
Countries	83	83	83	83	83	83	83
R2-adj.	.24	.32	.57	.68	.64	.68	.64
No. of instruments					61		65
AR-1/ AR-2 p-values					.0013/ .98		.0014 / .97
Hansen J p-value					.98		.83

Dep. var: gross capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.17: Financial Reform and Capital Inflows: Robustness 3, excl. UK, US and Switzerland

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.125***	0.0983**	0.0311*	0.0144*	0.0367***		
	(.0416)	(.0414)	(.0187)	(.0105)	(.00901)		
Before Financial Liberalization:							
5 to 3 years						-0.00843	-0.0103
						(.0104)	(.0078)
2 to 1 year						0.00188	0.00491
						(.0161)	(.0125)
After Financial Liberalization:							
0 to 2 years						-0.0226*	-0.0221***
						(.0114)	(.00786)
3 to 4 years						0.00859	0.00987
						(.024)	(.0227)
5+ years						0.0479***	0.0511***
						(.017)	(.00837)
Trade Openness	-0.00820	-0.0275	-0.0106	-0.00870	-0.00982	0.00000746	-0.0116
	(.0213)	(.0234)	(.0322)	(.0194)	(.0133)	(.018)	(.0134)
Fin. Openness	0.0118***	0.0129***	0.0156**	0.00844**	0.00683***	0.00828**	0.00998***
	(.00438)	(.00423)	(.00674)	(.00355)	(.00247)	(.00362)	(.00262)
Cap. Ctrls (IMF)	0.00373	-0.00147	-0.00704	-0.00265	-0.00125	-0.00117	-0.00107
	(.00535)	(.00619)	(.00822)	(.00378)	(.00295)	(.00358)	(.00308)
Ex. Rate Regime	-0.0191**	-0.0175*	-0.00963*	-0.00387	-0.00710**	-0.00391	-0.00652**
	(.00926)	(.00927)	(.00549)	(.00332)	(.00285)	(.00321)	(.00284)
Freedom House	-0.000871	-0.000653	-0.00673**	-0.00362**	-0.000612	-0.00298*	-0.000167
	(.00202)	(.00199)	(.00284)	(.00167)	(.00101)	(.00161)	(.00116)
GDP growth	0.00329**	0.00152	-0.00111	-0.000335	0.000413	-0.000382	0.000384
	(.00156)	(.0016)	(.00111)	(.000759)	(.000736)	(.000746)	(.000742)
Trade volume to gdp	0.000265	0.000234	0.00139*	0.000703**	0.000142	0.000642*	0.000161
	(.000214)	(.000187)	(.000723)	(.000343)	(.000103)	(.000338)	(.000104)
ln GDP p.c.	0.0322***	0.0366***	0.116*	0.0663**	0.0207***	0.0661**	0.0237***
	(.00813)	(.00842)	(.0676)	(.0292)	(.00421)	(.0277)	(.00488)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1682	1682	1682	1681	1681	1681	1681
Countries	81	81	81	81	81	81	81
R2-adj.	.23	.32	.57	.67	.64	.68	.64
No. of instruments					63		67
AR-1 / AR-2 p-values					.0011 /.89		.0012 / .84
Hansen J p-value					.17		.15

Dep. var: gross capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.18: Financial Reform and Capital Inflows: Robustness 4, excl. Hong Kong and Singapore

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.116***	0.0919**	0.0245*	0.0120*	0.0341***		
	(.0422)	(.0422)	(.0209)	(.0101)	(.00912)		
Before Financial Liberalization:							
5 to 3 years						-0.0118	-0.0130
						(.0112)	(.0081)
2 to 1 year						0.00909	0.00868
						(.0161)	(.0124)
After Financial Liberalization:							
0 to 2 years						-0.0267**	-0.0246***
						(.0114)	(.00808)
3 to 4 years						0.00367	0.00654
						(.0267)	(.0242)
5+ years						0.0408**	0.0781**
						(.0168)	(.00853)
Trade Openness	-0.0165	-0.0155	-0.0166	-0.00909	-0.00801	0.000176	-0.00770
	(.0259)	(.0265)	(.0388)	(.0229)	(.014)	(.0211)	(.0142)
Fin. Openness	0.00987**	0.00789	0.0156**	0.00838**	0.00487*	0.00845**	0.00783***
	(.00492)	(.00485)	(.00751)	(.00388)	(.00277)	(.00392)	(.00281)
Cap. Ctrls (IMF)	-0.00174	-0.00628	-0.0106	-0.00436	-0.00285	-0.00259	-0.00271
	(.00681)	(.00731)	(.00966)	(.00431)	(.00321)	(.00412)	(.00338)
Ex. Rate Regime	-0.0220**	-0.0193**	-0.0117*	-0.00464	-0.00774***	-0.00458	-0.00719**
	(.00973)	(.00957)	(.0067)	(.00393)	(.00296)	(.00377)	(.00294)
ICRG Composite	0.0225**	0.0257***	0.000777	-0.000195	0.0101***	-0.000978	0.00978**
	(.00892)	(.00943)	(.00807)	(.00457)	(.00359)	(.00444)	(.00381)
Trade volume to gdp	0.000268	0.000227	0.00182**	0.000971***	0.000130	0.000902***	0.000148
	(.000218)	(.000192)	(.00088)	(.000332)	(.000102)	(.000332)	(.000102)
ln GDP p.c.	0.0195***	0.0224***	0.149*	0.0785**	0.0147***	0.0796**	0.0186***
	(.00589)	(.00637)	(.086)	(.0352)	(.00459)	(.0336)	(.00517)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1716	1716	1716	1715	1715	1715	1715
Countries	82	82	82	82	82	82	82
R2-adj.	.23	.32	.57	.67	.63	.68	.63
No. of instruments					63		67
AR-1 / AR-2 p-values					.0011 /.89		.0012 / .84
Hansen J p-value					.17		.15

Dep. var: gross capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.19: Financial Reform and Capital Outflows: Robustness 1, excl. UK and US

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.111***	0.0871**	0.0172	0.0119**	0.0273***		
	(.0413)	(.0421)	(.0185)	(.00944)	(.00805)		
Before Financial Liberalization:							
5 to 3 years						-0.0138	0.0108
						(.0108)	(.0612)
2 to 1 year						-0.0204	0.0162
						(.0139)	(.0973)
After Financial Liberalization:							
0 to 2 years						-0.0234**	-0.0140**
						(.0103)	(.00679)
3 to 4 years						-0.00186	0.00819
						(.0199)	(.0214)
5+ years						0.0337**	0.0958***
						(.0136)	(.0069)
Trade Openness	0.0209	0.0120	-0.0492	-0.0280*	-0.00532	-0.0207	-0.00157
	(.035)	(.0352)	(.033)	(.0161)	(.0105)	(.0145)	(.0113)
Fin. Openness	0.00264	0.00211	0.0101	0.00436	0.000830	0.00521*	0.00308
	(.00622)	(.00604)	(.00683)	(.00296)	(.00203)	(.00293)	(.00199)
Cap. Ctrls (IMF)	-0.00942	-0.0138*	-0.00913	-0.00322	-0.00391	-0.00206	-0.00363
	(.00665)	(.00719)	(.00844)	(.00364)	(.00241)	(.00335)	(.0025)
Priv. credit to gdp	0.000974**	0.000951**	0.00152*	0.000641**	0.000346***	0.000562*	0.000406***
	(.000445)	(.000418)	(.00085)	(.000286)	(.000125)	(.000293)	(.000136)
Ex. Rate Regime	-0.0155	-0.0133	-0.00132	0.00205	-0.00212	0.00232	-0.00161
	(.0108)	(.0106)	(.00592)	(.00288)	(.00249)	(.00269)	(.00238)
ICRG Composite	0.0138*	0.0153*	-0.00484	-0.00173	0.00436	-0.00259	0.00343
	(.00808)	(.00837)	(.00747)	(.00402)	(.00319)	(.0038)	(.00312)
Trade volume to gdp	0.000229	0.000184	0.00127*	0.000551**	0.0000831	0.000490**	0.0000960
	(.000238)	(.000211)	(.000697)	(.000228)	(.0000774)	(.000224)	(.000075)
ln GDP p.c.	0.0104	0.0150*	0.0783	0.0341	0.00722**	0.0382	0.00920***
	(.00855)	(.00836)	(.0735)	(.0292)	(.00328)	(.0267)	(.0033)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1623	1623	1623	1623	1623	1623	1623
Countries	82	82	82	82	82	82	82
R2-adj.	.24	.31	.62	.75	.75	.75	.76
No. of instruments					61		65
AR-1 / AR-2 p-values					.02 / .46		.021 / .47
Hansen J p-value					.12		.45

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.20: Financial Reform and Capital Outflows: Robustness 2, excl. China

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.122***	0.0982**	0.0265	0.0157*	0.0309***		
	(.0428)	(.0437)	(.0194)	(.00934)	(.0108)		
Before Financial Liberalization:							
5 to 3 years						-0.0137	-0.0132**
						(.00986)	(.00671)
2 to 1 year						-0.0178	-0.0174*
						(.0129)	(.0097)
After Financial Liberalization:							
0 to 2 years						-0.0220**	-0.0169**
						(.00973)	(.00668)
3 to 4 years						-0.00161	0.00320
						(.0177)	(.0194)
5+ years						0.0408***	0.0523***
						(.0134)	(.00594)
Trade Openness	-0.0291	-0.0339	-0.0606*	-0.0321**	-0.0182**	-0.0241*	-0.0175*
	(.0267)	(.0258)	(.0327)	(.0154)	(.00883)	(.0138)	(.00931)
Fin. Openness	0.0106**	0.00912**	0.0107	0.00460	0.00282	0.00493*	0.00543***
	(.00478)	(.00454)	(.00692)	(.00284)	(.00172)	(.00284)	(.00181)
Cap. Ctrls (IMF)	-0.00678	-0.0116*	-0.0120	-0.00476	-0.00361	-0.00322	-0.00352
	(.00621)	(.00679)	(.0088)	(.00359)	(.00231)	(.00328)	(.00247)
Ex. Rate Regime	-0.0165	-0.0140	-0.00302	0.00137	-0.00225	0.00154	-0.00166
	(.0105)	(.0105)	(.00596)	(.00271)	(.00239)	(.00248)	(.0023)
ICRG Composite	0.0200**	0.0230**	0.000327	0.000243	0.00673**	-0.000656	0.00646**
	(.00847)	(.00883)	(.00775)	(.00388)	(.00308)	(.00369)	(.0031)
GDP growth	0.00280	0.000853	-0.00123	-0.000576	-0.0000198	-0.000558	-0.0000424
	(.00174)	(.00182)	(.00108)	(.000532)	(.000493)	(.000505)	(.000478)
Trade volume to gdp	0.000214	0.000177	0.00150*	0.000647**	0.0000804	0.000574**	0.0000950
	(.00025)	(.000223)	(.000824)	(.000257)	(.0000808)	(.000249)	(.0000791)
ln GDP p.c.	0.0257***	0.0279***	0.112	0.0481*	0.0119***	0.0497*	0.0149***
	(.00688)	(.00722)	(.0797)	(.0276)	(.00304)	(.0263)	(.00359)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1718	1718	1718	1717	1717	1717	1717
Countries	83	83	83	83	83	83	83
R2-adj.	.23	.3	.61	.75	.72	.75	.72
No. of instruments					61		65
AR-1 / AR-2 p-values					.016 / .39		.016 /.39
Hansen J p-value					.23		.17

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.21: Financial Reform and Capital Outflows: Robustness 3, excl. UK, US and Switzerland

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.127***	0.100**	0.0297*	0.0160*	0.0307***		
	(.0437)	(.0439)	(.0169)	(.00815)	(.0102)		
Before Financial Liberalization:							
5 to 3 years						-0.00939	-0.00961
						(.00901)	(.00595)
2 to 1 year						-0.0128	-0.0149
						(.0125)	(.00922)
After Financial Liberalization:							
0 to 2 years						-0.0182*	-0.0144**
						(.00949)	(.00613)
3 to 4 years						0.00213	0.00551
						(.0156)	(.0182)
5+ years						0.0434***	0.0685***
						(.0138)	(.00547)
Trade Openness	-0.0122	-0.0347*	-0.0536**	-0.0300**	-0.0157**	-0.0233*	-0.0168**
	(.0201)	(.0192)	(.026)	(.0131)	(.0075)	(.0119)	(.00795)
Fin. Openness	0.0112**	0.0128***	0.0105*	0.00467*	0.00393***	0.00478*	0.00650***
	(.00434)	(.004)	(.00616)	(.00258)	(.00148)	(.0026)	(.00174)
Cap. Ctrls (IMF)	-0.000865	-0.00730	-0.00928	-0.00383	-0.00268	-0.00267	-0.00259
	(.00451)	(.00521)	(.00761)	(.00312)	(.00193)	(.00282)	(.00205)
Ex. Rate Regime	-0.0141	-0.0128	-0.00213	0.00167	-0.00197	0.00172	-0.00146
	(.00976)	(.00982)	(.0049)	(.0023)	(.00223)	(.00217)	(.00216)
Freedom House	-0.00260	-0.00233	-0.00694***	-0.00327**	-0.00114	-0.00266**	-0.000733
	(.00254)	(.00248)	(.00253)	(.00127)	(.000789)	(.00114)	(.000852)
GDP growth	0.00254	0.000715	-0.000785	-0.000393	0.00000863	-0.000413	-0.00000828
	(.00157)	(.00164)	(.000759)	(.000416)	(.000439)	(.000398)	(.00043)
Trade volume to gdp	0.000199	0.000166	0.00111*	0.000482**	0.0000767	0.000424*	0.0000907
	(.000235)	(.000208)	(.000655)	(.000234)	(.0000745)	(.000227)	(.0000735)
ln GDP p.c.	0.0375***	0.0424***	0.0861	0.0400*	0.0166***	0.0400*	0.0186***
	(.00912)	(.00928)	(.0627)	(.0234)	(.00318)	(.0224)	(.00369)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1682	1682	1682	1681	1681	1681	1681
Countries	81	81	81	81	81	81	81
R2-adj.	.23	.29	.61	.75	.73	.75	.73
No. of instruments					63		67
AR-1 /AR-2 p-values					.015 / .4		.016 / .4
Hansen J p-value					.55		.30

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.22: Financial Reform and Capital Outflows: Robustness 4, excl. Hong Kong and Singapore

	OLS	Year FE	Difference in differences (Year FE + Country FE)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
FREFORM	0.118***	0.0943**	0.0263**	0.0150*	0.0295***		
	(.044)	(.0443)	(.0091)	(.009)	(.0104)		
Before Financial Liberalization:							
5 to 3 years						-0.0136	0.0132
						(.00983)	(.0639)
2 to 1 year						-0.0175	0.0174
						(.0127)	(.0959)
0 to 2 years						-0.0212**	-0.0174***
						(.00995)	(.00643)
3 to 4 years						-0.00620	-0.00351
						(.0172)	(.0194)
5+ years						0.0410***	0.0504***
						(.0132)	(.0185)
Trade Openness	-0.0289	-0.0310	-0.0596*	-0.0312**	-0.0166**	-0.0233*	-0.0159*
	(.0246)	(.0234)	(.0319)	(.0151)	(.00833)	(.0133)	(.00889)
Fin. Openness	0.00974**	0.00857*	0.0106	0.00442	0.00267	0.00479*	0.00529***
	(.00474)	(.0045)	(.0068)	(.00275)	(.00173)	(.00274)	(.0018)
Cap. Ctrls (IMF)	-0.00468	-0.0105	-0.0126	-0.00493	-0.00329	-0.00339	-0.00318
	(.00596)	(.00645)	(.00909)	(.0036)	(.00214)	(.00326)	(.00233)
Ex. Rate Regime	-0.0176*	-0.0153	-0.00294	0.00149	-0.00263	0.00169	-0.00207
	(.0102)	(.0101)	(.00585)	(.00262)	(.00224)	(.00239)	(.00216)
ICRG Composite	0.0215**	0.0232**	-0.000660	-0.000555	0.00640**	-0.00145	0.00610*
	(.00903)	(.00944)	(.00695)	(.0035)	(.00308)	(.00332)	(.00312)
Trade volume to gdp	0.000168	0.000126	0.00145*	0.000660**	0.0000601	0.000591**	0.0000747
	(.00021)	(.000185)	(.000829)	(.000264)	(.0000652)	(.000257)	(.0000637)
ln GDP p.c.	0.0220***	0.0263***	0.112	0.0464*	0.0114***	0.0480*	0.0145***
	(.00607)	(.00659)	(.0788)	(.0266)	(.00323)	(.0252)	(.00371)
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	No	No	No	Yes	Yes	Yes	Yes
Observations	1716	1716	1716	1715	1715	1715	1715
Countries	82	82	82	82	82	82	82
R2-adj.	.23	.29	.61	.75	.73	.75	.73
No. of instruments					63		67
AR-1 /AR-2 p-values					.015 / .4		.016 / .4
Hansen J p-value					.55		.30

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (6) – (7) split the outcome of col. (4) – (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.23: Financial Reform and Capital Inflows: components, full results

	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREFORM	0.00674		0.0199**		0.0120**	
	(.00454)		(.00845)		(.00559)	
Before Financial Liberalization:						
5 to 3 years		0.00266		0.0106		0.0487
		(.00213)		(.01606)		(.0231)
2 to 1 year		0.00929		-0.0203***		0.0300
		(.00946)		(.0075)		(.0469)
After Financial Liberalization:						
0 to 2 years		0.000394		-0.0206***		0.0260
		(.00346)		(.00486)		(.0448)
3 to 4 years		0.0140		-0.0150		0.0113
		(.0131)		(.0129)		(.0829)
5+ years		0.00133		0.0535***		0.0418***
		(.00192)		(.00604)		(.00758)
Trade Openness	0.00244	0.00188	-0.00478	-0.00455	-0.00618	-0.00586
	(.0062)	(.00614)	(.00943)	(.00974)	(.00393)	(.00412)
Fin. Openness	0.00159	0.00190*	0.00283	0.00513***	0.000733	0.00147*
	(.0011)	(.00113)	(.00192)	(.00196)	(.000791)	(.000879)
Cap. Ctrls (IMF)	-0.000111	-0.000258	-0.00229	-0.00216	0.000101	0.000123
	(.0013)	(.00135)	(.00183)	(.00194)	(.0013)	(.00132)
Ex. Rate Regime	-0.00132	-0.00133	-0.00576***	-0.00541***	-0.00110	-0.000921
	(.00125)	(.00127)	(.00199)	(.00197)	(.00147)	(.0014)
ICRG Composite	0.00403***	0.00403***	0.00581**	0.00556**	0.00176	0.00182
	(.00127)	(.00128)	(.00271)	(.00284)	(.0017)	(.00174)
Trade volume to gdp	0.0000797**	0.0000811**	0.0000703	0.0000860	0.0000260	0.0000307
	(.0000327)	(.000033)	(.0000559)	(.0000574)	(.0000407)	(.0000411)
ln GDP p.c.	-0.00210	-0.00158	0.0121***	0.0149***	0.00418***	0.00542***
	(.00163)	(.00159)	(.00385)	(.00409)	(.00122)	(.00142)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1733	1733
Countries	84	84	84	84	84	84
R2-adj.	.4	.4	.59	.59	.43	.43
No. of instruments	60	64	60	64	60	64
AR-1 / AR-2 p-values	.00051/ .69	.00051 / .87	.00048 / .43	.00059 / .28	.023 / .29	.023 /.44
Hansen J p-value	.30	.15	.31	.25	.56	.23

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. (2), (4), (6) split the outcome of col. (1), (3), (5) (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.24: Financial Reform and Capital Outflows: components, full results

	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREFORM	0.0831***		0.0159**		0.0116***	
	(.00255)		(.00739)		(.00378)	
Before Financial Liberalization:						
5 to 3 years		0.00305		0.00876		0.00405
		(.0147)		(.0425)		(.0197)
2 to 1 year		0.00350		0.0160		-0.0218
		(.0191)		(.0685)		(.0285)
After Financial Liberalization:						
0 to 2 years		0.0495		-0.0117**		0.0490
		(.0446)		(.00504)		(.0349)
3 to 4 years		0.0236		-0.00925		0.0476
		(.0823)		(.0148)		(.0597)
5+ years		0.04157***		0.0491**		0.0407**
		(.0017)		(.00353)		(.00123)
Trade Openness	-0.00201	-0.00190	-0.00667	-0.00648	-0.00414	-0.00357
	(.00316)	(.00331)	(.00594)	(.00606)	(.00287)	(.00292)
Fin. Openness	0.000939**	0.00166***	0.00209	0.00372**	0.00125**	0.00213***
	(.000453)	(.00064)	(.00134)	(.00145)	(.000611)	(.000629)
Cap. Ctrls (IMF)	-0.000303	-0.000297	-0.00363***	-0.00354**	-0.00145*	-0.00142
	(.000469)	(.000535)	(.00138)	(.00147)	(.000825)	(.000881)
Ex. Rate Regime	-0.000790	-0.000640	-0.00210	-0.00178	-0.000140	0.0000212
	(.000546)	(.00055)	(.00131)	(.00125)	(.000983)	(.000928)
ICRG Composite	0.000573	0.000558	0.00529**	0.00508**	0.00141	0.00140
	(.000802)	(.000807)	(.00214)	(.00218)	(.00101)	(.00108)
Trade volume to gdp	0.0000181	0.0000224*	0.0000367	0.0000468	0.0000247	0.0000299
	(.0000129)	(.0000136)	(.0000434)	(.0000437)	(.0000292)	(.0000293)
ln GDP p.c.	0.00308*	0.00391*	0.00597**	0.00789***	0.00383***	0.00507***
	(.00173)	(.0021)	(.00251)	(.00268)	(.000955)	(.00123)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1717	1717
Countries	84	84	84	84	84	84
R2-adj.	.53	.53	.69	.69	.5	.49
No. of instruments	60	64	60	64	60	64
AR-1 / AR-2 p-values	.0029 / .89	.0032 / .87	.022 / .95	.023 / .94	.041 / .38	.041 / .38
Hansen J p-value	.47	.62	.13	.28	.17	.19

Dep. var: gross capital outflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. $(2), (4), (6)$ split the outcome of col. $(1), (3), (5)$ (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.25: Financial Reform and Net Capital Inflows: FDI, debt and equity flows

	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREFORM	-0.00760*		0.00169		0.000770	
	(.00423)		(.0098)		(.00588)	
Before Financial Liberalization:						
5 to 3 years		0.00688*		0.00701		-0.00166
		(.00356)		(.00873)		(.00331)
2 to 1 year		0.0162**		0.00684		0.00382
		(.00647)		(.00989)		(.00632)
After Financial Liberalization:						
0 to 2 years		0.00679		0.00311		0.00192
		(.00528)		(.00986)		(.00477)
3 to 4 years		0.0112		-0.00384		0.00850
		(.0124)		(.0163)		(.011)
5+ years		-0.00412		0.00493		0.000313
		(.00355)		(.0073)		(.00202)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1733	1733
Countries	84	84	84	84	84	84
R2-adj.	.2	.2	.14	.14	.12	.12
No. of instruments	60	64	60	64	60	64
AR-1 / AR-2 p-values	.0075 / .68	.0068 / .67	.089 / .1	.089 /.1	.021 / .32	.021 / .35
Hansen J p-value	.17	.19	.9	.89	.84	.58

Dep. var: net capital inflows to GDP in constant 2005 USD. All regressions include regional trends in capital flows. Col. $(2), (4), (6)$ split the outcome of col. $(1), (3), (5)$ (resp.) into time effects. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order autocorrelated disturbances in the first differences equations. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.26: Financial Reform and Capital Flows: Transparency and Competition

	Total Capital Inflows		Total Capital Outflows	
	(1)	(2)	(3)	(4)
FREF Compet.	-0.00175	-0.00665	-0.00275	-0.00478
	(.0072)	(.00792)	(.0031)	(.00376)
FREF Superv.	0.0291***	-0.00199	0.0253**	0.00444
	(.0107)	(.014)	(.0101)	(.0161)
FREF Compet. x FREF Superv.		0.0406***		0.0271**
		(.0109)		(.0104)
Trade Openness	0.00143	0.00162	-0.0209**	-0.0207**
	(.0163)	(.0162)	(.00962)	(.00941)
Fin. Openness	0.00485*	0.00457*	0.00409**	0.00393**
	(.0027)	(.00268)	(.00167)	(.00163)
Cap. Ctrls (IMF)	-0.00420	-0.00378	-0.00310	-0.00282
	(.00323)	(.00315)	(.00234)	(.00223)
Ex. Rate Regime	-0.00749**	-0.00740**	-0.00156	-0.00153
	(.00318)	(.00316)	(.00282)	(.0028)
ICRG Composite	0.00999***	0.0104***	0.00675**	0.00707**
	(.00343)	(.00354)	(.00284)	(.00297)
Trade volume to gdp	0.000123	0.000119	0.0000745	0.0000724
	(.0000982)	(.0000991)	(.0000769)	(.0000777)
ln GDP p.c.	0.0133***	0.0132***	0.0109***	0.0109***
	(.00434)	(.00431)	(.00288)	(.00287)
Year FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741
Countries	84	84	84	84
R2-adj.	.64	.64	.72	.72
No. of instruments	61	62	61	62
AR-1 / AR-2 p-values	.0014 / .89	.0013 / .89	.016 / .4	.016 / .4
Hansen J p-value	.66	.64	.11	.12
Wald p-value		.023		.073

Dep. var: gross capital inflows/outflows to GDP in constant 2005 USD. Hansen J reports the p-value for the null hypothesis of instrument validity. AR-1/AR-2 are the p-values for first and second order auto-correlated disturbances in the first differences equations. Joint sign. p-value is the p-value of the Wald test for the joint significance of $FREFcompet$, $FREFsuperv$ and $FREFCompet.xFREFSuperv$. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.27: Financial Reform and Capital Inflows: Transparency and Competition, all components

	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREF Compet.	0.00209	0.00182	-0.00413	-0.00821	0.0279*	-0.00506
	(.00206)	(.00214)	(.00619)	(.00656)	(.0169)	(.00588)
FREF Superv.	0.00923**	0.00777	0.0153**	-0.00461	0.00793*	-0.00523
	(.00423)	(.00533)	(.0069)	(.0117)	(.00469)	(.00559)
FREF Compet. x FREF Superv.		0.00196		0.0461***		0.0270**
		(.00734)		(.0145)		(.0101)
Trade Openness	0.00811	0.00810	0.000335	0.000423	-0.00540	-0.00518
	(.00921)	(.00923)	(.0088)	(.00881)	(.00443)	(.00425)
Fin. Openness	0.000191	0.000174	0.00350**	0.00332*	0.000885	0.000772
	(.00124)	(.00123)	(.00174)	(.0017)	(.000887)	(.000906)
Cap. Ctrls (IMF)	-0.00104	-0.00102	-0.00302*	-0.00276*	0.000301	0.000491
	(.00147)	(.00145)	(.00166)	(.00161)	(.00135)	(.00129)
Ex. Rate Regime	-0.00189	-0.00188	-0.00477**	-0.00471**	-0.00164	-0.00162
	(.00123)	(.00122)	(.00211)	(.0021)	(.00162)	(.00162)
ICRG Composite	0.00461***	0.00463***	0.00595**	0.00621**	0.00102	0.00121
	(.00131)	(.00132)	(.00285)	(.0029)	(.00147)	(.00156)
Trade volume to gdp	0.0000729**	0.0000726**	0.0000620	0.0000595	0.0000182	0.0000166
	(.0000306)	(.0000306)	(.0000498)	(.0000504)	(.0000353)	(.0000356)
ln GDP p.c.	-0.00257	-0.00258	0.0116***	0.0115***	0.00387***	0.00383***
	(.00162)	(.00163)	(.00371)	(.00371)	(.00125)	(.00123)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1733	1733
Countries	84	84	84	84	84	84
R2-adj.	.40	.40	.59	.59	.43	.43
No. of instruments	61	62	61	62	61	62
AR-1 / AR-2 p-values	.0046 / .85	.0047 / .84	.0061 /.42	.0006 / .44	.026 / .29	.025 / .29
Hansen J p-value	.35	.36	.4	.44	.21	.21
Wald p-value		.037		.045		.086

Dep. var: gross capital inflows to GDP in constant 2005 USD. Hansen J reports the p-value for the null hypothesis of instruments validity. AR-1/AR-2 are the p-values for first and second order auto-correlated disturbances in the first differences equations. Wald p-value is the p-value of the Wald test for the joint significance of $FREFcompet$, $FREFsuperv$ and $FREFCompet.xFREFSuperv$. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.28: Financial Reform and Capital Outflows: Transparency and Competition

	Direct Investment		Debt Flows		Portfolio Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
FREF Compet.	0.00390	-0.00131	-0.00182	-0.00392	0.000491	-0.00183
	(.0768)	(.000814)	(.00206)	(.0025)	(.000925)	(.0014)
FREF Superv.	0.0690***	0.00997	0.0132**	0.00313	0.00713**	-0.00346
	(.00247)	(.0314)	(.00617)	(.0101)	(.00308)	(.00328)
FREF Compet. x FREF Superv.		0.0758***		0.0131**		0.0138**
		(.00423)		(.00624)		(.00562)
Trade Openness	-0.00245	-0.00235	-0.00811	-0.00803	-0.00260	-0.00254
	(.00252)	(.00247)	(.00569)	(.00565)	(.00298)	(.00293)
Fin. Openness	0.000864*	0.000829*	0.00268**	0.00259**	0.00143***	0.00135***
	(.000477)	(.000474)	(.00127)	(.00125)	(.00055)	(.000524)
Cap. Ctrls (IMF)	-0.000337	-0.000242	-0.00343**	-0.00330**	-0.00155*	-0.00140*
	(.000497)	(.000474)	(.00148)	(.00145)	(.000899)	(.00084)
Ex. Rate Regime	-0.000730	-0.000721	-0.00114	-0.00111	-0.000510	-0.000475
	(.000546)	(.000545)	(.00148)	(.00148)	(.0011)	(.00109)
ICRG Composite	0.000902	0.001000	0.00540***	0.00554***	0.00191	0.00206*
	(.000941)	(.000955)	(.00191)	(.00197)	(.00118)	(.00123)
Trade volume to gdp	0.0000159	0.0000154	0.0000322	0.0000310	0.0000237	0.0000227
	(.000012)	(.0000122)	(.0000387)	(.0000389)	(.000029)	(.0000293)
ln GDP p.c.	0.00300*	0.00301*	0.00494**	0.00491**	0.00379***	0.00379***
	(.00154)	(.00154)	(.00207)	(.00207)	(.00101)	(.001)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Lagged $cflow$	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1741	1741	1741	1741	1717	1717
Countries	84	84	84	84	84	84
R2-adj.	.53	.53	.69	.69	.49	.49
No. of instruments	61	62	61	62	61	62
AR-1 / AR-2 p-values	.0044 / .86	.0045 / .85	.019 / .94	.019 / .94	.039 / .34	.038 / .34
Hansen J p-value	.73	.74	.16	.15	.77	.76
Wald p-value		.04		.094		.033

Dep. var: gross capital outflows to GDP in constant 2005 USD. Hansen J reports the p-value for the null hypothesis of instruments validity. AR-1/AR-2 are the p-values for first and second order auto-correlated disturbances in the first differences equations. Wald p-value is the p-value of the Wald test for the joint significance of $FREFcompet$, $FREFsuperv$ and $FREFCompet.xFREFSuperv$. Standard errors clustered at the country level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Chapter 2

There and Back Again? Heterogeneous Firms, Product Quality and Reshoring Decision[1]

Abstract

We develop a novel theory to explain the recent phenomenon of reshoring, *i.e.* firms moving back their previously offshored business activities. Thanks to the access to a unique survey of American reshoring firms, we provide evidence for the importance of quality behind the reshoring decision. Building on Antoniades (2015) we develop a dynamic heterogeneous firms model in which firms decide where to locate production and choose the quality of the produced variety. In the dynamic setting quality choice plays an important role as the production location decision entails a tradeoff between payroll and quality-related costs. In equilibrium reshoring decision arises as some firms initially offshore, exploit the rise in the profits due wages differentials and finally return to domestic country to further increase the quality. Moreover, the model delivers equilibrium sorting of firms: the most productive firms will never offshore, the least productive firms will always offshore and the firms with an intermediate productivity decide to reshore.[2]

Keywords: Heterogeneous Firms, Quality Choice, Offshoring, Reshoring
JEL Classification: F12, O14, R3

[1]This chapter is a joint work with Barbara Bratta.

[2]We would like to thank to Matteo Cervellati, David Collie, Gianmarco Ottaviano, Alireza Naghavi, Paolo Manasse and the participants of internal seminars at University of Bologna, Cardiff University and ETSG 2017 Conference in Florence for constructive comments.

2.1 Introduction and literature review

The reshoring of the manufacturing production has recently gained a lot of publicity in the advanced economies. Although the aggregate offshoring trends do not seem to be yet reverted[3], the increasing number of firms choosing to transfer back the manufacturing activities to their home countries caught the attention of both media and the experts. Especially in the United States the public debate on the topic is very lively as the most prominent examples of reshorers include General Electric transferring the production of the water heaters from China to Louisville, Kentucky[4], Ford Motor Company shifting its production of the newest EcoBoost engines from China to Cleveland[5] or General Motors moving the production of the next-generation Cadillac SRX from Mexico to Spring Hill, Tennessee[6]. In his 2013 State of the Union speech president Obama stated: *So we have a huge opportunity, at this moment, to bring manufacturing back. But we have to seize it.*[7].

Despite such a broad public debate the academic discussion of the topic is scarce. Empirical investigation is suffering from the lack of a representative economy-wide data and relies on the surveys conducted within reshoring companies. Kinkel (2014) and Kinkel and Maloca (2009) report the survey data for German firms, Dachs and Zanker (2014) report reshoring surveys for eight European countries, Bailey and Propris (2014) and Pricewaterhouse Coopers (2014) report on the reshoring trends in UK. The trends in US reshoring over recent years are thoroughly covered by various consultancy companies reports: The Boston Consulting Group (2011, 2013, 2014) and The Hackett Group (2012) with mixed conclusions on the prospects of reshoring. Attempts to measure the importance of reshoring on aggregate economy level are limited. Oldenski (2015) reports that in the period $1999 - 2012$ imports by US-based multinational (MNE) affiliates were steadily increasing. DeBacker et al. (2016) study MNEs activity for a number of advanced countries and check whether there were are any changes in the share of the productive resources deployed in the home countries of those companies. In the sample of US MNEs they find no evidence of any increase in the home share in employment, however they provide some evidence of a growing concentration of capital investments; they document this pattern also for some other high-income economies. In spite of the obvious issue of the representativeness, the survey studies provide some interesting insights into the drivers of reshoring decision. Kinkel (2014) report that 65% of reshorers in Germany in the period $2010 - 2012$ quoted quality-related problems as the main reason behind production transfer. Similarly, EEF The Manufacturer's Organization/GFK

[3]Oldenski (2015)
[4]National Public Radio, *As Overseas Costs Rise, More US Companies Are Reshoring*, January 27, 2014.
[5]Alisa Priddle, *Ford Starts Building Newest Engines in Cleveland*, Detroit Free Press, March 7, 2015
[6]Associated Press, *GM Moving Cadillac SRX Production from Mexico to TN*, August 27, 2014
[7]See State of the Union 2013 and also Economist article

(2014) reports that the main motivation of the UK reshorers surveyed in 2014 was an intention to improve quality, mentioned by 49% of the interviewed companies. Thanks to the access to a unique survey of American reshoring firms in the period $1995-2015$, we provide a preliminary evidence for the importance of quality and technology upgrade as the main drivers behind the reshoring decision also for US-based companies. It turns out that also within the group of US reshorers the quality-related problems are the main negative (push) factor behind giving up on the offshoring activity. Additionally, over 27% of those firms quote innovation possibilities and skilled workforce access as the main positive (pull) factors for locating the production back in the US. Moreover, another 12% of the firms quote access to skilled workforce as an important reshoring driver. In this paper we embrace this quality-related evidence and we develop a novel theory that explains the recent growing reshoring activity.

To our best knowledge there is only one theoretical paper that generates reshoring patterns. Baldwin and Venables (2013) analyze theoretically the location decision of a global firm, separating between a sequential (snake) and a more separated (spider) production processes. The location decision in their model is the outcome of the proximity-concentration tradeoff, *i.e.* the tradeoff between the international differences in the production costs and the production co-location benefits. The reductions in international frictions (trade costs, communication or coordination costs) facilitate the relocation of production but can result in overshooting of offshoring and a subsequent reshoring pattern. Recent working paper by Tyazhelnikov (2016), a generalization of Baldwin and Venables (2013) also delivers a reshoring pattern in equilibrium. Similarly to Baldwin and Venables (2013) line of reasoning, for the high values of trade costs firms chose to produce the whole good in the first country, but given a decrease in trade costs, they choose to offshore a large cluster. When trade costs decrease even further, firms further fragment their production and reshore a part of the previously offshored cluster. However, none of those papers considers the innovation prospects or quality choice in the production process. Therefore, our approach to reshoring is complementary, as we put the quality-related factors at the heart of our analysis. Moreover, we conduct the analysis in a heterogeneous firm framework, a margin which is absent in Baldwin and Venables (2013) (yet present in Tyazhelnikov (2016)).

This paper also contributes to the literature by developing a theory for the offshoring and the quality choice in the heterogeneous firm framework. To our best knowledge, Smeets et al. (2014) is the only one paper that studies this question. However, the model developed there is static and therefore it does not admit a reshoring possibility, which is in turn the core of our analysis.

In our setting each firm produces a single good for the domestic country market[8], deciding the quantity and the quality supplied as well as the factory location. We build on Antoniades (2015), a model introducing the quality choice into seminal Melitz and Ottaviano (2008) framework and we enrich it in two steps. First, we add the offshoring possibility. Offshoring is reducing the wage costs paid by the firms, but it is increasing the quality production costs and entails a transportation cost for the components (of an iceberg type). The introduction of the offshoring possibility into Antoniades (2015) leads to the following findings: i) the most productive firms produce only domestically, ii) the least productive firms offshore, iii) thanks to the offshoring possibility some of the least productive firms, who would have to otherwise exit the market, produce. Second, we extend the enriched model into a dynamic, two-period setting. The high quality varieties yield higher revenues than the low quality ones, yet quality production is costly. Firms would be therefore facing a choice between setting a high quality upfront or smoothing the quality upgrade across both periods. Since the fixed costs of quality innovation are convex, firms will find it optimal to set a given level of quality in the first period and upgrade it in the second period. Once we allow for offshoring, some firms in the first period produce abroad. Yet given the second period quality upgrade and increasing quality adaptation costs it entails, they transfer the production back to the domestic country.

We solve the model numerically. The equilibrium delivers a sorting pattern: the most productive firms always produce domestically, the least productive always offshore and the firms with an intermediate productivity reshore. We discuss the crucial parameters affecting the equilibrium interval of the productivity for which reshoring arises. Comparative statics exercises points the importance of the love for quality parameter. The increase in the consumers' taste for quality increases the intensity of the reshoring activity in equilibrium.

The reminder of this paper is organized as follows: in section 2.2 we present stylized facts about the US reshoring firms. In section 2.3 we develop the static model, section 2.4 introduces the dynamic model and describes the solution method as well as the equilibrium outcomes and comparative statics. Section 2.5 concludes.

2.2 The US Reshorers: a brief view

Reshoring Initiative (RI)[9] is a non-profit organization assisting US companies in the reshoring process. One of the core assets of RI is its reshoring database, in which the organization collects the data on the events of reshoring among the US companies from the publicly avail-

[8] We assume that the domestic and offshore countries are the advanced and developing economies, respectively.

[9] www.reshorenow.org

able sources (press releases, companies white papers, media announcements, *etc.*) as well as directly from the firms, and verifies their accuracy. In June 2015 RI kindly shared this database with us. Its full content covered 410 reshoring firms and another 231 classified as kept from offshoring. Each record comprises the company name, the year of reshoring, the product reshored, industry classification and the main domestic and offshore factors behind the transfer decision.

Table 2.2 in the Appendix summarizes the timing of the observed reshoring events. Although there were occasional events of reshoring dating back to as early as 1995, the majority of the reshoring decisions were taken in post-2010, with a clear concentration in the period $2012 - 2014$.[10]. Figure 2.8 in the Appendix represents the sectoral composition of reshored companies: it is clearly dominated by manufacturing industry, which coupled with retail and wholesale trade, and professional services account for almost 90% of the sample.

OFFSHORE FACTOR	% of firms quoting	**DOMESTIC FACTOR**	% of firms quoting
Quality Issues	31,63	Technology and innovation difficulties	27,74
Freight costs	29,20	Other	20,19
Lead time, inventory	27,49	Skilled workforce	12,41
Wage costs	19,22	Government Incentives	9,00
Communication & audit	10,46	U.S. price of natural gas	4,38
Intellectual property	6,33	Customer/demand issues	4,38
Loss of control	5,35	Eco-system synergies	3,89
Other	4,87	Infrastructure	2,92
Ethical/green considerations	4,14	Lower real-estate/construction costs	0,97
Difficulty of Innovation	2,92	Supplier issues	0,49
Currency variation	3,89		
Regulatory compliance	1,46		
Political instability	1,46		
Employee turnover	0,97		
Image/Brand	0,24		

Table 2.1: Main offshore and domestic factors behind reshoring decision for US firms

Probably the most important aspect of RI data are survey questions in which the reshoring firms quote the main drivers of reshoring, describing both the offshore *push* factors and the *pull* home country incentives. Table 2.1 summarizes this information[11]. Although some of the firms point to more than one factor (with the single top-scorer quoting 11 factors), the

[10]Observation in year 2016 refers to the firms that declared reshoring scheduled to take place in 2016.

[11]Note that in Table 2.1 the percentage do not sum up to 100 as each firm can quote one or more factors. The percentage is expressed in reference to the total number of factors quoted.

mode for the number of pull and push factors is 1. Similarly to the survey-based reshoring evidence in Germany and the UK, the quality-related problems faced by offshore plants seem to be the leading factor behind a production transfer also for the American firms. The quality-related factors comprise problems with necessary rework, warranty issues, low product liability and alike. Overall, above 31% of the firms report quality problems followed by lead time and inventory and freight costs (29% and 27%, resp.). Increasing wage costs are quoted by 19% of firms. The prominent role of the quality considerations is even more evident once we limit the analysis to the group of firms who quote only one main driver behind their reshoring decision (Figure 2.1): over 40% of the firms point to the quality issues with lead time and inventory costs being second factor, mentioned in less than 20% of the answers; wage costs are mentioned by less than 10% of the firms. Complimentary to the quality issues domination in the negative offshore factors, approximately a third of the firms interviewed point also to the limited scope for the product innovation as the main positive domestic reason for reshoring (Table 2.1).

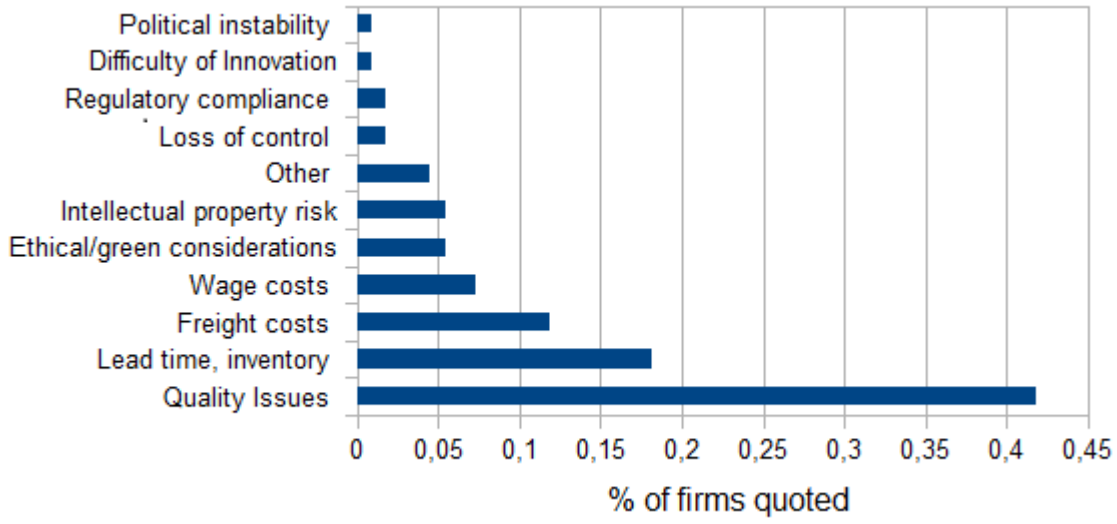


Figure 2.1: Offshore factors behind reshoring in the sample of firms quoting one reason only

2.3 Static Model

Prior to developing a full dynamic model, we begin with a simple static framework in which we can highlight the relationships between the quality choice and offshoring. We base our setting on the closed economy version of Antoniades (2015) which we alter by adding the production location choice.

Preferences The economy is populated with L consumers, each supplying one unit of labor. The utility expression follows closely Antoniades (2015) and reads:

$$U = q_o^c + \alpha \int_{\omega\in\Omega} q_\omega^c d\omega + \beta \int_{\omega\in\Omega} z_\omega q_\omega^c d\omega - \frac{1}{2}\gamma \int_{\omega\in\Omega} (q_\omega^c)^2 d\omega - \frac{1}{2}\eta \Big\{ \int_{\omega\in\Omega} q_\omega^c \Big\}^2 \tag{2.3.1}$$

where q_ω^c and q_o^c represent the consumption of the numeraire good and the variety ω, and z_ω stands for the quality of a variety ω. α and η capture the degree of substitution between each variety and the numeraire, γ describes the degree of differentiation among the varieties. Importantly, β is a taste for quality parameter. The inverse demand for each variety is:

$$p_\omega = \alpha - \gamma q_\omega^c + \beta z_\omega - \eta Q^c \tag{2.3.2}$$

Technology As in Antoniades (2015) a firm produces a given variety ω with an inelastically supplied labor input. Homogeneous good and labor markets are competitive. Upon payment of the entry cost f_e, a firm draws productivity which determines its marginal cost c (distributed accordingly to $G(c)$ on the support $[0, c_M]$). The firms that can cover their marginal cost survive and produce, those with the lowest productivity exit the market. The survivors maximize the profits based on the residual demand curve, taking the average prices, the average quality level and the number of firms, N, as given. We allow the firms to choose their production location: they decide whether to remain and produce at home or whether to offshore. For simplicity, we assume the extreme view of offshoring: once deciding to offshore, a firm will offshore all of its production.[12] We formulate the total cost structures by closely following Antoniades (2015), but we introduce a difference in the total costs due to the location of production:

$$\begin{aligned} TC_\omega^H &= c_\omega q_\omega + \delta_H z_\omega q_\omega + \theta z_\omega^2 \\ TC_\omega^O &= w\tau c_\omega q_\omega + \delta_O z_\omega q_\omega + \theta z_\omega^2 \end{aligned} \tag{2.3.3}$$

TC_ω^H and TC_ω^O stand for the total cost of a firm ω located in the home country and offshore[13]. The first terms of the total cost functions capture the variable costs of production as in standard Melitz and Ottaviano (2008) setting. The second terms with parameters δ_H and δ_O capture the increases in the marginal costs due to the quality upgrades. Those quality adaptation costs are brought about by the implementation of quality innovations. We assume that the quality-related production costs are always greater for the offshoring firm (δ_H

[12]The model can be easily extended to a version where a firm combines a range of the potentially offshorable tasks in the spirit of Grossman and Rossi-Hansberg (2008). Each firm would then decide on the fraction of the tasks offshored. However, this complication would not qualitatively change the results of the model.

[13]Wage in the domestic country is normalized to 1.

$\leq \delta_O$), *i.e.* the greater the geographical distance between the plants and the headquarters, the more costly is the quality adaptation. Those variable costs entail for instance machines fine-tuning for the new technology processes, new materials, workers retraining, *etc.* The third terms, involving θ's account for fixed cost of quality innovation, invariant to the quantity produced. They describe firms' R&D investments, product re-design, the invention of the new technology processes and so on. Following Antoniades (2015) we assume this cost to be convex. In principle, we could allow for differences in θ's across production locations. However, firms R&D activities are predominantly located in the headquarters, in particular if the main destination market is the domestic one, therefore we assume θ's to be equal across production locations[14]. Additionally, we assume that the total wage costs are always lower offshore: $w\tau < 1$.

In such a setting, the problem for a firm producing domestically is identical to the closed economy solution in Antoniades (2015). Therefore, we solve the problem only for the offshoring firm and present the equilibrium outcome.

Denote by $c_{D,O}$ the marginal cost value for which the offshoring firm's demand is driven to zero, $q_\omega(c_{D,O}) = 0$ and $z_{D,O}$ stands for the quality level relative to $z_{D,O}$. We can now express the prices and the quantities as functions of $c_{D,O}$, c_ω and qualities z_ω and $z_{D,O}$:

$$p_\omega = \frac{1}{2}(w\tau)(c_{D,O} + c_\omega) + \frac{1}{2}\Big(z_\omega(\beta + \delta_O) - z_{D,O}(\beta - \delta_O)\Big) \tag{2.3.4}$$

$$q_\omega = \frac{L}{2\gamma}(w\tau)(c_{D,O} - c_\omega) + \frac{L}{2\gamma}(\beta - \delta_O)(z_\omega - z_{D,O}) \tag{2.3.5}$$

$$\pi_\omega = \frac{L}{4\gamma}\Big((w\tau)(c_{D,O} - c_\omega) + (\beta - \delta_O)(z_\omega - z_{D,O})\Big)^2 - \theta(z_\omega)^2 \tag{2.3.6}$$

Next, we find the optimal quality level, $z^\star_\omega$, which is maximizing the profit (2.3.6)[15].

$$z^\star_\omega = \lambda_O\Big((c_{D,O} - c_\omega)(w\tau) - z_{D,O}(\beta - \delta_O)\Big) = \lambda_O(c_{D,O} - c_\omega)(w\tau) \tag{2.3.7}$$

$$\lambda_O = \frac{L(\beta - \delta_O)}{4\gamma\theta - L(\beta - \delta_O)^2}$$

The last passage in (2.3.7) follows from the fact that for $c_\omega = c_{D,O} \Rightarrow z_{D,O} = \lambda_O((c_{D,O} - c_{D,O})(w\tau) - z_{D,O}(\beta - \delta_O)) \Rightarrow z_{D,O} = -z_{D,O}\lambda_O(\beta - \delta_O) \Rightarrow z_{D,O} = 0$. Given the optimal

[14]The earlier version of this paper assumed $\theta_H \leq \theta_O$. The qualitative results of both the static and the dynamic model are identical. The results are available upon request.

[15]As in Antoniades (2015) firms here choose simultaneously the price and the quality for a given output level. Given the linearity and separability of the model, we first solve for the optimal price and next, we find the optimal quality level.

quality, we can express (2.3.4), (2.3.5) and (2.3.6) dependent on c_ω and the cost cutoff $c_{D,O}$:

$$p_\omega = \frac{1}{2}(w\tau)(c_{D,O} + c_\omega) + \frac{1}{2}(w\tau)\lambda_O(\beta + \delta_O)(c_{D,O} - c_\omega) \tag{2.3.8}$$

$$q_\omega = \frac{L}{2\gamma}(w\tau)(c_{D,O} - c_\omega)(1 + \lambda_O(\beta - \delta_O)) \tag{2.3.9}$$

$$\pi_\omega = (w\tau)^2(c_{D,O} - c_\omega)^2\frac{L}{4\gamma}(1 + \lambda_O(\beta - \delta)) \tag{2.3.10}$$

This results lead to two parametric assumptions. First, to assure the concavity of profit π_ω in quality z_ω it is required that $L(\beta - \delta_O)^2 - 4\gamma\theta < 0$. Second, in order to impose a non-negative quality z_ω we must assume that $\beta > \delta_O$. Each firm, given its marginal cost c_ω, will be choosing the location of its production by comparing the maximized profits under each of the scenarios:

$$\pi_\omega^H = \frac{L}{4\gamma}(c_{D,H} - c_\omega)^2(1 + \lambda_H(\beta - \delta_H)) \tag{2.3.11}$$

$$\pi_\omega^O = \frac{L}{4\gamma}(w\tau)^2(c_{D,O} - c_\omega)^2(1 + \lambda_O(\beta - \delta_O)) \tag{2.3.12}$$

As long as $\pi_\omega^H \geq \pi_\omega^O$ a given firm with a marginal cost c_ω would prefer to produce domestically instead of offshoring. We find that the pivotal firm that is indifferent between producing domestically and offshoring is characterized by the following marginal cost c_1[16]:

$$c_1 = c_{D,O}w\tau\Big(\frac{\Gamma_H + \Gamma_O w\tau + (1 - w\tau)\sqrt{\Gamma_H\Gamma_O}}{\Gamma_H + \Gamma_O w\tau^2}\Big) \tag{2.3.13}$$

where $\Gamma_H = \frac{\theta(\beta+4\gamma-\delta\mathrm{h})+L(\delta\mathrm{h}-\beta)}{L(\beta-\delta\mathrm{h})-4\gamma\theta}$ and $\Gamma_O = \frac{\theta(\beta+4\gamma-\delta\mathrm{o})+L(\delta\mathrm{o}-\beta)}{L(\beta-\delta\mathrm{o})-4\gamma\theta}$. It is easy to show that under the model parametric restrictions, it is always the case that $c_1 < c_{D,H} < c_{D,O}$. In Figure 2.2 we present the equilibrium location choices.

The firms with the marginal costs below the cost cutoff c_1 produce in the home country, whereas the firms with the marginal costs above this threshold produce offshore. $c_{D,H}$ is the critical cost cutoff originating from the closed economy model of Antoniades (2015), where firms with marginal costs above $c_{D,H}$ exit the market. The introduction of the offshoring possibility results in a new critical cost cutoff, $c_{D,O}$, $c_{D,O} > c_{D,H}$. This implies that thanks to offshoring we observe in equilibrium some firms with a very low productivity (with their marginal costs falling into $[c_{D,H}, c_{D,O}]$ interval) that without an offshoring option would not

[16]See the derivation in section 2.6.1 in the Appendix.

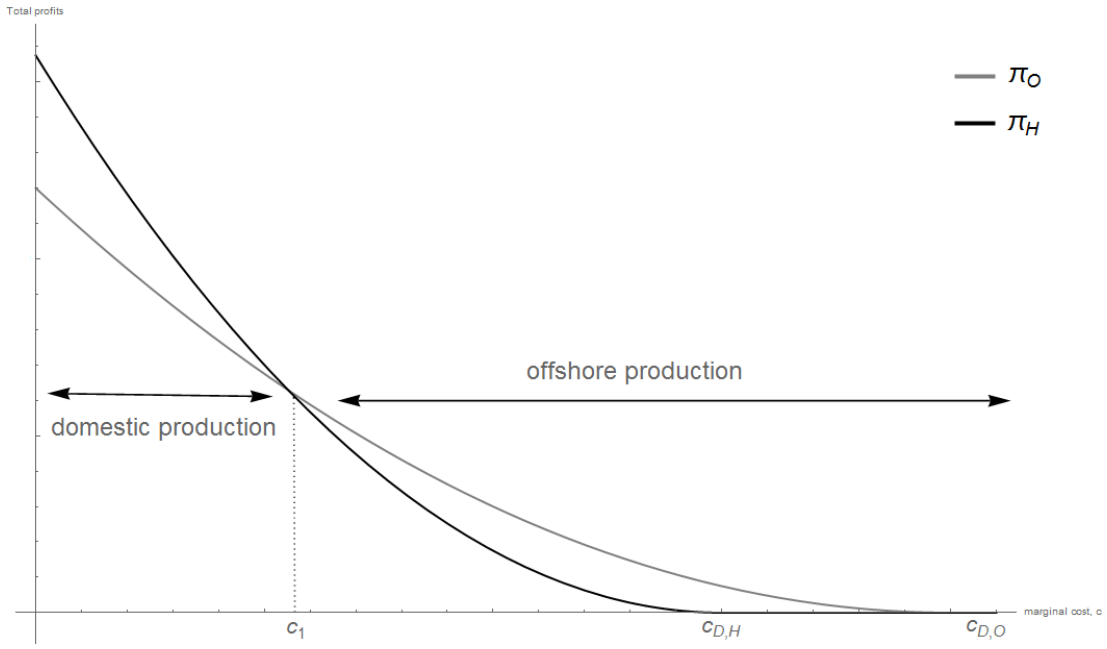


Figure 2.2: Static model equlibrium.

be able to survive. This can be rationalized along the theory presented in Rodriguez-Lopez (2012) who describes the two forces behind the offshoring decisions: a *Schumpeterian effect*, *i.e.* selection effects *á la* Melitz that drive out the least productive firms from the market and an *escape-from-competition effect*[17] which increases the offshore profits and makes offshoring attractive exactly for the less productive firms. Moreover, for the firms whose marginal cost lays between c_1 and $c_{D,H}$ offshoring leads to a higher profits.

The model is closed by the free entry condition as the firms *ex ante* expect zero profits:

$$\int_0^{c_1} \pi_\omega^H dG(c) + \int_{c_1}^{c_{D,O}} \pi_\omega^O dG(c) = f_e \tag{2.3.14}$$

This condition determines the cost cutoff $c_{D,O}$. Following Melitz (2003), Melitz and Ottaviano (2008) and Antoniades (2015) we assume that the firm cost draws are Pareto distributed on the support $[0, c_M]$ with $G(c) = \left(\frac{c}{c_M}\right)^k$. The cost cutoff in this economy is:

$$c_{D,O} = \left(\frac{4\gamma f_e (k+1)(k+2) {c_M}^k}{L w \tau ((\lambda_H(\beta - \delta_H) - \lambda_O(\beta - \delta_O))\psi + ((4k^2 + 8k + 2)(1 + \lambda_O(\beta - \delta_O))))} \right)^{\frac{1}{k+2}} \tag{2.3.15}$$

(2.3.16)

[17]This effect is based on the earlier innovation and competition literature, see Aghion et al. (2005).

where $\psi = \Big((k+1)(k+2)(\chi w\tau)^k + 2(k+2)k(\chi w\tau)^{k+1} + (k+1)k(\chi w\tau)^{k+2}\Big)$, χ is the constant multiplying cutoff c_1 (equation (2.3.13)) and $\lambda_H = \frac{L(\beta-\delta_H)}{4\gamma\theta - L(\beta-\delta_H)^2}$ and $\lambda_O = \frac{L(\beta-\delta_O)}{4\gamma\theta - L(\beta-\delta_O)^2}$.

2.4 Dynamic Model

Let us now analyze the firm location decision in a two-period setting. Analogously to the static formulation, offshoring comprises a tradeoff between lower wages costs and a higher quality-related production costs. The timing of the events is as follows: firstly all firms pay the entry cost, f_e, and draw the marginal cost c_ω from the common distribution $G(c)$. Firm productivity is invariant across the periods. Next, given the realized value of c_ω firms decide the quantities produced, the quality upgrades and the production location in both periods. Finally the production takes place. Each firm can choose to produce always in the home country, to always offshore, to reshore in the second period or to offshore in the second period. Given the realized marginal cost, c_ω and the location choice, the firms experience different marginal costs of production. They choose the profit maximizing scenario.
Denote by $i \in \{Home(H), Offshore(O)\}$ a firm's location decision in the first period and by j an analogous decision in the second period. The joint profit for the ω firm reads:

$$\Pi_\omega^{i,j} = \Pi_{\omega,1}^{i,j} + \Pi_{\omega,2}^{i,j} = q_{\omega,1}^{i,j}(p_{\omega,1}^{i,j} - c_\omega T^i - \delta_i z_{\omega,1}^{i,j}) - \theta_i (z_{\omega,1}^{i,j})^2 + q_{\omega,2}^{i,j}(p_{\omega,2}^{i,j} - c_\omega T^j - \delta_i(z_{\omega,1}^{i,j} + \Delta_\omega^{i,j})) - \theta_j(\Delta_\omega^{i,j})^2 \tag{2.4.1}$$

where $q_{\omega,1}^{i,j}$ and $q_{\omega,2}^{i,j}$ stand for the quantity in the first and second period, $z_{\omega,1}^{i,j}$ is the quality level in the first period and $\Delta_\omega^{i,j}$ is the second period quality upgrade. The fixed costs of quality innovation are convex and paid only on the *per period* quality upgrade (*i.e.* the first period innovation cost is $\theta_i(z_{\omega,1}^{i,j})^2$, whereas in the second period it equals $\theta_j(\Delta_\omega^{i,j})^2$)[18]. T^i and T^j are the payroll costs, conditional on the location choice. For home production the wages are normalized to 1, $T^H = 1$. On the other hand, the offshore labor costs include the offshore wages (assumed to be lower than the home wages, $w < 1$) and an iceberg cost of shipping the goods back to the home country ($\tau > 1$) $T^O = w\tau$. Denoting the period by $t \in \{1, 2\}$, the inverse demand function is expressed in a standard way:

$$p_{\omega,t}^{i,j} = \alpha - \gamma q_{\omega,t}^{c,i,j} + \beta z_{\omega,t}^{i,j} - \eta Q_t^c \qquad \text{with} \qquad Q_t^c = \int_{i\in\Omega_t} q_{\omega,t}^{c,i,j}\, d\omega \tag{2.4.2}$$

As before, we can express the optimal quantities and prices, and the maximized profit as the

[18] In principle the innovation costs are symmetric for both the quality upgrades and downgrades, however, in equilibrium the latter choice is absent.

functions of the per period cost cutoffs, the quality choices and the marginal cost, c_ω:

$$q^{i,j}_{\omega,1} = \frac{L}{2\gamma}T^i(c^{i,j}_{D,1} - c_\omega) + \frac{L}{2\gamma}(\beta - \delta_i)(z^{i,j}_{\omega,1} - z^{i,j}_{D,1}) \tag{2.4.3}$$

$$q^{i,j}_{\omega,2} = \frac{L}{2\gamma}T^j(c^{i,j}_{D,2} - c_\omega) + \frac{L}{2\gamma}(\beta - \delta_j)(z^{i,j}_{\omega,1} + \Delta^{i,j}_\omega - z^{i,j}_{D,2}) \tag{2.4.4}$$

$$p^{i,j}_{\omega,1} = \frac{1}{2}T^i(c^{i,j}_{D,1} + c_\omega) + \frac{1}{2}\Big((\beta + \delta_i)z^{i,j}_{\omega,1} - (\beta - \delta_i)z^{i,j}_{D,1}\Big) \tag{2.4.5}$$

$$p^{i,j}_{\omega,2} = \frac{1}{2}T^j(c^{i,j}_{D,2} + c_\omega) + \frac{1}{2}\Big((\beta + \delta_j)(z^{i,j}_{\omega,1} + \Delta^{i,j}_\omega) - (\beta - \delta_j)z^{i,j}_{D,2}\Big) \tag{2.4.6}$$

$$\begin{aligned}\Pi^{i,j}_\omega =& \frac{L}{4\gamma}\Big(T^i(c^{i,j}_{D,1} - c_\omega) + (\beta - \delta_i)(z^{i,j}_{\omega,1} - z^{i,j}_{D,1})\Big)^2 + \\ & \frac{L}{4\gamma}\Big(T^i(c^{i,j}_{D,2} - c_\omega) + (\beta - \delta_j)(z^{i,j}_{\omega,1} + \Delta^{i,j}_\omega - z^{i,j}_{D,2})\Big)^2 + \\ & - \Big(\theta_i(z^{i,j}_{\omega,1})^2 + \theta_j(\Delta^{i,j}_\omega)^2\Big)\end{aligned} \tag{2.4.7}$$

In the equations (2.4.3) - (2.4.7) $c^{i,j}_{D,1}$ and $c^{i,j}_{D,2}$ are the marginal cost cutoff values for a firm making a location decision $\{i,j\}$ in period 1 and 2, respectively. A firm with a marginal cost c_ω, $c_\omega > c^{i,j}_{D,1}$ ($c_\omega > c^{i,j}_{D,2}$) will not be producing in period 1 (period 2). $z^{i,j}_{D,1}$ and $z^{i,j}_{D,2}$ are the quality levels that are associated with the marginal cost cutoffs $c^{i,j}_{D,1}$ and $c^{i,j}_{D,2}$, respectively. While in the static model z_D is zero in equilibrium, in the dynamic model it is not necessarily the case. This is the dynamic feature due to a two period horizon combined with the convexity of quality innovation costs. Consider a firm's with a marginal cost c_ω such that it is equal to $c^{i,j}_{D,1}$ and lower than $c^{i,j}_{D,2}$: it does not produce in the first period, but it produces in the second one. However, despite no production in the first period, it engages in quality enhancing investments, as it would allow for the highest quality upgrade at the lowest possible cost in the following period. As in the static formulation, the optimal quality choice in every period can be found by maximizing (2.4.7) with respect to $z^{i,j}_{\omega,1}$ and $\Delta^{i,j}_\omega$:

$$z^{i,j}_{\omega,1} = \Phi_{i,j}(\beta - \delta_j)\left(\frac{L(\beta - \delta_i)}{\lambda_j}\Big((c^{i,j}_{D,1} - c)T^i - z^{i,j}_{D,1}(\beta - \delta_i)\Big) + 4\gamma\theta_j\Big(T^j(c^{i,j}_{D,2} - c) - z^{i,j}_{D,2}(\beta - \delta_j)\Big)\right) \tag{2.4.8}$$

$$\Delta^{i,j}_\omega = \Phi_{i,j}(\beta - \delta_i)(\beta - \delta_j)L\left((\beta - \delta_j)\Big((c^{i,j}_{D,1} - c)T^i - z^{i,j}_{D,1}(\beta - \delta_i)\Big) + \frac{1}{\lambda_i}\Big((c^{i,j}_{D,2} - c)T^j - z^{i,j}_{D,2}(\beta - \delta_j)\Big)\right) \tag{2.4.9}$$

$$z^{i,j}_{\omega,2} = z^{i,j}_{\omega,1} + \Delta^{i,j}_{\omega}$$

$$\Phi_{i,j} \equiv \frac{\lambda_i \lambda_j}{(\beta-\delta_j)(L(\beta-\delta_i) - 4\gamma\theta_j\lambda_i\lambda_j(\beta-\delta_j))}$$

$$\lambda_j \equiv \frac{L(\beta-\delta_j)}{4\gamma\theta_j - L(\beta-\delta_j)^2}$$

$$\lambda_i \equiv \frac{L(\beta-\delta_i)}{4\gamma\theta_i - L(\beta-\delta_i)^2}$$

By imposing $c = c^{i,j}_{D,1}$ and $c = c^{i,j}_{D,2}$ in the equations (2.4.8) and (2.4.9). We are left with a system of two equations which enables us to express $z^{i,j}_{D,1}$ and $z^{i,j}_{D,2}$ as functions of $c^{i,j}_{D,1}$, $c^{i,j}_{D,2}$ and parameters. Therefore, we can rewrite equations (2.4.3) -(2.4.9) as follows:

$$q^{i,j}_{\omega,1} = 2\Phi_{i,j}(c^{i,j}_{D,1} - c_\omega)L(\beta-\delta_j)\left(T^j\theta_j(\beta-\delta_i) + T^i\frac{\theta_i}{\lambda_j} - (\beta-\delta_j)\theta_j T^i\right) \tag{2.4.10}$$

$$q^{i,j}_{\omega,2} = 2\Phi_{i,j}(c^{i,j}_{D,2} - c_\omega)L\theta_j(\beta-\delta_i)\left(\frac{T^j}{\lambda_i} + T^i(\beta-\delta_j)\right) \tag{2.4.11}$$

$$\begin{aligned} p^{i,j}_{\omega,1} = \frac{\Phi_{i,j}(\beta-\delta_j)}{\theta_i}\Bigg(& c^{i,j}_{D,2}\delta_i L(\beta-\delta_i)\theta_j\left(\frac{T^j}{\lambda_i} + T^i(\beta-\delta_j)\right) + \\ &+ c\theta_i\left(\frac{T^i}{\lambda_j}(2\gamma\theta_i - L\beta(\beta-\delta_i)) - 2\gamma\theta_j(T^i(\beta-\delta_j) + T^j(\beta+\delta_i))\right) + \\ &+ c^{i,j}_{D,1}\left((2\gamma\theta_i + L(\beta-\delta_i)\delta_i)\Big(\frac{T^i\theta_i}{\lambda_j} - \theta_j(T^i(\beta-\delta_j) - T_j(\beta-\delta_i))\Big)\right)\end{aligned} \tag{2.4.12}$$

$$\begin{aligned} p^{i,j}_{\omega,2} = \frac{\Phi_{i,j}}{\theta_i}\Bigg(& c^{i,j}_{D,2}(\beta-\delta_i)\Big(\frac{T^j}{\lambda_i} + T^i(\beta-\delta_j)\Big)(2\gamma\theta_i\theta_j + L(\beta-\delta_j)\delta_j(\theta_i+\theta_j)) + \\ &+ c\theta_i\left(2\gamma\theta_j(\beta-\delta_i)\Big(\frac{T^j}{\lambda_i} - T^i(\beta+\delta_j)\Big) - \beta T^j(\beta-\delta_j)\Big(4\gamma\theta_j + \frac{L(\beta-\delta_i)}{\lambda_i}\Big)\right) + \\ &+ c^{i,j}_{D,1}(\beta-\delta_i)L(\beta-\delta_j)\delta_j\Big(\frac{T^i\theta_i}{\lambda_j} - \theta_j(T^i(\beta-\delta_j) - T^j(\beta-\delta_i))\Big)\Bigg)\end{aligned} \tag{2.4.13}$$

$$\begin{aligned} z^{i,j}_{\omega,1} = \frac{\Phi_{i,j}(\beta-\delta_j)}{\theta_i}\Bigg(& c^{i,j}_{D,1}L(\beta-\delta_i)\Big(\frac{T^i\theta_i}{\lambda_j} + \theta_j(T^j(\beta-\delta_i) - T_i(\beta-\delta_j))\Big) + \\ &+ c^{i,j}_{D,2}L(\beta-\delta_i)\Big(\frac{T^j\theta_j}{\lambda_i} + \theta_j T^i(\beta-\delta_j)\Big) - c\theta_i\Big(\frac{T^j L(\beta-\delta_i)}{\lambda_j} + 4\gamma\theta_j T^j\Big)\Bigg)\end{aligned} \tag{2.4.14}$$

$$\Delta^{i,j}_{\omega} = \Phi_{i,j}(c^{i,j}_{D,2} - c)L(\beta-\delta_j)(\beta-\delta_i)\Big(\frac{T^j}{\lambda_i} + (\beta-\delta_j)T^i\Big) \tag{2.4.15}$$

$$z^{i,j}_{\omega,2} = \frac{\Phi_{i,j}}{\theta_i}\Bigg(c^{i,j}_{D,1}L(\beta-\delta_j)(\beta-\delta_i)\Big(\frac{T^i\theta_i}{\lambda_j} - \theta_j(T^i(\beta-\delta_j) - T^j(\beta-\delta_i))\Big) + \\ + c^{i,j}_{D,2}L(\beta-\delta_j)(\beta-\delta_i)\Big(\frac{T_j}{\lambda_i} + T_i(\beta-\delta_j)\Big)(\theta_i+\theta_j) + \\ - c\theta_i\Big(\frac{T^jL(\beta-\delta_j)(\beta-\delta_i)}{\lambda_i} + 4\gamma\theta_j(T^i(\beta-\delta_i) + T^j(\beta-\delta_j))\Big)\Bigg) \tag{2.4.16}$$

In each period t firms with the marginal cost c_ω above cost cutoff value $c_{D,t}$ will not produce. They exit the market (*i.e.* they engage neither in any production, nor in any quality investments) if $c_\omega > max\{c^{i,j}_{D,1}, c^{i,j}_{D,2}\}$. For the sake of clarity of the exposition from now onward we restrict the attention only to the firms that are producing in both periods, *i.e.* $c_\omega \leq min\{c^{i,j}_{D,1}, c^{i,j}_{D,2}\}$, for given $\{i,j\}$ location choice. The entry of firms is unrestricted and the firms enter until the expected profit is driven to zero.
Note that the maximum price a firm can quote is bounded and it is associated with zero quantity produced. It also must equal the marginal cost, thus we can write the following regularities:

$$c^{i,j}_{D,1} = \frac{1}{T^i}\Big(\alpha - \eta Q_1 + (\beta-\delta_i)\Big)z^{i,j}_{D,1}(c^{i,j}_{D,1}, c^{i,j}_{D,2}) \\ c^{i,j}_{D,2} = \frac{1}{T^j}\Big(\alpha - \eta Q_2 + (\beta-\delta_j)\Big)z^{i,j}_{D,2}(c^{i,j}_{D,1}, c^{i,j}_{D,2}) \tag{2.4.17}$$

where $Q_t = \int_{i\in\Omega_t} q^{c,i,j}_{\omega,t} d\omega, t \in \{1,2\}$ and it stands for the consumption level over all varieties in period t. As in our setup the only destination market is the home country market, in equilibrium Q_1 and Q_2 are unique and common for all the production location scenarios. Considering the all possible location choices, the equations (2.4.17) generate a system. Once the system is solved, we can express all the performance measures (2.4.3) -(2.4.9) and the maximized profits as the functions of the model parameters and Q_1 and Q_2[19]. We can write the conditions that fully specify the equilibrium as:

[19]To be found in the Appendix.

$$\Pi_{\omega}^{i^\star,j^\star} = \max_{i,j\in\{H,O\}} \left\{ \Pi_{\omega}^{i,j}(c_\omega, Q_1, Q_2; \Theta) \right\} \tag{2.4.18}$$

$$\int_0^{\widetilde{c_1}} \Pi_{1,\omega}^{i^\star,j^\star}(c_\omega)dG(c_\omega) + \int_{\widetilde{c_1}}^{\widetilde{c_2}} \Pi_{2,\omega}^{i^\star,j^\star}(c_\omega)dG(c_\omega) + \int_{\widetilde{c_2}}^{\widetilde{c_3}} \Pi_{3,\omega}^{i^\star,j^\star}(c_\omega)dG(c_\omega) + \int_{\widetilde{c_3}}^{\widetilde{c_M}} \Pi_{4,\omega}^{i^\star,j^\star}(c_\omega)dG(c_\omega) = f_e \tag{2.4.19}$$

$$Q_t = \int_0^{\widetilde{c_1}} q_t^{i^\star,j^\star} dG(c_\omega) + \int_{\widetilde{c_1}}^{\widetilde{c_2}} q_t^{i^\star,j^\star} dG(c_\omega) + \int_{\widetilde{c_2}}^{\widetilde{c_3}} q_t^{i^\star,j^\star} dG(c_\omega) + \int_{\widetilde{c_3}}^{\widetilde{c_M}} q_t^{i^\star,j^\star} dG(c_\omega) \tag{2.4.20}$$

$$\text{s.t. } \widetilde{c_k} \leq min\left\{ min\left\{ c_{D,1}^{i^\star,j^\star}(Q_1,Q_2), c_{D,2}^{i^\star,j^\star}(Q_1,Q_2) \right\}, c_M \right\}, k \in \{1,2,3,M\}$$

where $i^\star, j^\star$ are the optimal location choices. $\widetilde{c_k}$ for $k \in \{1,2,3\}$ are the profit cutoffs between 4 potential location scenarios. $\widetilde{c_M}$ is the maximum value for the marginal cost. As profit functions are convex, there are at most 3 cutoffs, however in equilibrium we do not necessarily observe all of them. $\Pi_{k,\omega}^{i^\star,j^\star}(c_\omega)$ for $k \in \{1,2,3,4\}$ stand for the maximal profit for a given interval of the marginal cost and Θ stands for the model parameter set. $G(c)$ is the common cost distribution, assumed to be Pareto for productivity $\frac{1}{c}$, *i.e.* $G(c) = \left(\frac{c}{c_M}\right)^k$. Equation (2.4.18) describes each firm's optimal location decision $\{i,j\}$ as the choice of the scenario under which the maximized joint two period profit is the greatest. Equation (2.4.19) is the standard Free Entry condition, bounded by the requirement that the firms should produce in both of the two periods (thus restrictions on $\widetilde{c}$). (2.4.20) is the condition closing the model, stating the aggregate equilibrium consumption levels of Q_1 and Q_2.

Because of the complex analytical form of the profit functions $\Pi_{\omega}^{i,j}(c_\omega, c_{D,1}^{i,j}, c_{D,2}^{i,j}; \Theta)$ and a large set of model parameters[20] the model cannot be solved analytically. Instead, we solve it by means of the numeric methods. The numerical solution procedure is based on the fixed point theorem. We proceed as follows: given a set of parameter values, we initially guess the values of Q_1 and Q_2 and we find the relative profit-maximizing location choices $\{i^\star, j^\star\}$ for each $c_\omega \in [0, c_M]$. Next, we compute the Free Entry condition (2.4.19) and verify whether the guessed values of Q_1 and Q_2 overlap with their model-based counterparts, *i.e.* whether (2.4.20) holds. If not, the guess on Q_1 and Q_2 is updated. We repeat this procedure by iterating over the combinations of the parameter values.

We would assume, similarly to the formulation in the static model in the previous section that a firm's fixed cost of the quality innovation is invariant both to the production location and timing, *i.e.* $\theta_i = \theta_j = \theta$. As argued before, θ's stand for the R&D-related quality

[20] $\Theta \equiv \{\alpha, \beta, \delta_H, \delta_O, \eta, \gamma, \theta_H, \theta_O, w, \tau, L\}$

investments, that are most likely to take place in the headquarters. Moreover, the reshoring phenomenon does not address the re-location of R&D activities, but it is concentrated in the component manufacturing business. Modeling the choice of R&D location is beyond the scope of this model. Moreover, it is easy to show that in the dynamic setting firm's quality choice in the first period is always greater than the subsequent quality upgrade in the following period. Therefore, if θ's would differ accordingly to the production location, the firms would always choose to remain in the first period in the location offering lower fixed quality costs. As a consequence, if the quality innovation costs are greater offshore, the firms initially choose to produce domestically, build-up the quality stock in the first period and finally offshore. We would not observe any reshoring activity whatsoever, which is at odds with the data.

2.4.1 Equilibrium Results

The numerical solution delivers reshoring in equilibrium. The equilibrium is characterized by a sorting pattern into production location choices according to the individual firm productivity: the most productive firms (with the lowest marginal cost draws, c_ω) always decide to produce in the home country, whereas the least productive (with the highest marginal cost draws) always offshore. Reshoring arises for the intermediate values of productivity. For illustration, in Figure 2.3 we present one parametrization that delivers a reshoring equilibrium. Firms within the area A choose production at home, firms from the region C choose production offshore, whereas the intermediate productivity firms (region B) are the reshorers. For the reshoring firms the first period benefits from lower offshore wages outweigh higher offshore quality adaptations costs. However, when the quality upgrade in the second period materializes, the quality adaptations costs abroad rise as well and those firms prefer to transfer the production back to the domestic country[21].

In Figure 2.4 we present the reshoring equilibrium sensitivity to the variations in the taste for quality parameter (β) and to the degree of product differentiation (γ). When the consumer's love for quality increases two effects take place (panel 2.4a). First, there is an increase of the interval of the productivity where reshoring is an equilibrium outcome, *ceteris paribus*. Secondly, the equilibrium reshoring takes place for a lower productivity firms, *ceteris paribus*. Intuitively, as the consumers in the home country value quality more and more, the scope for reshoring is also growing. The opposite effects happen for an increase in the degree of product differentiation, γ (panel 2.4b). First, in the more differentiated sectors reshoring is less likely to occur and more and more firms choose to offshore the production in both peri-

[21] Arguably, the production transfer across countries can entail an important fixed costs, from which our framework abstracts. However, an introduction of fixed offshore or/and fixed reshoring costs would not alter qualitatively the main results of the model.

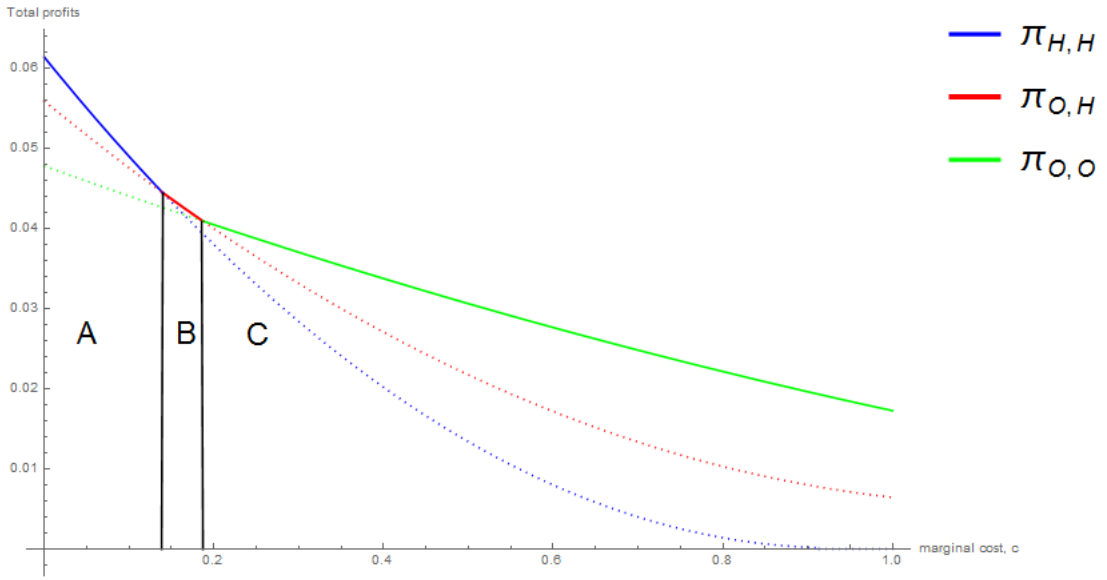
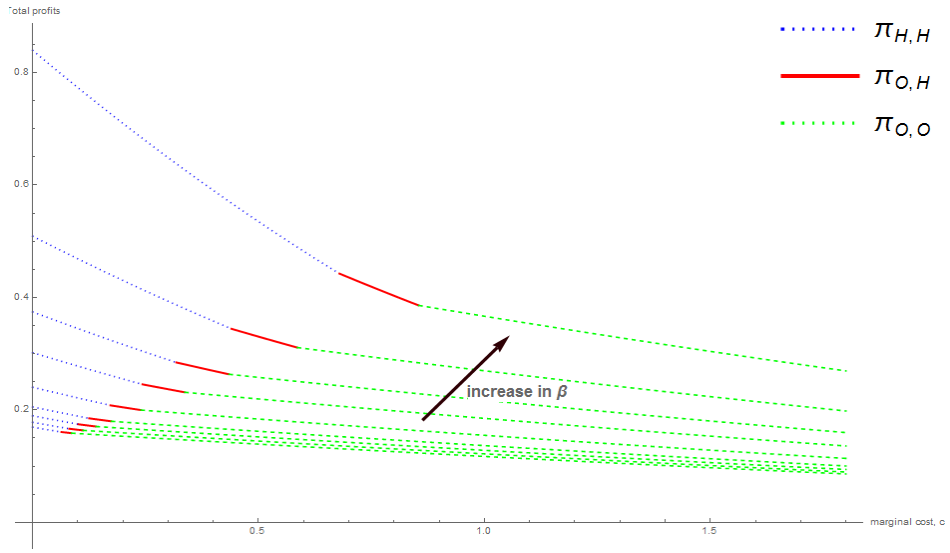


Figure 2.3: Reshoring equilibrium illustration.

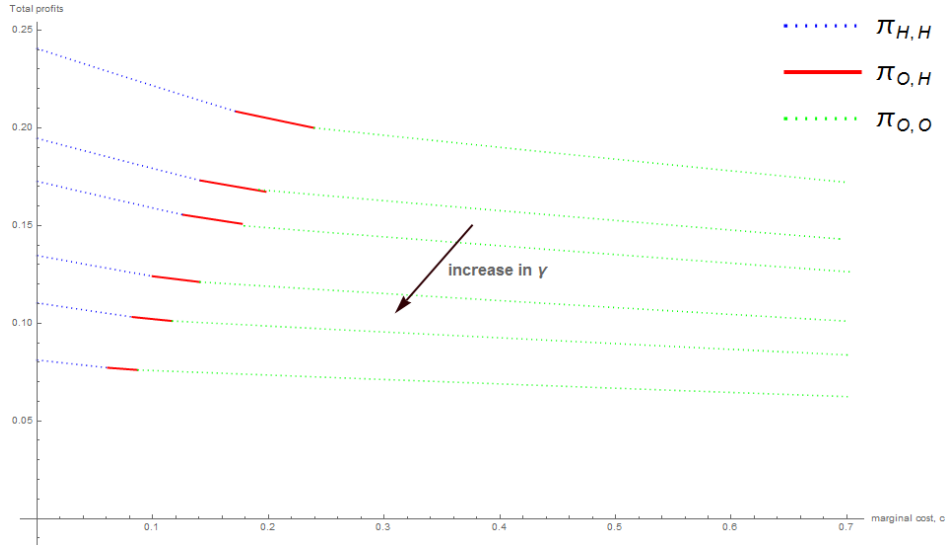
ods. Secondly, in the more differentiated sectors, reshoring takes place for more productive firms. Increase in the degree pf product differentiation decreases the importance of quality in the choice of the consumers. The consumers are now more interested in different goods than similar goods with different quality, thus there is less and less incentive for firms to increase the quality. This fall in quality induces a decrease in profits and an increase in the number of firms deciding to offshore all the periods. Summing up, the model predicts that reshoring should be more prevalent in the sectors characterized by a lower degree of product differentiation and a higher taste for quality.

In Figure 2.5 we present equilibrium sensitivity to the variations in the quality cost structure. In the panel 2.5a there are plotted reshoring equilibrium changes due to an increase in the variable costs of producing quality, δ_O. The reaction pattern is non-monotonic. Initially, for low values of δ_O (when δ_H is close in value to δ_O) the reshoring activity is more likely to occur, and it takes place for lower productivity firms. However, when the quality production becomes very costly (for δ_O sufficiently higher than δ_H), the reshoring interval starts to shrink and eventually it vanishes. Increasing the quality adaptation costs decrease the net benefits from the offshore production, *ceteris paribus*. In the limiting case, when the quality production is prohibitively expensive, we would observe only the home producing firms. On the other hand, in the panel 2.5b there are plotted the equilibrium changes due to variations in θ. It describes the cost of quality innovation, *i.e.* the new design expenses, R&D outlays, the machinery replacement costs, *etc.* An increase in θ results in the reshoring activity being less and less likely to occur and taking place for more and more productive firms. This is because rising θ reduces the net benefits from the investments in the quality and depresses

Figure 2.4: Reshoring equilibria. Comparative statics (I).



(a) taste for quality, β

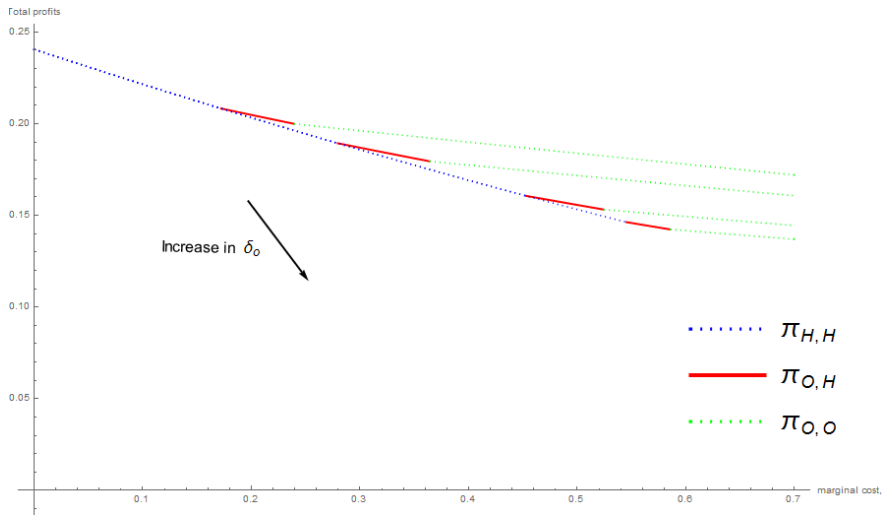


(b) degree of product differentiation, γ

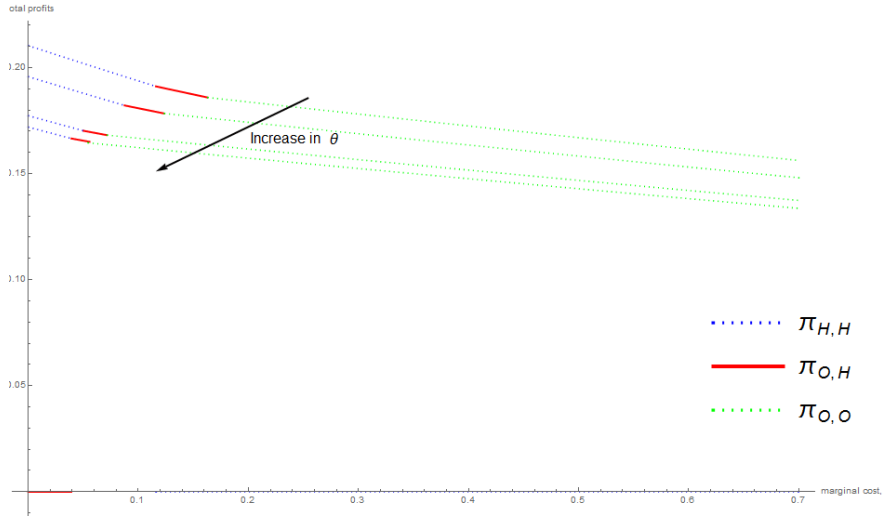
the profits for all the firms, but most prominently for the home producers. In the limiting case, when the quality innovation is very costly we would observe all the firms producing only offshore.

In Figure 2.6 we present the comparative statics exercise for wages, w (panel 2.6a) and the transport cost parameter, τ (panel 2.6b). Qualitatively, the impact of an increase in wages or a rise in the transportation cost is similar, as those parameters jointly describe the effective unit labor cost of the offshore labor. Increase in w or in τ decrease the profits of the firms producing at least one period abroad. When offshoring is more expensive, a higher number of

Figure 2.5: Reshoring equilibria. Comparative statics (II).



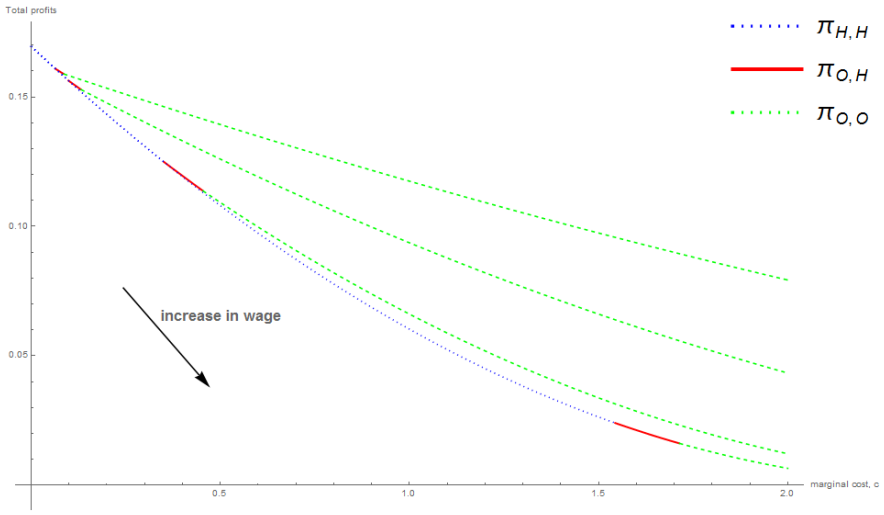
(a) offshore quality adaptation cost, δ_O



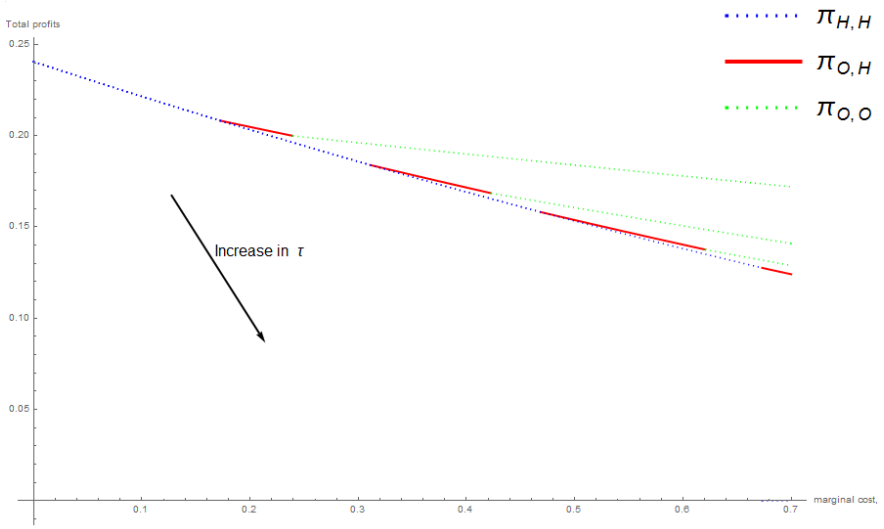
(b) quality innovation cost, θ

firms will decide to produce in the US and to reshore, also, alongside increasing w and τ, we observe less and less productive firms transferring their offshored production back because the most productive ones are incentivized to produce at home in both of the periods.

Figure 2.6: Reshoring equilibria. Comparative statics (III).



(a) offshore wage, w

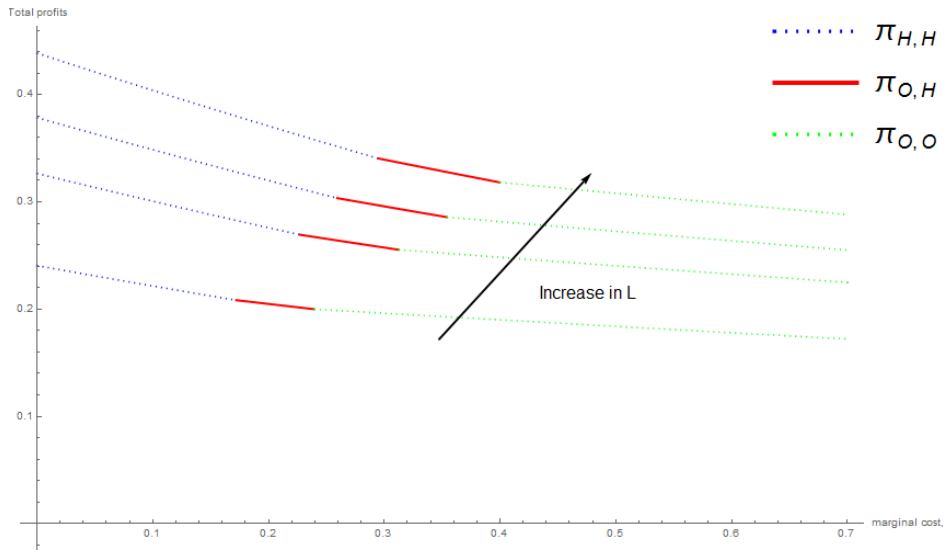


(b) transportation costs, τ

Finally, in Figure 2.7 we report how the reshoring equilibrium reacts to the changes in the market size, L. Similarly to the impact of an increasing offshore wages and a rise in the transportation costs, an increase in the market size results in the reshoring activity taking place for less and less productive firms. As the market size grows, the scope for quality differentiation increases[22], the firms invest more in quality and experience higher profits.

[22] An increase in the scope for quality differentiation leading to a higher optimal quality choice by the firms is one of the main findings in Antoniades (2015).

Figure 2.7: Reshoring equilibria. Comparative statics (IV): market size, L



2.5 Conclusions

We present a novel theory explaining the recent phenomenon of reshoring. We develop a dynamic model of heterogeneous firms choosing both the quantity and the quality of the good, and deciding on the production location. Quality production is attractive as consumers are willing to pay a higher price for the higher quality good, yet quality production is costly. Offshoring offers a way for reducing the payroll costs, however it comprises quality production costs greater than the domestic manufacturing. The model generates the equilibrium reshoring of production and yields an equilibrium sorting pattern with reshoring arising for the intermediate values of productivity. Comparative statics exercises suggest that the reshoring activity is more prevalent in sectors with lower degrees of product differentiation and exhibiting higher love for quality. We leave the empirical verification of those hypotheses for the future research.

Bibliography

Aghion, P., N. Bloom, R. Blundell, R. Griffith, and P. Howitt (2005): "Competition and Innovation: an Inverted-U Relationship," *The Quarterly Journal of Economics*, 120, 701–728.

Antoniades, A. (2015): "Heterogeneous Firms, Quality, and Trade," *Journal of International Economics*, 95, 263–273.

Bailey, D. and L. D. Propris (2014): "Manufacturing Reshoring and Its Limits: the UK Automotive Case," *Cambridge Journal of Regions, Economy and Society*, 7, 379–395.

Baldwin, R. and A. J. Venables (2013): "Spiders and snakes: Offshoring and agglomeration in the global economy," *Journal of International Economics*, 90, 245–254.

Dachs, B. and C. Zanker (2014): "Backshoring of Production Activities in European Manufacturing," *European Manufacturing Survey Bulletin*, 154–165.

DeBacker, K., C. Menon, I. Desnoyers-James, and L. Moussiegt (2016): "Reshoring: Myth or Reality?" *OECD Science, Technology and Industry Policy Papers*.

EEF The Manufacturer's Organization/GFK (2014): "Make it Britain Survey," .

Grossman, G. M. and E. Rossi-Hansberg (2008): "Trading Tasks: A Simple Theory of Offshoring," *American Economic Review*, 98, 1978–97.

Kinkel, S. (2014): " Future and Impact of Backshoring Some Conclusions from 15 Years of Research on German Practices," *Journal of Purchasing & Supply Managements*, 20, 63–65.

Kinkel, S. and S. Maloca (2009): " Drivers and Antecedents of Manufacturing Offshoring and Backshoring A German Perspective," *Journal of Purchasing & Supply Management*, 15, 154–165.

Melitz, M. J. (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71, 1695–1725.

Melitz, M. J. and G. I. P. Ottaviano (2008): "Market Size, Trade, and Productivity," *Review of Economic Studies*, 75, 295–316.

Oldenski, L. (2015): "Reshoring by US Firms: What Do the Data Say?" Tech. Rep. PB15-14.

PRICEWATERHOUSE COOPERS (2014): " Reshoring A New Direction for the UK Economy," .

RODRIGUEZ-LOPEZ, J. A. (2012): "Competition and Offshoring," Working Papers 111213, University of California-Irvine, Department of Economics.

SMEETS, V., S. TRAIBERMAN, AND F. WARZYNSKI (2014): "Offshoring and the Shortening of the Quality Ladder: Evidence from Danish Apparel," Working Papers 2014-14, CEPII research center.

THE BOSTON CONSULTING GROUP (2011): " Made In America Again, Why Manufacturing Will Return to the U.S." .

——— (2013): "Behind the American Export Surge: The U.S. as One of the Developed Worlds Lowest-Cost Manufacturers," .

——— (2014): " The Shifting Economics of Global Manufacturing, How Cost Competitiveness Is Changing Worldwide ," .

THE HACKETT GROUP (2012): "Reshoring Global Manufacturing: Myths and Realities," .

TYAZHELNIKOV, V. (2016): "Production Clusters and Offshoring," Working papers.

2.6 Appendix

	Full Sample		Reshorers		KFO	
	No.	%	No.	%	No.	%
1995	1	0,16	.	.	1	0,44
1997	1	0,16	1	0,24	.	.
1999	1	0,16	.	.	1	0,44
2001	2	0,31	1	0,24	1	0,44
2002	1	0,16	.	.	1	0,44
2003	2	0,31	2	0,49	.	.
2005	1	0,16	.	.	1	0,44
2006	3	0,47	2	0,49	1	0,44
2007	6	0,94	4	0,98	2	0,88
2008	19	2,98	11	2,69	8	3,51
2009	32	5,02	19	4,65	13	5,70
2010	34	5,34	27	6,6	7	3,07
2011	76	11,93	41	10,02	35	15,35
2012	101	15,86	76	18,58	25	10,96
2013	185	29,04	108	26,41	77	33,77
2014	140	21,98	95	23,23	45	19,74
2015	30	4,71	20	4,89	10	4,39
2016	2	0,31	2	0,49	.	.
Total	637	100	409	100	228	100,00
Observations	637		409		228	

Table 2.2: The year of reshoring, different samples

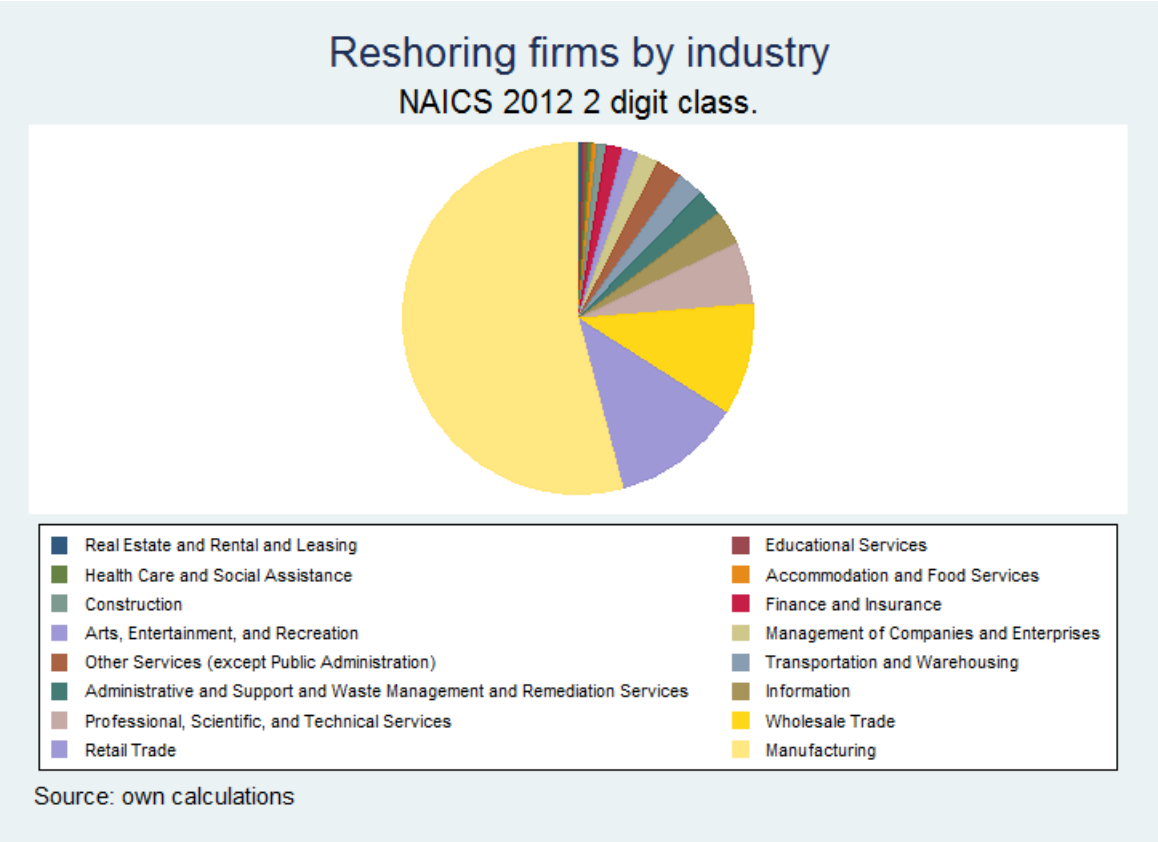


Figure 2.8: Reshoring firms by industry

Domestic factor	% of companies
Technology and/or innovation difficulties	27,74
Other	20,19
Skilled workforce	12,41
Government Incentives	9,00
U.S. price of natural	4,38
Customer/demand issues	4,38
Eco-system synergies	3,89
Infrastructure	2,92
Lower real-estate/construction costs	0,97
Supplier issues	0,49

Table 2.3: Main domestic factors behind reshoring decision for US firms

2.6.1 Static model: equilibrium cost cutoff

Noticing that $\lambda_k(\beta-\delta_k)=\frac{L(\beta-\delta_k)^2}{4\gamma\theta_k-L(\beta-\delta_k)^2}$ for $k\in\{H,O\}$ and $c_{D,O}=\frac{c_{D,H}}{w\tau}$:

$$\frac{L}{4\gamma}(c_{D,H}-c_\omega)^2(1+\lambda_H(\beta-\delta_H))>\frac{L}{4\gamma}(w\tau)^2(c_{D,O}-c_\omega)^2(1+\lambda_O(\beta-\delta_O))$$

$$(c_{D,O}^2-2c_{D,O}c_\omega+c_\omega^2)(\frac{4\theta_O\gamma}{4\theta_O\gamma-L(\beta-\delta_O)^2})>(c_{D,O}^2-2c_{D,O}c_\omega(w\tau)+c_\omega^2(w\tau)^2)(\frac{4\theta_O\gamma}{4\theta_O\gamma-L(\beta-\delta_O)^2})$$

$$(c_{D,H}^2-2c_{D,H}c_\omega+c_\omega^2)(\frac{\theta_H}{4\theta_H\gamma-L(\beta-\delta_H)^2})>(c_{D,H}^2-2c_{D,H}c_\omega(w\tau)+c_\omega^2(w\tau)^2)(\frac{\theta_O}{4\theta_O\gamma-L(\beta-\delta_O)^2})$$

$$(c_{D,H}^2-2c_{D,H}c_\omega+c_\omega^2)(\Gamma_H)>(c_{D,H}^2-2c_{D,H}c_\omega(w\tau)+c_\omega^2(w\tau)^2)(\Gamma_O)$$

$$\text{where } \Gamma_H\equiv\frac{\theta_H}{4\theta_H\gamma-L(\beta-\delta_H)^2},\ \Gamma_O\equiv\frac{\theta_O}{4\theta_O\gamma-L(\beta-\delta_O)^2}$$

$$\Leftrightarrow c_\omega^2(\Gamma_H-(w\tau)^2\Gamma_O)-2c_\omega c_{D,H}(\Gamma_H-(w\tau)\Gamma_O)+c_{D,H}^2(\Gamma_H-\Gamma_O)>0 \qquad (2.6.1)$$

Chapter 3

Export Upgrade and Global Value Chains Participation

Abstract

This study provides the evidence suggesting that a more intensive integration into global production networks (GVCs) via forward linkages offers a potential for the increase in the quality of exports, in particular for the developing economies. Our analysis relates the sector-level GVCs participation indicators derived from the international OECD Input-Output Tables to the data on the unit values of exports at the product-exporter level. The sample consists of 63 economies observed between 2000 and 2011. We find a strong association between the export prices and GVCs forward participation, in particular for the developing countries. We document also a less robust negative relationship between the GVCs backward participation and unit values of exports. The findings suggest that the driver behind the quality-improving role of the forward linkages are the exports to the rich markets and technologically advanced sectors.[1]

Keywords: Export Upgrade, Global Value Chains, Product Quality, Unit Values
JEL Classification: F10, F14, F23, F60

[1]This paper is a work in progress. We would like to thank to Stefano Bolatto, David Collie, Gianmarco Ottaviano, Paolo Manasse and the participants of internal seminars at University of Bologna and Cardiff University for their constructive comments at the various stages of this work.

3.1 Introduction

The positive association between economic growth and trade is a well-established fact in the economic literature. However recently, starting from the seminal work by Hausmann et al. (2007) and Hausmann and Hidalgo (2011), the focus of interest for both academics and policymakers has shifted away from the mere export volumes toward the export composition and their sophistication. From a firm perspective, certain product quality is often a prerequisite for successful exporting, which itself can further lead to *learning by doing* productivity and quality gains. Therefore, it comes as no surprise that many countries actively pursue industrial policies aimed explicitly at upgrading their production structure, with a particular emphasis put on the exports.

Simultaneously, the factor that dominated international trade and development policy of the last two decades are Global Value Chains (GVCs), a broad term related to the processes of production fragmentation and production sharing, vertical integration, task offshoring and outsourcing, and measurement of trade in value added. As Pascal Lamy, the former WTO chief put it: *Any discussion today of international trade and investment policy that fails to acknowledge the centrality of global value chains would be considered outmoded and of questionable relevance.*[2] Yet the benefits stemming from joining the GVCs are neither self-evident, nor unconditional. Many high income countries fear that the GVCs-related relocation of labour-intensive, lower-value tasks into developing countries would result in the loss of value added and jobs. Also, although the core nature of the modern GVCs is the transfer of innovation stimulating know-how, a critical and a necessary first step toward product upgrades (Taglioni and Winkler (2016)), many lower income economies approach the GVCs-related policy with caution. They want to avoid getting stuck at low-value added tasks, which could undermine the prospects for quality advancements and, subsequently, for the future growth.

To contribute to this debate this paper aims at investigating whether GVCs participation through forward/selling linkages and backward/buying linkages influenced the product quality of the exports[3]. In addition, we try to shed some light onto channels of the potential impact of GVCs participation on the unit values of exports as we test whether the host country level of development, the source/destination country and source/destination sector matter for the outcomes. Due to data availability on the trade in value added, it is only recently that this question can be addressed in a rigorous manner.

[2] Elms and Low (2013)

[3] Product quality is measured as unit value at exporting country-product-year level. Backward (buying) linkages in GVCs can be broadly defined as the amount of foreign value added in the home country exports, whereas the forward (selling) linkages are the amount of domestic value added in the foreign countries exports (or re-exports).

Integration into GVCs can lead to export upgrading via many channels. First, firms can benefit from a direct interaction within GVCs. A more intense forward (selling) linkages as could require suppliers to upgrade the products as a result of compliance with tighter foreign quality norms (for instance via submitting specific certifications, meeting standards, passing technical audits) which would manifest in higher unit values. Similar outcomes could be triggered thanks to access to foreign high quality inputs leading to quality improvements and products of higher unit values. Eventually, thanks to combination of a scale-effect, a GVCs-related transfer of know-how and access to better inputs firms can also upgrade functionally. As an example think of a domestic subcontractor in a textile industry moving from assembling an imported pre-cut trousers to producing and exporting the pre-packaged product, which would also manifest in higher unit values. Second, GVCs integration can affect the unit values of the exports indirectly, due to industry spillover effects, sectoral competition forces or imitation of good practices observed among their counterparts involved in an international production network. An intensified GVCs trade within a sector can have an impact on competition, both via extensive and intensive margins. As a result of increased competition, the least productive exporters (or products) may drop of the market, somewhat mechanically leading to an export upgrade. However, as outlined in Antoniades (2015) firms may respond differently to a higher competition in presence of a high scope for quality differentiation, conditional on their productivity. Within modeling framework of Antoniades (2015) in highly differentiated markets an increase in competition incentivizes the most productive firms to upgrade and the least productive firms to downgrade the quality. The overall impact of increased competition would then depend on the degree of quality differentiation and firm productivity distribution, and ultimately it remains an empirical question.

In this paper, by exploiting the new International Input-Output Tables (ICIO) by the OECD and a high-quality dataset on the trade in unit values, we show that there is a strong, positive and economically meaningful association between forward GVCs linkages and the unit value of exports that holds across all levels of development. We also find a less robust negative association between backward GVCs linkages and unit values of exports. The specifications and robustness checks addressing the question of potential reverse causality result in a corroboration of a strong and positive relationship between export quality and selling linkages, particularly present for the developing countries subsample. On the other hand, the negative association between backward GVCs linkages and unit values of exports is found to be less robust.

A finer look at the estimates reveals interesting patterns related to GVCs sourcing/destination country and GVCs sourcing/destination sector. We find that forward linkage impact on the developing countries export prices is mostly due to selling to the richer and more technolog-

ically advanced markets. Additionally, we find that the advanced economies gain the most in terms of the unit values of exports when selling to high-tech sectors, whereas the developing countries benefit both from supplying to high-tech and low-tech sectors. As for the backward linkage, we find that no single country group or sector grouping is responsible for the negative effect. However, we find that sourcing from low and middle income economies in particular leads to lower export unit values of the intermediate goods.

Last but not least, we present additional evidence suggesting that the increase in the unit values of exports we document is indeed a quality upgrade, not a mere increase in the mark-ups. We show that the increase in the unit values of exports is accompanied by an increase in the unit values of imports of the intermediate goods. Interestingly, the decrease in the unit values related to backward GVCs linkages is accompanied by a simultaneous decrease in the unit values of imports.

This paper is structured in the following way: the next subsection presents the relevant related literature. Section 3.2 describes the datasets used in the analysis and outlines the empirical specification. Section 3.3 presents the main results and the robustness checks, and section 3.4 concludes.

3.1.1 Related Literature

To my best knowledge this paper is the first one to rigorously study the relationship between GVCs participation and export upgrade in a wide range of countries. The major body of literature on the GVCs has focused so far on the development of the novel vertical specialization indicators, description of their geographical evolution and a subsequent reevaluation of gross trade patterns[4]. Hummels et al. (2001) show that the vertical specialization measured as foreign value added in exports has increased on average by 30% between 1970 and 1990, based on OECD input-output tables for years $1970 - 1990$. Their analysis is updated and complemented by Daudin et al. (2011) who report also a massive increase in GVCs trade when looking at the selling (forward) linkages, *i.e.:* the domestic value added in third countries exports for years $1997 - 2004$. Most recently, Baldwin and Lopez-Gonzalez (2015) present a portrait of the global pattern of supply-chain and its evlolution since 1995, based on World Input-Output Databse (WIOD). They discuss three components of value added trade: importing to produce ($i2p$), importing to export ($i2e$) and factor content trade (va) and via a myriad of different indicators they make a strong case for a largely increased internationalization of production since 1995. Lately, Piermartini and Rubinova (2014) show that GVCs trade facilitates knowledge transfers and potentially can pave the way for a faster economic development. This paper, complements this finding by showing the association be-

[4]See Amador and Cabral (2016) for a detailed survey on measuring GVCs.

tween forward and backward linkages and export structure upgrade.
Despite scarcity of the empirical evidence on export upgrade within the GVCs literature, there exist many studies documenting a positive relationship between FDI and unit values of exports. Among others, Swenson and Chen (2014) in a study of Chinese firms show a positive association between the presence of multinational companies and higher unit value transactions in the same industry. In a companion paper Swenson (2008) documents that the presence of multinationals increases the number of new export connections by private Chinese exporters, which may be due to information spillovers. In a work closely related to this paper, Harding and Javorcik (2012) study the impact of FDI inflow on the export upgrade in a cross-country setting, exploiting the data on sectors targeted by investment promotion agencies. They document an increase of approx. 11% in unit values of exports across the targeted sectors in developing countries. They attribute the increase to the upgrade of final goods and more differentiated goods, finding no impact on the intermediates. Interestingly, this paper finds that sectors with a greater exposure to GVCs trade[5] have recorded an increase in unit values of *both* the intermediate and final goods exports.

3.2 Data and empirical strategy

3.2.1 GVCs participation: forward and backward linkages

The measures of forward and backward participation in GVCs are based on the International Input-Output Tables from the OECD (ICIO). Their most recent release (April 2017) offers a broad coverage of the middle and low income economies, in particular when compared to the alternative sources of trade in value added data like WIOD. 2017 ICIO release covers 63 economies in years $1995 - 2011$ and it contains 34 Isic Rev.3 industries. This analysis restricts the sample start to year 2000, due to data availability of the unit values database. As the dataset on the unit values of exports does not cover trade in services, we additionally restrict the analysis to 16 manufacturing sectors.
In the following analysis, we refer to forward or selling linkage as the value of domestic value added subsequently re-exported to the third countries (exporting to re-export) and to backward or buying linkage as the value of foreign value added embodied in the home exports (importing to export).
To obtain the GVCs participation measures we use the classical Leontief decomposition of the international Input-Output Tables. The routine for the decomposition is implemented in R and thoroughly documented by the authors in Quast and Kummritz (2015). The final

[5]GVCs trade is a term more broad than sectoral FDI presence as firms entering GVCs can be both multinational affiliates as well as arm's length buyers/suppliers without an ownership relationship.

product of the Leontief decomposition is a matrix, say V, where each cell $v_{li}^{js} \in V$ is an estimate for the industry s country i value added originating from industry j in country l. We therefore define the backward linkage of an industry s in country i as the sum of all the foreign value added from all the foreign countries l and sectors j used in exports of the sector s, country i (in other words it is a sum across rows of the matrix V):

$$\text{backward linkage}_{si} = \sum_{l \neq i} \sum_{j} v_{li}^{js} \tag{3.2.1}$$

Analogously, the forward linkage in industry s, country i is defined as the domestic value added in exports re-exported to all the industries j of all the third countries l (in other words it is a sum across the columns of the matrix V):

$$\text{forward linkage}_{si} = \sum_{l \neq i} \sum_{j} v_{il}^{sj} \tag{3.2.2}$$

In order to avoid spurious effects of the oil imports, we exclude from the indices all the value added sourced from the mining sector (Isic Rev. 3, ICIO code $C10T14$). The summary statistics of backward and forward linkages are presented in Table 3.1 below.

Table 3.1: Summary statistics for GVC indicators

Indicator	Mean	Std Dev.	Std Dev. (within)	Min	Max	Obs
backward linkage *(fva)*	4.83	3.78	0.51	-9.95	10.91	10584
forward linkage *(dva)*	3.97	5.47	0.46	-20.48	10.15	10584

All GVC indicators in natural logs.

3.2.2 Unit Values

Export quality is proxied by the unit values of exported goods[6]. Data on unit values are taken from Trade in Value Added database (TUV) from Cepii[7]. This database relies on United Nations (UN) Statistical Division dataset on Tariff Lines, corresponding to the values and quantities of trade declared by individual countries to the UN. Data are processed in order to provide reliable and comparable unit values across countries. Unit values of exports are used in this analysis. They are Free on Board prices, computed for each exporter, partner and product at the highest level of disaggregation reported in the Tariff Lines dataset. Processing methodology adopted improves the reliability and comparability of the unit values as compared to the alternative product-destination data (such as UN Comtrade). Crucially, in TUV missing values of exported quantity for the entries with non-missing trade value are estimated. The estimation procedure is a departure from the standard one using a unique world unit value, defined at world level. Conversely, in TUV estimation of missing quantities there is no reliance on the world unit value and therefore heterogeneity in pricing across different countries is preserved. Secondly, TUV tackles some of the typical aggregation issues which arise when working with unit values: *Comtrade aggregates separately values and quantities into HS 6-digits nomenclature. This can bias unit values when some of the quantity information is initially missing at a higher level of disaggregation. In our database [TUV], unit values, rather than the values themselves are computed at the highest level of disaggregation before aggregation in HS 6-digits categories, thus reducing the bias due to separate aggregation of values and quantities.* (Berthou and Emlinger (2011))
Given the strict methodology applied in the construction of TUV, its coverage both in terms of products and countries is slightly smaller than Comtrade. Importantly, the TUV data starts in year 2000, which would mean that we are forced to restrict our sample start period to year 2000.
For the analysis we collapse the product-exporter-destination dimension of the TUV dataset to product-exporter one. We aggregate all destination-specific unit values for each product-exporter pair by using the trade value weights inferred from BACI Cepii database.

[6]Although the unit values of exports are not a perfect proxy for export quality, it has been a widely adopted measure in the literature (see Schott (2004), Fitzgerald and Hallak (2004), Harding and Javorcik (2012) among others). Unit values may suffer from measurement error and aggregation issues, and can vary for a number of reasons, not necessarily reflecting the quality. If the threat is related to unit values reflecting production costs, then the inclusion of country-specific controls such as GDP *per capita* in the specification should account for that. If the threat is related to market power, to the extent that the market power of a country exporting a product to a given destination is not time-varying, the product-exporter fixed effect should take care of this issue. The aggregation and measurement error are typically the most difficult problems to deal with, yet the design of TUV dataset is directly aimed at tackling those issues, as explained in the main text.

[7]www.cepii.fr

TUV database does not provide any split into final and intermediate goods. The aim of this paper is to study the impact of GVCs-induced upgrade of the exports and therefore we would like also to investigate the potentially differential impact of GVCs trade on the intermediates and final goods. Therefore, we turn to the United Nations Broad Economic categories (UN BEC) Classification by end use to distinguish final goods from the intermediates. UN BEC maps all six-digit HS codes into 19 basic categories of goods: six categories of consumption goods, two categories of capital goods, eight categories of intermediate goods and three non-specified categories. In the subsequent analysis we restrict our attention to intermediate and consumption goods only.

To illustrate the recent changes in export unit values we consider the largest increases in the export prices in a cross-country comparison. Table (3.13) in the Appendix lists 35 countries that have recorded the greatest surges in unit values of exports. We compute the changes in unit values as changes in unit value of a product p, exported by a country c averaged across country $c's$ export basket in between year 2011 (sample end) and year 2000 (sample start). We exclude countries exporting less than 30 products. The largest increases in export prices have been recorded in Japan (383%), Tunisia (336%), Poland (282%), Hungary (266%), Switzerland (247%) and the Czech Republic (235%). Both among the top 10 and top 20 economies, the positions were split almost equally between low and middle income and high income countries[8]. Interestingly, among the low and middle income group there is a particular concentration of Central and Eastern European (CEE) countries[9]. In the last decade most of CEE countries have been intensively integrating into global but predominantly regional production networks, most notably creating business relationships with rich European headquarters economies (Germany, France) within so-called *factory Europe* (Baldwin (2016)). Table (3.2) reports the largest increases in unit values of product p exported by country c for country-sector pairs. We exclude sectors exporting less than 10 products. The last two columns of Table (3.2) describe the changes in GVC indices: forward and backward linkages, calculated in line with subsection 3.2.1. The top increases in unit values of exports across sector-country pairs are of a large magnitude, with the record Lithuanian *Chemicals and chemicals products* enjoying a 1133% rise in unit values. Increases in *Rubber and plastic products* sector dominate the list. The changes in GVC indices accompanying unit values evolution over the studied period suggest that in principle increases in export prices have been associated with a growing interconnectedness, both on the selling side (forward) as well as on the buying side (backward). Notable exceptions are Irish *Rubber and plastic products* and New Zealand's *Chemicals and chemical products* which have enjoyed an increase in

[8]Classification after World Bank as of year 2000.

[9]CEE economies present in top 20 list are: Poland (POL), Hungary (HUN), the Czech Republic, Estonia (EST) and Lithuania (LTU). Croatia (HRV) ranks 33*rd*.

Table 3.2: Changes in unit values 2000 – 2011

Rank	Country	Unit Value % change	Sector code and description	forward l. % change	backward l. % change
1	LTU	1133.48	8. Chemicals and chemical products	789.68	2329.59
2	AUT	960.55	9. Rubber and plastics products	117.35	98.42
3	FRA	822.62	18. Other manufacturing	130	255.21
4	TUN	596.33	11. Basic metals	672.39	835.55
5	TUN	574.13	12. Fabricated metal products	530.14	870.19
6	POL	566.69	13. Machinery and equip.	620.03	867.65
7	BEL	541.26	9. Rubber and plastics products	91.8	76.55
8	EST	523.3	9. Rubber and plastics products	453.59	409.57
9	IRL	501	10. Other non-metallic mineral products	-43.52	-44.46
10	GRC	495.21	9. Rubber and plastics products	210.42	326.14
11	IRL	485.27	9. Rubber and plastics products	64.24	111.16
12	ESP	469.52	9. Rubber and plastics products	139.68	130.78
13	KOR	447.16	9. Rubber and plastics products	-20.82	20.49
14	POL	436.35	8. Chemicals and chemical products	390.17	441.45
15	LTU	431.69	15. Electrical machinery and apparatus	194.27	247.18
16	FIN	417.87	11. Basic metals	288.22	147.95
17	EST	407.6	11. Basic metals	1278.28	834.53
18	POL	398.7	12. Fabricated metal products	518.8	535.22
19	POL	398.3	11. Basic metals	286.18	327.75
20	USA	394.72	9. Rubber and plastics products	92.86	122.4
21	THA	388.33	9. Rubber and plastics products	110.93	121
22	EST	386.41	13. Machinery and equip.	407.14	270.04
23	EST	385.69	6. Paper products, printing and publishing	390.84	363.4
24	USA	384.74	10. Other non-metallic mineral products	34.4	98.17
25	LTU	377.95	13. Machinery and equip.	434.92	507.14
26	TUN	373.56	13. Machinery and equip.	488.22	480.82
27	HRV	362.71	11. Basic metals	161.96	115.33
28	LTU	360.08	11. Basic metals	394.35	329.45
29	NLD	359.66	9. Rubber and plastics products	57.65	41
30	NZL	349.41	8. Chemicals and chemical products	-63.73	-52.96
31	CZE	345.5	11. Basic metals	456.1	323.71
32	CHE	339.49	9. Rubber and plastics products	102.12	114.55
33	LTU	337.73	9. Rubber and plastics products	539.14	491.6
34	THA	335.8	11. Basic metals	245.91	722.93
35	DEU	333.97	9. Rubber and plastics products	134.48	229.53
36	HRV	321.27	13. Machinery and equip.	315.04	220.23
37	HUN	319.8	6. Paper products, printing and publishing	190.26	159.73
38	CZE	319.08	10. Other non-metallic mineral products	261.4	101.22
39	SVN	318.91	14. Computer, electronic and optical equip.	78.1	45.58
40	LTU	306.32	10. Other non-metallic mineral products	195.74	436.95

export unit values with a simultaneous decrease in GVCs-related trade.

3.2.3 Other data sources

The detailed list of all control variables altogether with sources can be find in Table (3.14) the Appendix.

3.2.4 Specification

The relationship between a more intense GVCs trade and unit values upgrade can be simultaneous in nature. Possibly it is not only that a more intensified trading within GVCs leads to product quality upgrades, but also the sectors with an already diversified, highly sophisticated export basket are populated with firms more attractive for foreign customers or already source more from abroad. It is a very challenging task to come up with an instrument for GVC participation that would vary at sectoral level and successfully capture the difference between forward and backward linkages. Therefore, as a first step towards a casual interpretation we resort to estimating a specification with lagged GVCs indicators. To investigate whether the increased participation in GVCs in a given sector affects the unit values of products exported by this sector we set up the following baseline specification:

$$\begin{aligned} lnUVAL_{pit} = \beta_0 + \beta_1 lnBackward_{si,t-1} + \beta_2 lnForward_{si,t-1} + \beta_3 lnExpVal_{pi,t-1} + \\ + \beta_4 lnImpDC_{pi,t-1} + \beta_5 X_{i,t-1} + \gamma_{pi} + \gamma_{pt} + \epsilon_{pit} \end{aligned} \tag{3.2.3}$$

The dependent variable, $lnUVAL_{pit}$, are unit values of exported product varying at product p, exporter country i and year t level. GVCs forward and backward linkages, $lnBackward$ and $lnForward$ are measured at sector s (ISIC Rev.3), country i, year t level. Additionally, the specification controls for the size of the exporting industry proxied by the the value of exports of a given product by a given country, $lnExpVal_{pit}$. $lnImpDC$ is the value of intermediate imports destined for domestic consumption (as opposed to intermediate imports subsequently embodied in the exports) varying at the sector-exporter-year level. This variable is a proxy for sectoral openness, comparative advantage and size, it captures different factors that may simultaneously affect both the GVC participation and export prices and thus mitigates the potential omitted variable issues. X_{it} stands for the vector of country-level controls. As suggested by Hummels and Klenow (2005), we control not only for the country size (GDP *per capita*), but also for the log of population size. To control for the potential effect of transfer pricing of multinational (MNEs) corporations we add as

a covariate country level corporate tax rate[10]. We also control for the country-level FDI to GDP. Detailed list of all the summary statistics and data sources is reported in Table (3.14) in the Appendix.

The richness of the TUV dataset allows for controlling for a number of fixed effect without compromising on the significance. γ_{pi}, γ_{pt} stand for product-country and product-time fixed effects, respectively. Product-country fixed effects control for all the observed and unobserved time-invariant characteristics specific to each product-country pair combination. In other words, they account for the fact that the unit value of a kilo of pencils may differ from that of a kilo of semiconductors for reasons different than quality. We include also product-time fixed effects, γ_{pt} which control not only for the differences in unit values across products, but also for the changes in the relative prices brought about by demand forces or technological progress, *i.e.:* if technological progress will cause the semiconductors prices to fall relatively to the pencils prices, this impact will be absorbed by γ_{pt}.
Therefore, the regression is exploiting the within-product-country variation over time. It is important to note that the regression could be alternatively run on a more aggregated, sector-country level unit values. Such an aggregation would however exclude the possibility to explicitly control for the product-specific characteristics.
The variables of interest, $lnBackward$ and $lnForward$, are at the sector-country-time level, and our dependent variable is at the more disaggregated product-country-time level. Therefore, we cluster standard errors at the sector-country-time, following Moulton (1990).

In the analysis Eq. (3.2.3) is often enriched with an interaction of the GVCs indices and a developing country dummy (LMI), an interaction of the GVCs indices and a intermediate good dummy (INT) or an interaction with a differentiated good dummy ($DIFF$). Both the unit value and the GVCs measures are entering the regressions in natural logarithm transformation. Therefore, all the specifications additionally include dummies (not reported in the tables, extended results available upon request) for the country-sector-year observations for which the value of a GVCs linkage is equal to zero, so that the interpretation of the coefficients remains standard.

In the baseline regression (3.2.3), both β_1 and β_2 are the coefficients of interest. They describe the magnitude and direction of the impact of an 1 percentage point ($1pp$) increase in GVCs participation in a given sector on the unit values of exported products from that sector. A positive coefficient may be driven by an upgrade in the existing exported products, by a shift in the export structure towards goods of higher unit values, or by a combination of these factors.

[10]In short, transfer pricing is understood as MNEs incentives to shift profits to lower tax locations in order to save on import tariffs.

3.3 Results

3.3.1 Baseline results

The baseline regression results of Eq.(3.2.3) are presented in Table 3.3 below. In column (1) we report the impact of both forward and backward linkages in the pooled sample of all the countries. Column (2) additionally distinguishes the effect of forward and backward linkages for the intermediates goods. In column (3) we investigate the possible differences between high income and low and middle income economies. Finally, the specification in column (4) accounts for both the development level and the differences between the final goods and intermediates.

We find a strong and positive impact of the forward linkages on the unit value of exports. All the coefficients of the forward linkages are statistically significant at 1% level and in the baseline specification, a 1*pp* increase in the GVCs selling linkages is associated with an increase of unit value of the exports of 0.08%[11]. The positive effect is present both in the high income and developing economies, however it is stronger in the latter group (col.(3) and (4)).

Somewhat surprisingly, we find a strong and negative association between the GVCs sourcing linkages and unit values of exports. A a 1*pp* increase in the integration within GVCs buying network is associated with a decrease of the unit values of exports of 0.06%[12]. Interestingly, this negative effect is much stronger across the low and middle economies (col.(3) and (4)). As we show in the next sections, this result is not driven by the multi-collinearity concerns, however its strength fades over time in contrast to the forward linkage impact.

Those effects of the GVCs linkages are economically meaningful. Based on the baseline coefficients from Table 3.3 the recorded increase in the forward GVCs linkages translates to an average increase of the unit values of exports of 22.6% over the studied period[13].

As for the other control variables, we find a strong and positive correlation between export unit values and the value of intermediates imports used for domestic consumption. As the sectors that import more of the inputs for domestic consumption tend to be more productive, bigger, more open to trade and potentially exhibit greater comparative advantage this result comes as no surprise. Somewhat interestingly, products with a greater export value tend to quote lower export prices. We find also a positive correlation between GDP per capita and product export prices in line with the evidence that the richer countries export higher

[11] exp(0.0774)-1=0.08, based on col. (1) in Table 3.3.

[12] exp(0.0548)-1=0.06, based on col. (1) in Table 3.3.

[13] Forward linkages have increased on average by 283% in the pooled sample between 2000 and 2011. Respective increases for the low and middle and high income economies are 125% and 874%.

Table 3.3: Export unit values and GVCs participation: baseline results

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
backward linkage	-0.0548***	-0.0456***	-0.0377***	-0.0104
	(.00828)	(.0136)	(.01)	(.0164)
backward l. x LMI			-0.0320***	-0.0755***
			(.0121)	(.0222)
backward l. x INT		-0.0137		-0.0440**
		(.0132)		(.0183)
backward l. x LMI x INT				0.0693***
				(.0239)
forward linkage	0.0774***	0.0706***	0.0396***	0.000938
	(.00848)	(.0169)	(.011)	(.0184)
forward l. x LMI			0.0618***	0.129***
			(.013)	(.0229)
forward l. x INT		0.0102		0.0634***
		(.0175)		(.0204)
forward l. x LMI x INT				-0.104***
				(.0244)
L.Exp. Value, log	-0.0290***	-0.0291***	-0.0291***	-0.0291***
	(.00106)	(.00105)	(.00106)	(.00106)
L.Intm's imports, log	0.0606***	0.0609***	0.0570***	0.0564***
	(.00976)	(.00976)	(.00973)	(.00966)
GDP p.c., log	0.217***	0.217***	0.218***	0.182***
	(.0278)	(.0278)	(.0279)	(.0316)
Population, log	-0.0600	-0.0585	-0.0574	-0.0522
	(.0877)	(.0876)	(.0871)	(.0873)
Corp. tax	-0.149**	-0.149**	-0.151**	-0.197***
	(.0594)	(.0594)	(.0598)	(.0596)
FDI to GDP	-0.000215**	-0.000217**	-0.000237**	-0.000217**
	(.000091)	(.0000911)	(.0000921)	(.000091)
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1310684	1310684	1310684	1310684
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level assigned after World Bank classification as of 2000. INT is equal to 1 for the intermediate goods. Standard errors (in parentheses) clustered at exporter-industry-year level.

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

goods of a higher quality. There is a negative (yet not significant) association between population size and unit values of exports. This finding corroborates the evidence from Hummels and Klenow (2005b), who show that the more labor-abundant countries tend to export less sophisticated products. Interestingly, the data suggest a negative and significant correlation between product export prices and national corporate tax rate, which could be a *prima facie* evidence for the profit shifting, *i.e.* tax avoidance exercised by multinational companies who artificially lower the export prices of their subsidiaries. Finally, the countries with a greater FDI to GDP share exhibit lower export unit values, however the coefficient is of a negligible magnitude.

In Table 3.4 we present a slightly modified specification from Eq.(3.2.3) where we consider the GVCs participation measures also in second and third lag. All the results reported in Table 3.4 account for the differential effects of GVCs participation on low and middle income and high income economies and investigate the potential differences between the intermediates and final goods.

Table 3.4: Export unit values and GVCs participation

	(1)	(2)	(3)	(4)	(5)	(6)
	L1		L2		L3	
backward linkage	-0.0377***	-0.0104	-0.0147	-0.000255	0.0217*	0.00584
	(.01)	(.0164)	(.0106)	(.0176)	(.0111)	(.0172)
backward l. x LMI	-0.0320***	-0.0755***	-0.0329**	-0.0408	-0.0417***	-0.0181
	(.0121)	(.0222)	(.0133)	(.0253)	(.0137)	(.0241)
backward l. x INT		-0.0440**		-0.0250		0.0201
		(.0183)		(.0192)		(.0196)
backward l. x INT x LMI		0.0693***		0.0182		-0.0284
		(.0239)		(.0264)		(.0257)
forward linkage	0.0396***	0.000938	-0.000282	-0.0412**	-0.0291**	-0.0474**
	(.011)	(.0184)	(.0117)	(.0195)	(.0125)	(.02)
forward l. x LMI	0.0618***	0.129***	0.0758***	0.119***	0.0898***	0.103***
	(.013)	(.0229)	(.0143)	(.0255)	(.0147)	(.0252)
forward l. x INT		0.0634***		0.0657***		0.0292
		(.0204)		(.0214)		(.0223)
forward l. x INT x LMI		-0.104***		-0.0684***		-0.0216
		(.0244)		(.0263)		(.0268)
Controls	Exp. Value, Intm's imports for home cons., Population, GDP p.c, Corp. tax , FDI to GDP					
Product-Exporter FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1310684	1310684	1178895	1178895	1049532	1049532
R2-adj.	.91	.91	.92	.92	.92	.92

Dep. variable: natural log of unit values of exports at product-exporter-year level. Col. (1) – (2), (3) – (4), (5) – (6) present results with a 1-year, 2-year and 3-year lagged GVC indicators, respectively. *LMI* dummy is equal to 1 for the low and middle income countries. Country development level assigned after World Bank classification as of 2000. *INT* is equal to 1 for the intermediate goods. Standard errors (in parentheses) clustered at exporter-industry-year level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

First, we find that the strong positive impact of the forward linkage is robust and persistent.

The magnitude of the impact declines with the longer lags, yet the coefficients remain positive and statistically significant. In the specification with a 3 years lag a $1pp$ increase in the selling linkages is associated with a 0.06% increase in the unit values of exports. Interestingly, with a longer lag structure the coefficients suggest a stronger impact for the low and middle income economies. Second, the negative impact of the sourcing linkage is less robust. It is present only for the low and middle income countries when using the second and third lag of the backward measure (Col.(3) and (4)), however, it disappears from the second lag onward when the intermediate good dummies are included.

The lagged specification of Eq.(3.2.3) along with a rich set of fixed effects is intended to mitigate the potential reverse causality problems, however, it cannot fully resolve this problem. To provide a further evidence that the results above are not driven by the reverse causality problem, we perform a strict exogeneity test as suggested by Wooldridge (2010). We estimate a modification of Eq.(3.2.3) including lags and leads of backward and forward linkages. If the sectoral GVCs integration is a consequence of quality upgrade in the respective sectors and not *vice versa*, we should observe statistically significant coefficients on the lead values of GVCs participation.

In Table 3.5 we present the outcome of the test. We see that the positive impact of selling linkages is driven by both the contemporaneous and past values of forward GVCs participation, with a slightly stronger effect of the contemporaneous variation. For the backward measure, a similar pattern is present. It is the lagged and contemporaneous values driving the effect of backward linkage. Most importantly, neither for forward, nor for the backward linkage the coefficient on the lead values is statistically significant, suggesting that the reverse causality is not driving the main results.

In Table 3.6 we present the results of the additional specification tests. First, we address the potential multicollinearity threat. In the main specification we include the measures of both forward and backward linkages. However, as the empirical trade literature suggests, exporting and importing are often the two sides of the same coin. Therefore, while a failure to include both of the GVCs measures could lead to the omitted variables problem, the inclusion of both of those proxies could bring about multicollinearity issues. To cross-check that our results are not influenced by the multicollinearity, in columns (1) and (2) we present the outcomes of the specifications including each GVCs linkage measure separately. The results remain qualitatively similar, with precision levels matching those from the baseline specification in Table 3.3.

As the aftermath of the financial crisis of 2008, the world trade flows have recorded a large fall commonly referred to as the Great Trade Collapse (Bems et al. (2013)). As our sample period $(2000-2011)$ includes the trade collapse, we test whether the main result holds when the sample is truncated only to the pre-crisis period $2000-2008$. The results in col.(3) are

Table 3.5: Export unit values and GVCs participation: Strict exogeneity test

	(1) Unit Val.
backward linkage	-0.0472***
	(.00897)
F.backward linkage	0.00508
	(.00772)
L.backward linkage	-0.0257***
	(.00757)
forward linkage	0.0373***
	(.00964)
F.forward linkage	0.00633
	(.00913)
L.forward linkage	0.0276***
	(.00946)
Controls	Yes
Product-Exporter FE	Yes
Product-Year FE	Yes
Observations	1129594
R2-adj.	.92

Strict exogeneity test as in Wooldridge (2010).
Dep. variable: natural log of unit values
of exports at product-exporter-year level.
Standard errors (in parentheses) clustered
at exporter-industry-year level.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

again qualitatively similar to the baseline results. Interestingly, the coefficient on the forward linkages increases. Finally in col.(4) we present the specification in which we drop all the country-year varying control variables and instead we include a full set of product-exporter, product-year and exporter-year fixed effects. In such a specification, the threat of a potential omitted variables problem is minimized and reduced to the variables varying at the product-exporter-year level. Again, the coefficients on the forward linkage remain qualitatively similar to the baseline and although of a slightly reduced magnitude, it remains strongly significant and positive. On the other hand, the backward linkage coefficient is much smaller and is estimated with a lower precision (significance at a 10% level).

3.3.2 Additional Results

Not all production chains are equal and not all of them could bring along the same prospects of the exports upgrade. There exists an extensive literature on the technology and knowledge transfer across countries (see Piermartini and Rubinova (2014) and Benz et al. (2014) among

Table 3.6: GVC participation and export upgrade: Robustness checks

	(1) multic.	(2) multic.	(3) before 2009	(4) extened FE
backward linkage	-0.0243***		-0.0560***	-0.0100*
	(.00787)		(.0118)	(.00638)
forward linkage		0.0525***	0.108***	0.0444**
		(.00763)	(.0121)	(.00664)
L.Exp. Value, log	-0.0293***	-0.0298***	-0.0226***	-0.0287***
	(.00107)	(.00107)	(.00137)	(.000973)
L.Intm's imports, log	0.0725***	0.0255***	0.0523***	0.00977
	(.0107)	(.0082)	(.0126)	(.00775)
L.GDP p.c., log	0.235***	0.230***	0.119***	
	(.0277)	(.0268)	(.0348)	
L.Population, log	-0.155*	-0.104	-0.209*	
	(.0868)	(.0866)	(.126)	
L.Corp. tax	-0.175***	-0.168***	-0.419***	
	(.0593)	(.0594)	(.0711)	
L.FDI to GDP	-0.000274***	-0.000329***	-0.000208	
	(.0000988)	(.0000959)	(.0002)	
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Exporter-Year FE	No	No	No	Yes
Observations	1294737	1294737	897883	1390010
R2-adj.	.91	.91	.92	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. Standard errors (in parentheses) clustered at exporter-industry-year level.

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

others) and it reports large and positive productivity effects that are associated with FDI and GVCs-related trade for the firms located in the developing South. In order to investigate the origin behind the baseline coefficients from the previous sections, we study the role of the specific groups of countries and sectors within buying and selling GVCs links. Intuitively, sourcing inputs from a more technologically advanced countries or selling components to richer economies is more likely to positively affect the unit values of the exports. In a similar manner, supplying inputs to high-tech sectors or sourcing the inputs from knowledge intensive services sectors could bring about more room for quality upgrade. We therefore decompose backward and forward GVCs participation indices and re-estimate Eq.(3.2.3) by taking into account only the value added sold to or sourced from a selected groups of countries or selected sector groupings. In detail, we obtain the *narrow* GVCs indices as follows:

$$Backward_{si}^{\text{source country}} = \sum_{l \neq i, l \in L} \sum_{j} v_{li}^{js}$$

$$Forward_{si}^{\text{destination country}} = \sum_{l \neq il \in L} \sum_{j} v_{il}^{sj}$$

$$Backward_{si}^{\text{source sector}} = \sum_{l \neq i} \sum_{j \in J} v_{li}^{js}$$

$$Forward_{si}^{\text{destination sector}} = \sum_{l \neq i} \sum_{j \in J} v_{il}^{sj}$$

where L and J stand for the countries' or sectors' groupings. L would contain 4 categories: (i) low income, (ii) middle income and (iii) high income economies[14] and (iv) G5[15]. J would consist of 2 main sector groupings: (i) high-tech sectors and (ii) low-tech sectors. For the backward linkages I would additionally distinguish sourcing from (iii) services sectors and (iv) knowledge intensive services (KI services). The sector classification into low-tech and high-tech sectors based on Branstetter and Saggi (2011) classification[16].

Destination country and sector

In Tables 3.7 and 3.15 in the Appendix we investigate the impact of the destination country taking into account the exporter development level as well as different product characteristics

[14] I classify income groups accordingly to the the World Bank classification as of 2000. As a robustness check an alternative classification accordingly to GDP p.c. thresholds was tested (low income lower than 6000 USD, middle income between 6000 USD and 20000 USD and high income greater then 20000USD), but it did not later the results

[15] G5 is defined as the group of the most technologically advanced countries, the world leaders in the R& D expenditure to GDP. It consists of United States, United Kingdom, Japan, France and Germany.

[16] An alternative classification into high-tech and low-tech industries by the OECD (2011) was also explored, but it did not change any of the results.

Table 3.7: Export unit values and GVCs participation: destination countries

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
forward linkage HI	0.0410***			
	(.0116)			
forward HI x LMI	0.0410***			
	(.00962)			
forward HI x INT	0.0205*			
	(.0112)			
forward HI x LMI x INT	-0.0250**			
	(.0101)			
forward linkage MI		0.0352***		
		(.00764)		
forward MI x LMI		0.00189		
		(.00979)		
forward MI x INT		-0.0332***		
		(.00819)		
forward MI x LMI x INT		0.00111		
		(.0101)		
forward linkage LI			0.0352***	
			(.00764)	
forward LI x LMI			0.00189	
			(.00979)	
forward LI x INT			-0.0332***	
			(.00819)	
forward LI x LMI x INT			0.00111	
			(.0101)	
forward linkage G5				0.0163
				(.0117)
forward G5 x LMI				0.0459***
				(.011)
forward G5 x INT				0.0119
				(.0114)
forward G5 x LMI x INT				-0.0274**
				(.0112)
backward linkage	-0.0839***	-0.0393***	-0.0393***	-0.0600***
	(.00957)	(.00757)	(.00757)	(.00885)
Controls	Yes	Yes	Yes	Yes
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1310684	1310684	1310684	1310684
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level level assigned after World Bank classification as of 2000. INT is equal to 1 for the inter--mediate goods. Standard errors (in parentheses) clustered at exporter-industry-year level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(intermediate vs. final good, differentiated vs. homogeneous good). In columns (1), (2), (3) and (4) we study the effect of the forward linkages when selling to high income, middle income, low income and G5 countries (resp.).

First, the results in Table 3.7 suggest that the destination markets behind the positive impact of GVCs participation on export upgrade are the high income countries. The overall effect of selling within GVCs to the middle and low income economies is almost negligible, both for the developed and developing country exporters (col.(2) and col.(3)). Second, although the impact of forward GVCs participation on unit values of exports is positive both for the intermediates and final goods, it is greater for the latter, irrespective of the destination market characteristics. Third, the results suggest that there is a premium in export prices for the exporters from the developing countries (as compared to their rich economies peers) when selling to the rich destinations, and technologically advanced G5 destinations in particular. Finally, accounting for the product differentiation does not alter qualitatively the results (Table 3.15 in the Appendix). We still observe that the main driver of the positive link between export upgrade and selling linkages are the rich and technologically advanced destination markets (high income economies and G5). However, we can observe that the forward GVCs linkages lead to increases in unit values of exports also when selling to low and middle income destination, yet only for the differentiated products.

In Table 3.8 we focus on the impact of sector of destination. In Col. (1) we report the impact of selling linkages on the unit values of exports when the destination sector is a high-tech. The developed countries see a positive impact on export prices when selling intermediates to the high-tech sectors, there is no impact on the final goods (1pp increase in the forward participation triggers a 0.05% increase in unit values of intermediates' exports). Interestingly, for the developing countries the high-tech destination sector has an impact on both the unit values of intermediate and final good exports, with a slightly greater coefficient for the final goods (0.0774 for the final goods vs.$0.0774 + 0.0468 - 0.059 = 0.0652$ for the intermediates). Forward linkages have no impact on unit values of exports in the developed countries when the destination sector is low-tech (col.(2)). Yet for the developing countries a $1pp$ increase in the forward GVCs participation brings about 0.05% increase in unit values of final goods exports and 0.01% increase in unit values of intermediates. In col. (3) and (4) we report the coefficients on the forward participation accounting for the differentiated and homogeneous goods division. Forward linkages impact stronger the non-differentiated goods across developing countries and both the direction and magnitude of this effect is similar for high-tech and low-tech industries (1pp increase in forward linkage results in and increase of 0.02% in export unit values of differentiated goods and an increase of 0.04% for the non-differentiated goods). For the developing subsample also both low-tech and high-tech destinations of forward linkages influence positively the export unit values. However,

Table 3.8: Export unit values and GVC participation: destination sector

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
forward linkage HT	0.0111			
	(.0151)			
forward HT x LMI	0.0774***			
	(.0134)			
forward HT x INT	0.0468***			
	(.0154)			
forward HT x LMI x INT	-0.0590***			
	(.0136)			
forward linkage LT		0.0184		
		(.0159)		
forward LT x LMI		0.0533***		
		(.0129)		
forward LT x INT		0.0176		
		(.0163)		
forward LT x LMI x INT		-0.0424***		
		(.0128)		
forward linkage HT			0.0673***	
			(.0129)	
forward HT x LMI			0.0152	
			(.0111)	
forward HT x DIFF			-0.0431***	
			(.0142)	
forward HT x LMI x DIFF			0.0410***	
			(.0121)	
forward linkage LT				0.0460***
				(.0132)
forward LT x LMI				0.00568
				(.0113)
forward LT x DIFF				-0.0249*
				(.0144)
forward LT x LMI x DIFF				0.0293**
				(.0117)
backward linkage	-0.0669***	-0.0942***	-0.0660***	-0.0926***
	(.00937)	(.0104)	(.00994)	(.0109)
Controls	Yes	Yes	Yes	Yes
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1310684	1310684	1182710	1182710
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level level assigned after World Bank classification as of 2000. INT is equal to 1 for the inter--mediate goods. $DIFF$ is equal to 1 for the differentiated goods (Rauch classification) HT and LT label high-tech and low-tech sectors, respectively. Standard errors (in paren--theses) clustered at exporter-industry-year level.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

in the case of the export prices of the differentiated goods sold to high-tech industries, the magnitude of the effect is twice of the size of the coefficients for the high-tech non-differentiated and all low-tech destinations.

Source country and sector

In Table 3.9 we investigate whether the source country level of development has an effect on the relationship between GVCs backward participation and unit values of exports. The results reported in Table 3.9 confirm the negative association between sourcing within GVCs and export prices. Additionally, we find that the negative relationship between the export prices and backward GVCs participation is not concentrated within a single group of countries. Sourcing from high-income economies, low or middle income economies has qualitatively the same negative impact on export unit values. Whereas for the backward linkages from the rich and technologically advanced countries the results suggest no statistically significant differences between the export prices of final goods and intermediates (col.(1) and col.(4)), we observe that sourcing from low and middle income economies results in lower unit values of exports of intermediates only (col.(2) and col.(3)). This finding suggests that at least a part of the negative effect of backward GVC participation on the export prices we find is possibly due to the internationalization and competition forces interplay. It can happen that as a given sector becomes more open to international competition, foreign partners put pressure on home firms both in the export and input markets. Firms in response to competition seek for the cost economies and source more intensively from the low-cost locations while at the same time reducing prices in their export markets.

There is an interesting side-finding regarding the backward sourcing from the services sectors. There are many empirical studies stressing the increasing importance of services inputs for the manufacturing productivity and our findings seem to corroborate this evidence. Despite the overall negative impact of the backward linkages on the unit values of exports, we find a strong and positive impact of foreign sourcing from services sectors (and in particular knowledge intensive services sectors) in the developing countries (Table 3.10, col.(3) and col.(4)). We find no positive effects across developed economies, which is no surprise as the high income countries typically rely on the domestic supply of quality services and they are often themselves net exporters of services. Accounting for the differentiated/non-differentiated products division does not alter the main results of this subsection and for the sake of brevity the results are reported in Table 3.16 in the Appendix.

Table 3.9: Export unit values and GVC participation: source country

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
backward linkage HI	-0.0500***			
	(.00977)			
backward HI x LMI	0.0233**			
	(.0104)			
backward HI x INT	-0.00141			
	(.0106)			
backward HI x LMI x INT	-0.00463			
	(.0109)			
backward linkage MI		-0.00570		
		(.00773)		
backward MI x LMI		-0.0000637		
		(.00871)		
backward MI x INT		-0.0248***		
		(.00832)		
backward MI x LMI x INT		0.000239		
		(.00867)		
backward linkage LI			-0.00570	
			(.00773)	
backward LI x LMI			-0.0000637	
			(.00871)	
backward LI x INT			-0.0248***	
			(.00832)	
backward LI x LMI x INT			0.000239	
			(.00867)	
backward linkage G5				-0.0416***
				(.00951)
backward G5 x LMI				0.0119
				(.0111)
backward G5 x INT				-0.000476
				(.0104)
backward G5 x LMI x INT				-0.00126
				(.0116)
forward linkage	0.0708***	0.0653***	0.0653***	0.0690***
	(.00843)	(.0079)	(.0079)	(.00788)
Controls	Yes	Yes	Yes	Yes
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1310684	1310684	1310684	1310684
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level level assigned after World Bank classification as of 2000. INT is equal to 1 for the inter--mediate goods. Standard errors (in parentheses) clustered at exporter-industry-year level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.10: Export unit values and GVCs participation: source sector

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
backward linkage HT	-0.0576***			
	(.0121)			
backward HT x LMI	0.00597			
	(.0116)			
backward HT x INT	0.00517			
	(.0116)			
backward HT x LMI x INT	-0.0105			
	(.0115)			
backward linkage LT		-0.0432***		
		(.0156)		
backward LT x LMI		0.00214		
		(.0131)		
backward LT x INT		-0.0165		
		(.0147)		
backward LT x LMI x INT		0.00212		
		(.013)		
backward linkage Services			-0.121***	
			(.0152)	
backward Services x LMI			0.233**	
			(.0112)	
backward Services x INT			0.00517	
			(.014)	
backward Services x LMI x INT			-0.0174	
			(.0115)	
backward linkage KI Services				-0.121***
				(.0141)
backward KI Services x LMI				0.327***
				(.011)
backward KI Services x INT				0.0161
				(.0134)
backward KI Services x LMI x INT				-0.0265**
				(.0113)
forward linkage	0.0638***	0.0447***	0.0604***	0.0649***
	(.00864)	(.00927)	(.00853)	(.00848)
Controls	Yes	Yes	Yes	Yes
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1310684	1310684	1310684	1310684
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level assigned after World Bank classification as of 2000. INT is equal to 1 for the intermediate goods. KI services stand for the knowledge intensive services (OECD classification). HT and LT label high-tech and low-tech sectors, respectively. Standard errors (in parentheses) clustered at exporter-industry-year level.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.3.3 Import Unit Values

As extensively reported in the previous sections we find a strong and robust positive association between forward/selling GVCs linkages and export unit values and a less robust negative association between backward/buying linkages and export prices. However, insofar we cannot claim that the increase or decrease in the export unit values is surely due to an increase or decrease in the export quality. It can well be that firms selling within the global production networks expand their market access to richer, more technologically advanced markets and increase mark-ups instead of upgrading quality. Conversely, the negative impact of the backward participation we find may not necessarily point to export downgrade but can be a result of a competition being intensified by an increasing internationalization of sectors. As a consequence firms facing competition in both export and input markets search for cheaper inputs and reduce their export markups, irrespective of quality.
In order to shed some light whether our results are driven by the export quality changes or the fluctuations in the mark-ups, we investigate at the *import* unit values.

The recent literature emphasizes the importance of quality inputs for the production of

Table 3.11: Unit values of imported intermediates and GVC participation

	(1)	(2)	(3)	(4)	(5)	(6)
	L1		L2		L3	
forward linkage	0.0233**	0.0284**	0.0236**	0.0274**	0.0250**	0.0230**
	(.00563)	(.00738)	(.00644)	(.00819)	(.00725)	(.00915)
forward l. x LMI	-0.0174*	-0.0192	-0.0203**	-0.0213*	-0.0238**	-0.0284**
	(.00917)	(.0118)	(.00953)	(.0119)	(.0104)	(.0128)
forward l. x DIFF		-0.00852		-0.00524		-0.0164*
		(.00769)		(.00816)		(.00894)
forward l. x DIFF x LMI		0.00317		0.00181		0.0113
		(.0126)		(.0127)		(.0137)
backward linkage	0.00808	0.0112	-0.0267***	-0.0239**	-0.0454***	-0.0445***
	(.00817)	(.0102)	(.00964)	(.012)	(.0112)	(.0134)
backward l. x LMI	-0.0234**	-0.0212	-0.0187*	0.00181	-0.0164	0.0228
	(.0104)	(.0135)	(.0108)	(.0096)	(.0127)	(.0154)
backward l. x DIFF		-0.00825		-0.00888		-0.00405
		(.0113)		(.0131)		(.0152)
backward l. x DIFF x LMI		-0.00449		-0.00495		-0.0140
		(.0147)		(.0143)		(.0155)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Product-Importer FE	Yes	Yes	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1175374	1140785	1061217	1030141	949365	921629
R2-adj.	.94	.93	.94	.94	.94	.94

Dep. variable: natural log of unit values of imports of intermediate goods at product-exporter-year level. Col. (1) – (2), (3) – (4), (5) – (6) present results with a 1-year, 2-year and 3-year lagged GVC indicators, respectively. LMI dummy is equal to 1 for the low and middle income countries. Country development level assigned after the World Bank classification as of 2000. $DIFF$ is equal to 1 for differentiated (Rauch classification). Standard errors (in parentheses) clustered at exporter-industry-year level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

quality outputs. Following this insight, we re-estimate Eq.(3.2.3), but with the import unit values of the intermediate goods as the dependent variable (data obtained from TUV Cepii database, collapsed at the product-importer-year level). To corroborate the hypothesis that the sectors that sell more within GVCs networks indeed enjoyed a quality upgrade, we would expect to see also an increase in the unit values of imported intermediates in the respective sectors.

In Table 3.11 we present the estimation results. In columns (1),(3) and (5) we report the baseline specification as in Eq.(3.2.3) enriched with developing country dummy, respectively for the specification with a 1, 2 and 3 year lags for the GVCs indicators. In columns (2),(4) and (6) we present the outcomes for the specifications additionally controlling for the differentiated goods.

We find that the sectors that are more intensively selling within the GVCs have recorded a positive and significant increase in the unit values of imported intermediates. A 1pp increase in forward GVCs participation is related to a 0.02% up to 0.03% increase in intermediate imports' unit values and the estimates are significant at the 5% level. The coefficient on the interaction with developing dummy is significant and negative, suggesting a smaller size of the increase is smaller for the low and middle income economies. Accounting for the differentiated products does not change qualitatively the results, with the exception of the specification with a 3 year lag, where the overall sign of the forward GVCs linkage turns negative (col.(6)).

As for the backward GVCs participation, we find a negative and significant relationship, yet a less robust than in the case of the forward linkages. A $1pp$ increase in the backward GVCs participation is associated with a 0.02% up to 0.045% (col.(1) and col.(5)) decline in the import unit values of the intermediates. The impact is of a greater magnitude for the developing economies in the specifications with 1 and 2 year lag of the GVCs indicators as suggested by the significant and negative interaction term (col.(1) and col.(3)).

Summing up, we document that the increase in the unit values of exports associated with the increase in the forward GVCs participation is at the same time accompanied by an increase in the unit values of intermediate imports. We would interpret this evidence as suggestive for a quality upgrade effect as opposed to a mere increase in the mark-ups. In contrast, the statistically weaker negative impact of the backward GVCs participation is found to be accompanied by a decrease in the import values of the intermediates. This finding could admit two explanations. It could be that due to competition forces induced by high backward GVCs participation in a sector, firms compete both in the export and input markets and source cheaper inputs from abroad. Subsequently, the decrease in the export prices could be the outcome of the downgraded quality or just a decrease in the export prices due to the reduced production costs. A further exploration of this possibilities would call for

an analysis at the firm-level data and we see it as a promising avenue for the future research.

3.4 Conclusion

The question of export composition, sophistication and its upgrade as well as the drive to successfully join the global value chains are the topics at the heart of both national and global policy debate. The aim of this paper is to contribute to this debate by shedding some light on the relationship between export quality and GVCs participation.

Our analysis suggests that intensified selling GVCs linkages might have a potential to lead to export quality upgrade. Based on the International Output-Input Tables (OECD ICIO) we construct the indices of forward and backward GVCs participation and relate them to the unit values of exports on the product level. We find a strong and persistent positive impact fo selling GVCs linkages on the export unit values. This effect is stronger for the developing countries and driven by the selling to rich and technologically advanced markets. We additionally find that this effect is accompanied by a simultaneous increase in the unit values of intermediates imports. In line with the view that high quality inputs are required for high quality outputs, we interpret this outcomes as a corroborating evidence for export quality upgrade.

On the other hand, we find a negative, although a less robust, association between backward GVCs linkages and unit values of exports export. There is no single group of source countries or sectors driving the results. We report no statistically significant differences between the export prices of final goods and intermediates for the developed countries, however, we observe that sourcing from low and middle income economies leads to lower unit values of exports of intermediate goods only. This finding coupled with the documented simultaneous decrease in the import values of the intermediates could admit two explanations. It could be that due to high backward GVCs participation in a sector, firms compete both in the export and input markets, and seek to source cheaper inputs from abroad. Subsequently, the decrease in the export prices could be the outcome of the downgraded quality or just a decrease in export price accompanied by reduced production costs, leaving the mark-ups unaltered. We see the exploration of this finding as a promising avenue for the future research.

The most robust of our estimated coefficients on the forward GVCs participation over the period between 2000 and 2011 correspond to a 22.6% increase in the export unit values. Although we do not claim that the GVCs forward participation is the only or the most important factor behind the export upgrade in the studied countries, our results point to the importance of promotion of *prospective* value chains, *i.e.* related to technologically advanced sectors and rich markets, in particular for the developing economies.

Bibliography

AMADOR, J. AND S. CABRAL (2016): "Global Value Chains: A Survey Of Drivers And Measures," *Journal of Economic Surveys*, 30, 278–301.

ANTONIADES, A. (2015): "Heterogeneous Firms, Quality, and Trade," *Journal of International Economics*, 95, 263–273.

BALDWIN, R., ed. (2016): *The great convergence: information technology and the new globalization*, Harvard University Press Cambridge.

BALDWIN, R. AND J. LOPEZ-GONZALEZ (2015): "Supply-chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses," *The World Economy*, 38, 1682–1721.

BEMS, R., R. C. JOHNSON, AND K.-M. YI (2013): "The Great Trade Collapse," *Annual Review of Economics*, 5, 375–400.

BENZ, S., M. LARCH, AND M. ZIMMER (2014): "Trade in Ideas: Outsourcing and Knowledge Spillovers," ifo Working Paper Series Ifo Working Paper No. 173, ifo Institute - Leibniz Institute for Economic Research at the University of Munich.

BERTHOU, A. AND C. EMLINGER (2011): "The Trade Unit Values Database," Working Papers 2011-10, CEPII.

BRANSTETTER, L. G. AND K. SAGGI (2011): "Intellectual property rights, foreign direct investment and industrial development," *Economic Journal*, 121, 1161–1191.

DAUDIN, G., C. RIFFLART, AND D. SCHWEISGUTH (2011): "Who produces for whom in the world economy?" *Canadian Journal of Economics*, 44, 1403–1437.

ELMS, D. K. AND P. LOW (2013): *Global value chains in a changing world*, Geneva : World Trade Organization.

FITZGERALD, D. AND J. C. HALLAK (2004): "Specialization, factor accumulation and development," *Journal of International Economics*, 64, 277–302.

HARDING, T. AND B. S. JAVORCIK (2012): "Foreign Direct Investment and Export Upgrading," *The Review of Economics and Statistics*, 94, 964–980.

HAUSMANN, R. AND C. HIDALGO (2011): "The network structure of economic output," *Journal of Economic Growth*, 16, 309–342.

HAUSMANN, R., J. HWANG, AND D. RODRIK (2007): "What you export matters," *Journal of Economic Growth*, 12, 1–25.

Hummels, D., J. Ishii, and K.-M. Yi (2001): "The nature and growth of vertical specialization in world trade," *Journal of International Economics*, 54, 75–96.

Hummels, D. and P. J. Klenow (2005): "The Variety and Quality of a Nation's Exports," *American Economic Review*, 95, 704–723.

Moulton, B. R. (1990): "An Illustration of a Pitfall in Estimating the Effects of Aggregate Variables on Micro Unit," *The Review of Economics and Statistics*, 72, 334–338.

Piermartini, R. and S. Rubinova (2014): "Knowledge spillovers through international supply chains," Wto staff working papers, World Trade Organization (WTO), Economic Research and Statistics Division.

Quast, B. and V. Kummritz (2015): "Decompr: Global Value Chain Decomposition In R," CTEI Working Papers series 01-2015, Centre for Trade and Economic Integration, The Graduate Institute.

Schott, P. K. (2004): "Across-Product Versus Within-Product Specialization in International Trade," *The Quarterly Journal of Economics*, 119, 647–678.

Swenson, D. L. (2008): "Multinationals and the creation of Chinese trade linkages," *Canadian Journal of Economics*, 41, 596–618.

Swenson, D. L. and H. Chen (2014): "Multinational Exposure and the Quality of New Chinese Exports," *Oxford Bulletin of Economics and Statistics*, 76, 41–66.

Taglioni, D. and D. Winkler (2016): *Making Global Value Chains Work for Development*, no. 24426 in World Bank Publications, The World Bank.

Wooldridge, J. M. (2010): *Econometric Analysis of Cross Section and Panel Data*, vol. 1 of *MIT Press Books*, The MIT Press.

3.5 Appendix

3.5.1 Tables

Table 3.12: Baseline Country Sample

High Income	**Upper-middle Income**		**Low Income**
AUT	ARG	BGR	KHM
BEL	BRA	CHN	IDN
CAN	CRI	COL	IND
CYP	HRV	LVA	VNM
DNK	CZE	LTU	
FIN	EST	PHL	
FRA	HUN	ROU	
DEU	KOR	THA	
GRC	MYS	TUN	
HKG	MEX		
ISL	POL		
IRL	SVK		
ISR	TUR		
ITA			
JPN			
MLT			
NLD			
NZL			
PRT			
SGP			
SVN			
ESP			
SWE			
CHE			
GBR			
USA			

Classification after the World Bank as of year 2000. Oil-exporters excluded.

Table 3.13: Changes in unit values 2000 – 2011

Country rank	Country	% change
1	EST	2748.91
2	AUT	2655.55
3	DNK	1531.84
4	SGP	707.45
5	HUN	462.88
6	POL	377.65
7	SVN	324.51
8	PRT	300.14
9	CZE	238.86
10	ITA	229.71
11	ZAF	188.57
12	ESP	170.07
13	BRA	129.42
14	HRV	126.16
15	ISL	121.94
16	CHE	120.57
17	SWE	119.26
18	KOR	117.88
19	ARG	117.63
20	NZL	115.27
21	CHN	112.9
22	FRA	112.15
23	GBR	110.02
24	KHM	107.95
25	ISR	106.83
26	IND	97.13
27	TUN	87.3
28	TUR	86.09
29	USA	69.03
30	BEL	61.43
31	MEX	45.06
32	THA	30.1
33	DEU	15.92
34	NLD	14.53
35	CHL	13.49

Table 3.14: Summary statistics

Variable; source	*mean*	*sd*	*min*	*max*	*N**
Product-exporter-year variables					
Unit Values (log); TUV Cepii	9.046158	1.94461	0.0185994	23.98577	1687398
Export Value (log); BACI Cepii	6.804349	3.076151	0	18.23779	1687398
Sector-exporter-year variables					
backward l. (log); OECD ICIO	7.17706	1.692971	2.203347	12.06924	10584
forward l. (log); OECD ICIO	5.544036	3.907034	-9.954597	10.91124	10584
Imp. Dom. Cons. (log); OECD ICIO	4.465136	5.911716	-20.48382	10.14911	10584
Country-year variables					
GDP per capita (log); WDI World Bank	10.04889	0.6704086	7.223172	11.22404	595
Population (log); WDI World Bank	9.773626	1.577765	5.370638	13.90232	595
Corp. tax rate; World Tax Database, KPMG, OECD	0.2846419	0.076677	0.1	0.4125	535
FDI to GDP; UNCTAD	5.150957	17.4631	0.0068569	499.6003	595

* Number of distinct observations.

3.5.2 Regression Appendix

Table 3.15: Export unit values and GVCs participation: destination country (2)

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
forward linkage HI	0.0654***			
	(.0115)			
forward HI x LMI	0.0107			
	(.00948)			
forward HI x DIFF	-0.0276**			
	(.0116)			
forward HI x LMI x DIFF	0.0238**			
	(.00969)			
forward linkage MI		0.00161		
		(.00673)		
forward MI x LMI		0.0113		
		(.00836)		
forward MI x DIFF		0.0224***		
		(.00757)		
forward MI x LMI x DIFF		-0.0106		
		(.00883)		
forward linkage LI			0.00161	
			(.00673)	
forward LI x LMI			0.0113	
			(.00836)	
forward LI x DIFF			0.0224***	
			(.00757)	
forward LI x LMI x DIFF			-0.0106	
			(.00883)	
forward linkage G5				0.0309***
				(.00965)
forward G5 x LMI				0.0119
				(.00883)
forward G5 x DIFF				-0.0154
				(.0105)
forward G5 x LMI x DIFF				0.0267***
				(.00975)
backward linkage	-0.0791***	-0.0424***	-0.0424***	-0.0582***
	(.00982)	(.00793)	(.00793)	(.00917)
Controls	Yes	Yes	Yes	Yes
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1182710	1182710	1182710	1182710
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level level assigned after World Bank classification as of 2000. $DIFF$ is equal to 1 for the diff--erentiated goods (Rauch classification). Standard errors (in parentheses) clustered at exporter-industry-year level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.16: Export unit values and GVC participation: source country (2)

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
backward linkage HI	-0.0469***			
	(.0109)			
backward HI x LMI	0.0154			
	(.00975)			
backward HI x DIFF	-0.0120			
	(.0108)			
backward HI x LMI x DIFF	0.00508			
	(.0103)			
backward linkage MI		-0.0284***		
		(.0066)		
backward MI x LMI		0.00340		
		(.00728)		
backward MI x DIFF		0.0128*		
		(.00742)		
backward MI x LMI x DIFF		-0.00279		
		(.0075)		
backward linkage LI			-0.0284***	
			(.0066)	
backward LI x LMI			0.00340	
			(.00728)	
backward LI x DIFF			0.0128*	
			(.00742)	
backward LI x LMI x DIFF			-0.00279	
			(.0075)	
backward linkage G5				-0.0359***
				(.0089)
backward G5 x LMI				0.00546
				(.00903)
backward G5 x DIFF				-0.0107
				(.00969)
backward G5 x LMI x DIFF				0.00803
				(.0104)
forward linkage	0.0752***	0.0647***	0.0647***	0.0717***
	(.00878)	(.00823)	(.00823)	(.00827)
Controls	Yes	Yes	Yes	Yes
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1182710	1182710	1182710	1182710
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level level assigned after World Bank classification as of 2000. $DIFF$ is equal to 1 for the diff--erentiated goods (Rauch classification). Standard errors (in parentheses) clustered at exporter-industry-year level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.17: Export unit values and GVCs participation: source sector (2)

	(1) Unit Val.	(2) Unit Val.	(3) Unit Val.	(4) Unit Val.
backward linkage HT	-0.0470***			
	(.00964)			
backward HT x LMI	-0.00602			
	(.00929)			
backward HT x DIFF	-0.0105			
	(.01)			
backward HT x LMI x DIFF	0.00742			
	(.00992)			
backward linkage LT		-0.0505***		
		(.0121)		
backward LT x LMI		-0.000305		
		(.00965)		
backward LT x DIFF		-0.00177		
		(.0119)		
backward LT x LMI x DIFF		0.00569		
		(.0108)		
backward linkage Services			-0.104***	
			(.0134)	
backward Services x LMI			0.241**	
			(.0986)	
backward Services x DIFF			-0.0167	
			(.0121)	
backward Services x LMI x DIFF			0.00979	
			(.0102)	
backward linkage KI Services				-0.0919***
				(.0129)
backward KI Services x LMI				0.398***
				(.0101)
backward KI Services x DIFF				-0.0251**
				(.0119)
backward KI Services x LMI x DIFF				0.0162
				(.0102)
forward linkage	0.0655***	0.0466***	0.0635***	0.0671***
	(.0091)	(.00964)	(.009)	(.00893)
Controls	Yes	Yes	Yes	Yes
Product-Exporter FE	Yes	Yes	Yes	Yes
Product-Year FE	Yes	Yes	Yes	Yes
Observations	1182710	1182710	1182710	1182710
R2-adj.	.91	.91	.91	.91

Dep. variable: natural log of unit values of exports at product-exporter-year level. LMI dummy is equal to 1 for the low and middle income countries. Country development level assigned after World Bank classification as of 2000. $DIFF$ is equal to 1 for the differentiated goods (Rauch classification). KI services stand for the knowledge intensive services (OECD classification). HT and LT label high-tech and low-tech sectors, respectively. Standard errors (in parentheses) clustered at exporter-industry-year level.* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$