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Date *31/01/2014*

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Dedicated to my beloved wife, Meltem.

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Abstract

Structural reforms are at the core of economic policy debates both in developed and developing countries. The purpose of this dissertation is to gain an in depth understanding of economic and political consequences of reforms. It consists of three chapters.

The first chapter draws attention to the lack of research on the short-run effects of structural reforms. This is an important gap since short-run costs associated with reforms may trigger dispute about the implementation of reforms. To this end, I make use of Pooled Mean Group (PMG) estimator in order to disentangle short and long-run impacts of reforms. Results reveal that in developing countries, structural reforms are positively associated with real GDP per capita in the long-run. More importantly, this paper provides policy implications to alleviate the short-run negative effects of reforms. Institutional development and optimal sequencing of reforms make countries benefit from liberalization also in the short-run.

In the second chapter, I investigate the political outcomes of structural reforms in developing countries. Developing countries experienced many reforms, reform reversals, economic and political crises in the last thirty years. However, the electoral consequences of structural reforms have largely been ignored in the literature. My results indicate that on average, being reformist is associated with lower probability of government change. However political impact of reforms is found to differ strongly depending on the macroeconomic structure, political factors and sequencing of reforms. Reformist governments decrease the probability of turnover, if they restore macroeconomic stability, they are strong enough and they take the optimal sequencing of reforms into account.

The third chapter provides a theoretical framework for studying the effects of union on skill acquisition and total output. In the model, I compare the skill acquisition and total output in competitive equilibrium and equilibrium with union which covers only low skilled workers in one out of two industries. I find that union equilibrium leads to greater skill acquisition compared to the perfectly competitive equilibrium if union exists in low-skilled intensive (LSI) industry and the high-skilled intensive (HSI) industry is union free, and vise versa. I then test for the differential effect of unionization across industries. I find evidence that unionization is negatively (positively) associated with total output of LSI (HSI) industry.

Chapter 1

Introduction

This dissertation contributes to the growing literature that studies the impact of structural reforms and labor unions on economic and political outcomes. It consists of three chapters.

The first chapter examines the effects of various types of structural reform on real GDP per capita for developing countries. Developing countries have experienced substantial reforms in the last quarter of twentieth century. The overall trend toward liberalization in international trade and financial sectors has led economists to study whether reforms promote growth and to what extent institutions matter on the relationship between reforms and growth. Since much of the literature concentrates on the long-run impacts of reforms, very less is known about their short-run impacts. Yet, this issue is important since possible short-run losses due to the adjustment costs may trigger dispute about the implementation of reforms. For this reason, I investigate short-run as well as long-run impacts of reforms by employing Pooled Mean Group (PMG) estimator developed by Pesaran et al. (1999). PMG estimator takes into consideration the cross-country heterogeneity and allows obtaining both the short-run and the long-run parameters of the model within the same estimation framework. Despite the short-run coefficients differ across groups; PMG estimator constrains the long-run coefficients to be homogenous over cross countries.

Using PMG estimator I find that international trade, capital account, and domestic financial reforms are positively associated with real per capita GDP in the long-run. One standard deviation increase in current account, trade, capital account and domestic financial reform indices lead to 26%, 7%, 10%, 11% increase in real GDP per capita respectively, over the period 1973-2006. The chapter's main contribution, however, consists in examining the determinants of short-run effects of reforms. Since the applied econometric methodology allows me to estimate the country specific short-run effects of structural reforms on growth, I analyze their relationship with other reforms and institutional development. Estimation results indicate that institutional development; higher property rights for instance, help reforms alleviate the short-run negative effects. Furthermore, I find that the sequence of reforms matter. Developing countries benefit from reforms if

international trade reforms precede financial reforms.

The second chapter concentrates on the electoral consequences of structural reforms, a subject which has largely been ignored in the literature. I test whether structural reforms increase or impair the probability of government turnover in developing countries over the period 1975-2006. I find that on average, being reformist is associated with lower probability of government change. Analyzing each reform separately, suggest that trade reform is negatively and significantly related to government turnover whereas current account, capital account and domestic financial reforms do not have statistical effect on it. However political impact of reforms is found to differ strongly depending on the macroeconomic structure, political factors and sequencing of reforms. First, a volatile economy makes voters punish governments for the reform implementations. Whereas voters reward reformist governments if macroeconomic conditions are stable. Second, findings suggest that stronger reformist governments have more chance to stay in the office compared to the weaker ones. Finally I have provided evidence that reformist governments increase the probability of staying in power if optimal sequence of reforms is taken into account. In particular, voters reward reformist governments if international trade reforms precede financial reforms.

The third chapter analyzes the effects of unions on skill acquisition and total output by developing a two-sector, two-labor general equilibrium model in an economy with dual labor market, heterogeneous agents, and human capital investment. I first develop a competitive equilibrium model, in which skill acquisition is a positive function of skill premium. Then I develop the union model, in which low skilled workers in one sector unionized while the labor market for low skilled workers in the other sector remains perfectly competitive. By comparing the skill acquisition in the competitive equilibrium model and union model, I find that whether skill acquisition is lower or greater in the latter case depends on the type of the industry that union is present. More precisely, if union exists in low-skilled intensive (LSI) industry and the high-skilled intensive (HSI) industry is union free, I find that union equilibrium leads to greater skill acquisition compared to the perfectly competitive equilibrium. On the contrary, if union is present in HSI industry and low skilled workers in LSI are not covered by union, then the equilibrium skill acquisition is less compared to the competitive equilibrium. More importantly, the associated skill acquisition leads to differential effect on total output. Higher skill acquisition makes HSI industry grow and LSI industry contract. Lower skill acquisition; however, is related to greater output of LSI industry and lower output of HSI industry as there are less high skilled workers in the economy. Once the theoretical framework is set up and the predictions are made, I employ the skill intensity measures of industries in order to test for the differential effect of unionization across industries. The estimates imply that, the value added share difference between an industry at the 75th percentile of the skill intensity distribution and an industry at the 25th percentile is 1.07% in an industry at

the 75th percentile of the union density share distribution with respect to an industry at the 25th percentile.

Chapter 2

Structural Reforms and Growth in Developing Countries

Abstract

This paper investigates the effects of various types of structural reforms on real per capita GDP in the short and long-run by employing Pooled Mean Group (PMG) approach of Pesaran et al. (1999). The PMG methodology allows short-run coefficients, speeds of adjustment and error variances to differ across groups, while constraining long-run coefficients to be homogenous over cross-sectional units. I find that during the period 1973-2006, there is a positive long-run relationship between international trade reforms, financial (capital account, and domestic finance) reforms and real per capita GDP. My results also indicate that letting international trade reforms precede financial reforms contribute positively to short-run growth. More importantly, the adverse effects of reforms in the short-run can be mitigated by improving property rights and contract enforcement. Therefore, promoting institutional quality is a prerequisite for reforms to be successful.

Keywords: Growth, Structural Reforms - Current Account, Trade, Capital Account, Domestic Finance -, Pooled Mean Group Estimator.

JEL Classification Numbers: C23, O16, O24, O40.

2.1 Introduction

The last quarter of twentieth century has witnessed a dramatic decrease of restrictions in a number of areas such as international trade, capital account, and domestic financial sector in developing countries. Growth impacts of these reforms at large on the economy have long been investigated. Since the research to date focuses on the long-run impacts

of structural reforms, much less is known about their short-run effects. Yet, this issue is important since possible short-run losses due to the adjustment costs may trigger dispute about the implementation of reforms.

Is there any difference between short-run and long-run effects of reforms? Are reforms harmful in the short-run? What are the policy implications to alleviate the short-run costs of the reforms? In order to answer these questions, this paper employs Pooled Mean Group (PMG) estimator developed by Pesaran et al. (1999). PMG estimator takes into consideration the cross-country heterogeneity and allows obtaining both the short-run and the long-run parameters of the model within the same estimation framework. Despite the short-run coefficients differ across groups, PMG estimator constrains the long-run coefficients to be homogenous over cross countries. This feature of the estimator is crucial for the research question of the paper since short-run adjustment to the reforms might depend on country-specific characteristics such as policy regimes and market imperfections. On the other hand, I expect the long-run relationship between structural reforms and growth to be homogeneous across countries.

In this paper, I endeavor to make a number of contributions to the empirical literature. First of all, I analyze various types of structural reforms on growth. Hence it is possible to detect which reforms work in which direction. Secondly, in contrast to most of the previous studies, I distinguish the effects of reforms in the short and the long-run. Thirdly, by using the short-run coefficients, I investigate the determinants of growth effects of liberalizations. Considering the possible adjustment costs of reforms, it is crucial to examine what the policy implications to mitigate the detrimental effects of liberalizations in the short-run are.

The main findings can be summarized as follows. In the long-run, international trade, capital account, and domestic financial reforms are positively related to real per capita GDP. Moreover the positive long-run relationship between reforms and growth is robust to inclusion of *de facto* measures of reforms and quality of democracy variable. Having identified the long-run relationship, I take the short-run coefficients of the reforms for each country and analyze their determinants. Results indicate that, stimulating institutions preceding reforms is a prerequisite in order to mitigate the adverse short-run impacts. It is also worth noting that, countries gain from international trade reform already in the short-run provided that they are financially more closed. Therefore, the second part of the paper sheds some light on the optimal sequencing of reforms issue.

The paper is organized as follows. Section 2.2 gives a brief review of the relevant literature, while section 2.3 describes the data set used and the econometric methodology applied following the descriptive analysis. In section 2.4, I initially discuss the long-run impacts of liberalizations. Then I make use of the country-specific short-run effects of liberalizations on growth and analyze their determinants. Finally, section 2.5 offers some concluding remarks.

2.2 Related Literature

I am certainly not the first to investigate the relationship between structural reforms and economic growth[1]. Most closely related in motivation to this paper are Kaminsky and Schmukler (2008) and Bussiere and Fratzscher (2008). Kaminsky and Schmukler (2008) construct a new data set of financial liberalization for twenty-eight countries, which captures deregulation of the domestic banking industry, removal of controls on international capital flows, and the liberalization of the domestic stock market. They find that although larger booms follow liberalization in both emerging and mature economies, financial crashes are severe only for the former ones. In both groups, financial liberalization is associated to more stable financial markets in the long-run. Furthermore, institutional quality improves following the liberalization, which is argued by the authors as the reason for long-run gain from liberalization.

Bussiere and Fratzscher (2008) examine short and long-run impacts of capital account liberalization for forty-five emerging and developed economies. They find evidence that countries grow more rapidly immediately after liberalization thanks to the increase in portfolio investments and debt inflows. On the contrary, growth rate returns to or even below its pre-liberalization rate in the long-run.

My paper differs from these two contributions in several important respects. First, I examine the effects of a broad set of reforms; international trade, capital account and domestic financial reforms instead of concentrating only one of them. Second my data set has higher dimensions in terms of both country and year. Though Kaminsky and Schmukler (2008)'s data set has some informational advantages, it is available only for a small set of countries. Therefore it is difficult to draw a broad conclusion. Bussiere and Fratzscher (2008) on the other hand, analyze only the time period from 1980 to 2002 for forty-five countries. A possible drawback in their analysis is that, while many developing countries deregulated their capital accounts after the second half of 1980s, developed countries had already started in 1970s. Thus, their results are likely to suffer from low time dimension of the data. Third, while their methodology makes it possible to differentiate the short and long-run impacts, it does not allow one to go further. In contrast, by employing PMG estimator, I obtain the short-run effects of liberalization for each country and then investigate how to mitigate the adverse effects of liberalization in the short-run. In this way, the empirical results provide policy implications for governments in order to prevent possible economic contraction following liberalization.

Looking at wider literature, Slaughter (2001) applies difference-in-differences approach to study the relationship between trade liberalization and per capita income convergence. He considers four different liberalization events: formation of the European Economic

[1]See, for instance, Levine (1997) and Henry (2007) for an extensive survey of the finance-growth nexus and macroeconomic impacts of capital account liberalization.

Community (EEC); formation of the European Free-Trade Area (EFTA), liberalization between the EEC and EFTA, and the Kennedy round of the General Agreement on Tariffs and Trade (GATT). He finds no systematic convergence between liberalization and per capita income, instead, he suggests that trade liberalization diverges incomes among the liberalized countries. Wacziarg and Welch (2008) update the economic liberalization indicator by Sachs et al. (1995) and analyze the relationship between trade liberalization and growth. Their within-country estimates suggest that over the 1950-1998 term, countries experienced average annual growth rate about 1.5 percentage points, investment rates 1.5-2.0 percentage points, and openness ratio about 5 percentage points higher in the post liberalization period.

DeJong and Ripoll (2006) provide evidence of the favorable effects of trade liberalization on economic growth only among the rich countries. Poor countries, however, take advantages of higher trade barriers. According to their results, a 10 percentage point rise in tariff rates induces 1.6 percentage point decrease and 1.3 percentage point increase in per capita growth rate, among the countries in the top and bottom quarter of world's income distribution respectively. Due to the heterogeneous effects, they argue that developing countries should consider different economic policies than the developed ones. A recent study by Billmeier and Nannicini (2012), on the other hand, points out the weaknesses of the existent empirical evidences for the trade liberalization-growth relationship and apply the synthetic control method, which uses the linear combination of comparison units to the treated economy as counterfactual. Employing the binary indicator of Wacziarg and Welch (2003) and Wacziarg and Welch (2008) over the period 1963-2000, they show that liberalization led to higher income per capita for many countries. However, many African countries which had liberalization in the 1990s did not benefit from these reforms.

Regarding the relationship between capital account liberalization and growth, Quinn and Toyoda (2008) argue that the inconsistent results of the earlier studies stem from the measurement error or the time periods examined. The main premise of the study is that, their new de jure variable - extended version of Quinn (1997) - has informational advantages over the IMF's binary 0, 1 indicator. The latter treats completely closed (open) or substantially closed (open) countries in the same way, whereas the former takes into account the existence (absence) of restrictions, and the severity or magnitude of those restrictions as well. They point out that capital account liberalization has positive and significant relationship with growth, including different country groups and sub periods. Bekaert et al. (2005) argue that equity market liberalization leads to an approximate 1 percent increase in annual real per capita GDP growth. The positive and significant effect of equity market liberalization is robust to inclusion of usual control variables in economic growth regressions, and capital account openness. Moreover, exploiting Quinn's capital account measure, they suggest that capital account liberalization is also significantly and

positively associated with per capita GDP growth.

Prati et al. (2013) study the relationship between different types of structural reforms and growth. By analyzing trade, capital account, and domestic financial reform over the period 1973-2006, they find that reforms are on average positively associated with growth. Moreover, they remark the heterogeneity of the results depending on the distance to the technological frontier and the level of institutional structure. They conclude that reforms are more effective when markets and institutions are not at their infancy but at a somewhat more advanced stage in the process of development.

Bonfiglioli (2008) takes a different approach and draws attention to the channels through which international financial integration effects economic growth. Applying system GMM estimation, she concludes that financial liberalization has positive and significant relationship with total factor productivity (TFP), whereas it does not have any significant effect on capital accumulation. Thus she suggests that, the former is the driving factor of the cross-country differences in economic growth rather than the latter. Stiglitz (2000), on the other hand, casts doubts on the common wisdom that capital account liberalization leads to higher output and greater efficiency. He argues that capital markets are essentially different from goods and services markets. Since the main function of the former is information gathering, information imperfections causes different results in the case of capital market liberalization. Moreover, Stiglitz (2000) points out that capital market liberalization is detrimental to economic growth as it causes higher volatility and higher frequency of crises, which makes investments less attractive.

It is worth stressing that I investigate the short and long-run impacts of liberalization in a unified econometric framework. While the PMG methodology that I employ has been used in a number of studies, no previous study has used this methodology to examine the effects of structural reforms.

2.3 Data and Econometric Methodology

In this section, I describe the data set used in the estimations and spell out the methodological strategy following the descriptive analysis.

2.3.1 Data

The paper employs a rich *de jure* data set of reforms including real and financial sectors, which consist of yearly observations for 33 developing countries during the period 1973-2006 and other important determinants of growth such as government consumption, and lack of price stability[2]. The first reform I consider is international trade, which is measured

[2]Government consumption variable is used as ratio to GDP, and lack of price stability is defined as $\log(1 + \Delta \text{ CPI})$ as in Aghion et al. (2009), and Cavalcanti et al. (2012).

by average tariff rates and restrictions on current account transactions.

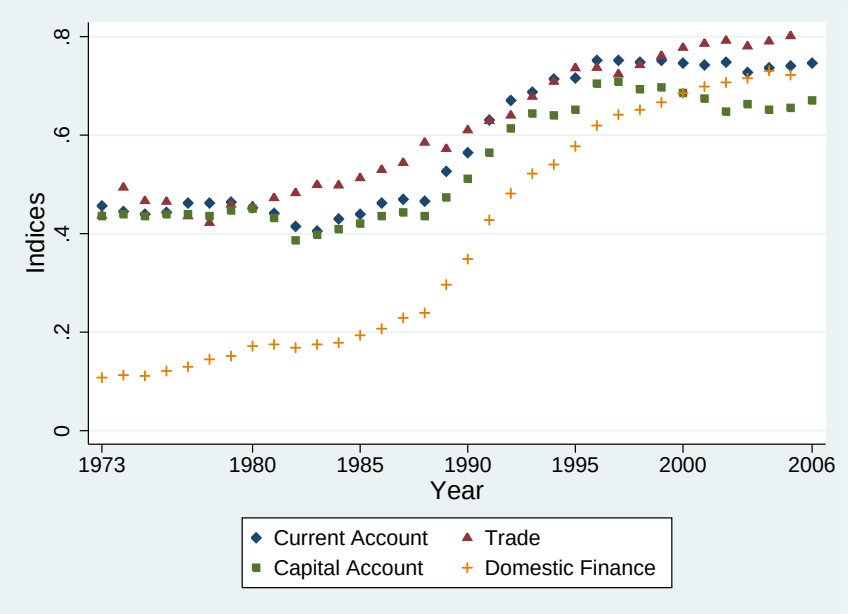
There are two financial sector reforms; domestic financial reform and capital account reform. The domestic financial reform index is derived from Abiad et al. (2009). The index is constructed as the average of six sub-indices: (i) credit controls, such as subsidized lending and directed credit; (ii) interest rate controls, such as floors, ceilings or interest rate bands; (iii) entry barriers, such as restrictions on the participation of foreign banks, and restrictions on the scope of the banks' activities; (iv) the degree of state ownership in the banking sector; (v) the quality of banking supervision and regulation, such as risk-based capital adequacy ratios based on the Basle I capital accord, and independent banking supervisory agency; (vi) securities market policy, which includes the auctioning of government securities, establishment of debt and equity markets, and policies to encourage development of these markets, such as tax incentives or development of depository and settlement systems. The capital account reform index measures a broad set of restrictions on financial transactions for residents and non residents, as well as the use of multiple exchange rates.

Each reform variable is a continuous variable between 0 and 1, with a higher values indicating greater degree of liberalization and expected to have a positive relationship with growth. Using indices instead of binary dummy variables makes the study more convenient since the former are able to capture the intensity of liberalizations and they are much better measure for the timing and magnitude of policy changes.

2.3.2 Descriptive Statistics

Figure 2.1 depicts how structural reform indices have changed over time. In the last thirty years, developing countries have chosen to eliminate rigidities in all four areas. Thanks to the gradual lifting of restrictions, indices of liberalization in current account, trade, capital account, and domestic financial market increased from initial values of 0.45, 0.43, 0.43, and 0.10 to 0.74, 0.80, 0.65 and 0.72 respectively. It is also worth noting that developing countries experienced reform reversals in the beginning of 1980s in almost all areas of reforms, but the liberalization attempts proceeded from the late 1980s.

Figure 2.1: Structural Reform Indices

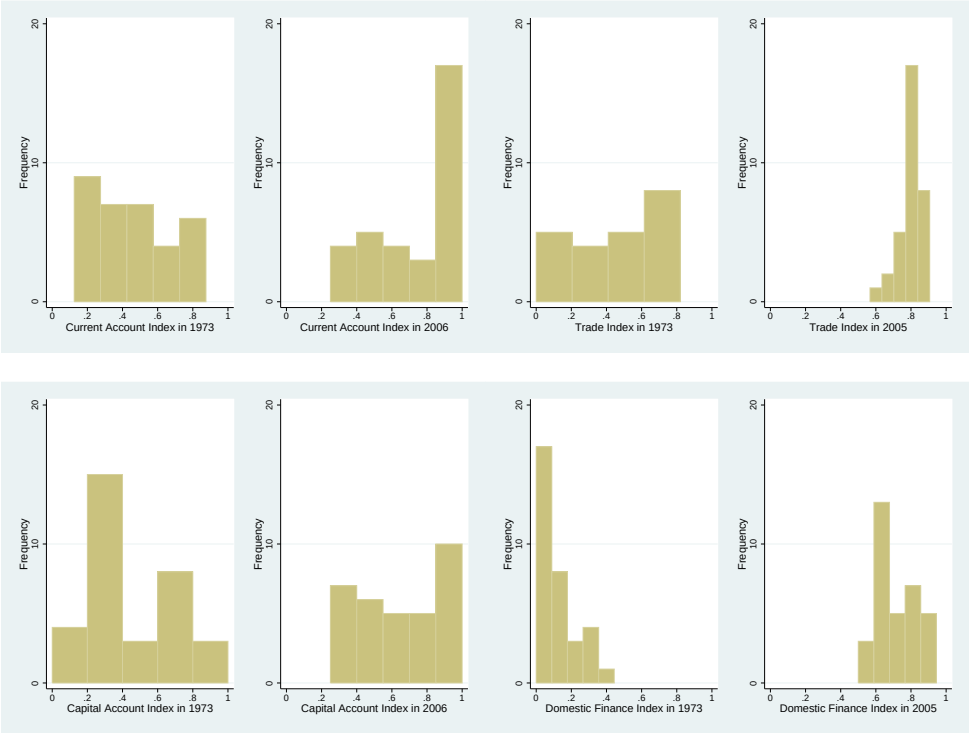


Source: IMF estimations.

Figure 2.2 displays the structural reform indices in the beginning and end of the sample period. By the mid of the 2000, most countries have fully open current and capital accounts. Despite there are still some restrictions in international trade and domestic financial market, they are much less compared to the initial years.

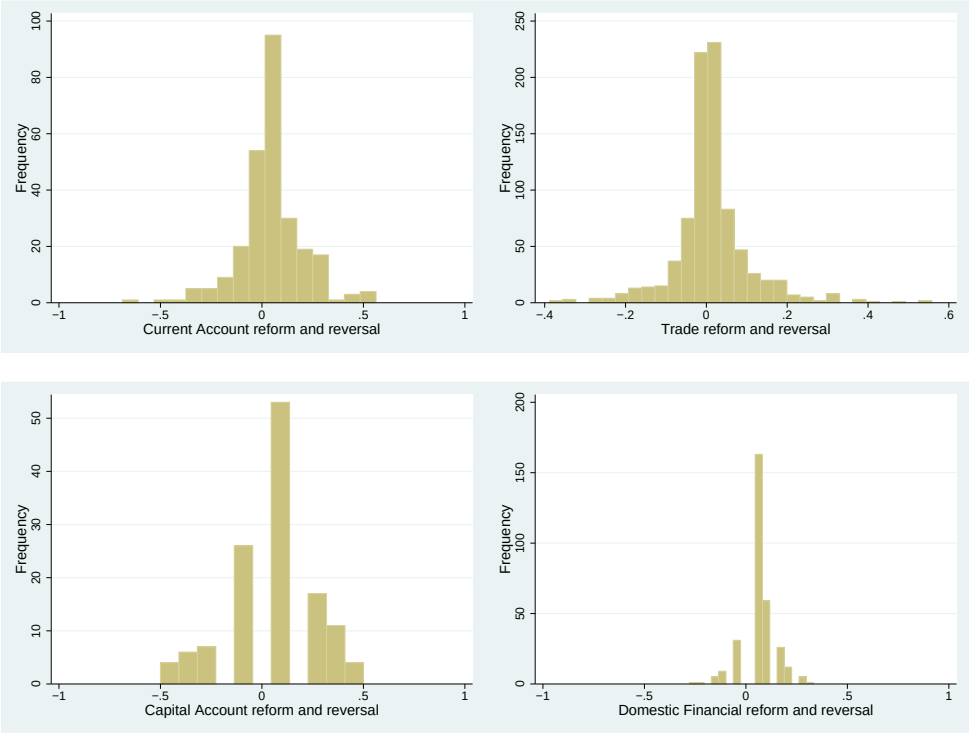
The cases of reform and reversal, which are defined as the difference of indices, are depicted in figure 3. There are many reform failures in current account, trade and capital account as we have seen before. In 1980s, developing countries re-introduced restrictions in the aftermath of 1982 debt crisis (Kaminsky and Schmukler, 2008), but these controls were temporary and eliminated from the end of 1980s. On the other hand, reform reversals in domestic financial sector are much less than the others and limited only to some least developed countries.

Figure 2.2: Structural Reform Indices



Source: IMF estimations.

Figure 2.3: Structural Reforms and Reversals



Source: IMF estimations.

Table 2.1 shows the summary statistics of the variables analyzed in the empirical section. The per capita GDP growth rate equals 1 percent annually over the sample period. Current account, trade and capital account reforms have very similar mean, however domestic finance is less than the former.

Table 2.1: Summary Statistics

Variables	**Observation**	**Mean**	**Std. Dev.**	**Min**	**Max**
Real per capita GDP growth	1122	0.01	0.04	-0.19	0.20
Current Account	1122	0.58	0.26	0.125	1
Trade	1027	0.61	0.24	0	0.94
Capital Account	1122	0.54	0.25	0	1
Domestic Finance	1089	0.38	0.27	0	0.94
Inflation	1082	4.63	0.34	4.57	4.88
log (Government Consumption/GDP)	1111	2.47	0.35	1.09	3.54

Table 2.2 reports the pair-wise correlations between growth, different reform indices, inflation and the ratio of government consumption to GDP. I find that real per capita GDP growth is positively and significantly correlated with the three indices of structural

reforms, in particular the current account reform, capital account reform and domestic financial reform. On the other hand, the correlation between trade reform and growth is negative. Furthermore, reform variables are highly correlated among each other; suggesting the less restriction in one area is related with less restriction on other areas as well. Concerning the control variables, both inflation and the ratio of government consumption to GDP are negatively related with growth though the former is statistically insignificant. It is also worth noting that the positive and statistically significant relationship between inflation and each reform provides evidence that macroeconomic instability is associated with reform implementation.

Table 2.2: Bivariate Correlations

Correlations	Growth	Current Account	Trade	Capital Account	Domestic Finance	Inflation	log (Government Consumption/GDP)
Growth	1						
Current Account	0.07	1					
	(0.01)						
Trade	-0.09	0.47	1				
	(0.00)	(0.00)					
Capital Account	0.05	0.79	0.38	1			
	(0.07)	(0.00)	(0.00)				
Domestic Finance	0.03	0.55	0.54	0.44	1		
	(0.30)	(0.00)	(0.00)	(0.00)			
Inflation	-0.00	0.30	0.31	0.26	0.43	1	
	(0.87)	(0.00)	(0.00)	(0.00)	(0.00)		
log (Government	-0.06	-0.19	-0.02	-0.12	0.05	-0.06	1
Consumption/GDP)	(0.02)	(0.00)	(0.42)	(0.00)	(0.06)	(0.03)	

Note: p-values are in parentheses.

2.3.3 Empirical Specification

Most of the studies in the literature employ five or ten year averaging in order to examine the long-run effect of structural reforms on growth[3]. Though using non-overlapping five-ten year intervals has been a common practice in the literature, one should consider that it causes a loss of information, and it is not obvious that averaging over fixed-length intervals effectively eliminates business cycle fluctuations (Loayza and Ranciere, 2006).

Instead of the common practice, in this study I make use of auto-regressive distributed lag model (ARDL), which can be defined in the following way:

$$y_{it} = \mu_i + \sum_{j=1}^{p} \lambda_{ij} y_{t-j} + \sum_{j=0}^{q} \xi'_{ij} X_{it-j} + \varepsilon_{it}, \tag{2.1}$$

where $i = 1, 2, ..., N$ indicates the cross-sections (groups); $t = 1, 2, ..., T$ the time periods, X_{it} is $kx1$ vector of explanatory variables for group i, μ_i represents the fixed effects; the coefficients of the lagged dependent variables λ_{ij}, are scalars and ξ'_{ij} are $kx1$ coefficient vectors.

By re-parametrization, equation (2.1) can be written as:

$$\Delta y_{it} = \mu_i + \varphi_i y_{it-1} + \beta'_i X_{it} + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{it-j} + \sum_{j=0}^{q-1} \xi^{*'}_{ij} \Delta X_{it-j} + \varepsilon_{it}, \tag{2.2}$$

where $\varphi_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$; $\beta_i = \sum_{j=0}^{q} \xi_{ij}$;
$\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}, j = 1, 2, ..., p-1$, and
$\xi^*_{ij} = -\sum_{m=j+1}^{p} \xi_{im}, j = 1, 2, ..., q-1$.

Finally, error correction parametrization of the equation (2.2) is:

$$\Delta y_{it} = \mu_i + \varphi_i (y_{it-1} - \theta'_i X_{it}) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{it-j} + \sum_{j=0}^{q-1} \xi^{*'}_{ij} \Delta X_{it-j} + \varepsilon_{it}, \tag{2.3}$$

where $\theta_i = -(\beta_i/\varphi_i)$ defines the long-run equilibrium relationship between y_{it} and X_{it}. Whereas, λ^*_{ij} and $\xi^{*'}_{ij}$ are the short-run coefficients relating growth to its past values and other determinants X_{it}. φ_i represents the speed of adjustment coefficient which measures the speed at which the values of y_{it} and X_{it} come back to equilibrium levels, once they violate the long-run equilibrium relationship. A negative and significant φ_i confirms that there exits a long run relationship between y_{it} and X_{it}, which is the evidence of cointegration between these variables. It also asserts that if y_{it} had previously been larger

[3]See, for example Bekaert et al. (2005), Bonfiglioli (2008), DeJong and Ripoll (2006), and Quinn and Toyoda (2008) among others.

than X_{it}, then that causes y_{it} to be lower for any given values of the other explanatory variables. The larger the value of φ_i the stronger is the response of the variable to the previous period's deviation from long-run equilibrium. On the contrary, in the case of low adjustment coefficient, any deviation from long-run equilibrium of the value of y_{it} and X_{it} requires a much longer time for the equilibrium to get restored. Finally, the long run coefficients on X_{it}, defined by $\theta_i = -(\beta_i/\varphi_i)$ above, are restricted to be the same across countries. The long-run homogeneity restriction can be tested:

$$H_0 : \theta_i = -(\frac{\beta_i}{\varphi_i}) = \theta. \tag{2.4}$$

using the Hausman statistic.

Lag selection in the ARDL model can be performed with different methods such as Schwarz-Bayesian Criterion (SIC) or Akaike Information Criterion (AIC). However, as I am also interested in analyzing short run parameters of the model, it is recommended to employ common lag structure across countries chosen in accordance to the model and data limitations (Loayza and Ranciere, 2006). Following this suggestion, this paper sets $p = 2$ and $q = 1$ and therefore has the following error correction equation[4]:

$$\Delta y_{it} = \mu_i + \varphi_i(y_{it-1} - \theta_i' X_{it}) + \gamma_1 \Delta y_{it-1} + \xi_1' \Delta X_{it} + \varepsilon_{it}, \tag{2.5}$$

where Δy_{it} is the annual growth rate of real GDP per capita for country i and year t, X_{it} is the vector of explanatory variables, namely current account reform, trade reform, capital account reform, domestic financial reform and the control variables.

There are various methods to estimate the above model. Dynamic fixed effects (DFE) specification, for instance, can be estimated by least-squares dummy variable (LSDV), instrumental variables or generalized methods of moments (GMM). DFE specification typically imposes all slope coefficients to be equal across countries but allows for different country intercepts. Namely, DFE imposes $(N-1)(2k+2)$ restrictions on the unrestricted model in equation (2.5), i.e. k long-run coefficients, k short-run coefficients plus the convergence coefficient and the common variance. However, Pesaran et al. (1999) point out that DFE estimators can produce inconsistent, and potentially misleading estimates of the average values of the parameters in dynamic panel data models unless the slope coefficients are exactly identical.

An alternative strategy would be to adopt mean group (MG) estimator introduced by Pesaran and Smith (1995), which imposes no cross-country parameter restrictions. MG estimator runs ARDL equations separately and calculates the mean of the short and long-run parameters across groups by the simple arithmetic average of the country specific

[4]Most importantly, other lags are found to be insignificant, and therefore they only cause to loss of degrees of freedom.

coefficients. Though MG estimator can provide consistent estimates, it depends on quite strong assumptions and does not take into account that certain parameters may be the same across groups.

In this study I make use of Pooled Mean Group (PMG) estimation developed by Pesaran et al. (1999). It is an intermediate path between DFE and MG estimators since it includes both pooling and averaging. PMG is a maximum likelihood based approach and it allows the intercepts, short-run coefficients, and the error variances to differ across groups, but constrains the long-run coefficients to be homogenous over the cross sectional units. In other words, the PMG imposes $(N-1)k$ restrictions on the unrestricted model shown in equation (2.5). Furthermore, PMG estimator produces consistent estimates of the short-run coefficients across countries by taking the simple average of individual country coefficients. This feature of the estimator is crucial for the research question of the paper since short-run adjustment to the reforms might depend on country specific characteristics such as policy regimes and market imperfections. On the other hand, I expect that the long-run relationship between economic reforms and growth is homogenous across countries.

As put forth in Catão and Solomou (2005), the main benefit of working with PMG structure is that of mitigating the contemporaneous feedback and reverse causality running from the dependent variable to the independent variables. Moreover, this approach allows for heterogeneity in the adjustment dynamics across countries, since the parameters in the above equation are not constrained to be the same across countries. Most important, PMG estimator does not require pre-testing for the presence of unit roots in the variables. Pesaran et al. (1999) derive the asymptotic distributions of the stationary and nonstationary variables, and show consistency of the PMG estimator under each case. PMG estimation provides consistent and efficient estimates of parameters between stationary and integrated variables, provided that there is a unique vector defining the long run relationship among the variables involved (Catão and Solomou, 2005).

It is worth noting that obtaining consistent and efficient PMG estimator requires several conditions to be satisfied. Firstly, the time dimension has to be long enough for the estimation of the model for each cross-sections separately. To this end, I include only countries for which I have at least 30 consecutive observations. Secondly, the lag order must be chosen to ensure that the residuals of the error correction model are serially uncorrelated, but it should not cause loss of degrees of freedom as well. Taking into consideration the latter point, this paper sets $p = 2$ and $q = 1$ as mentioned above.

Thirdly, PMG assumes cross-sectional independence of the regression residuals ε_{it}. Arising from omitted common effects (e.g. time-specific effects or common global shocks affecting countries), cross-sectional dependence influences the countries ARDL process and causes misspecification. Pesaran et al. (1999) offer either to use cross-sectional means

of the existent regressors as additional regressors[5] or include all of the variables as deviations from their respective cross-sectional means in each period. In this paper, I chose to follow the second procedure to eliminate the common factors.

The fourth condition is the existence of long-run relationship between the variables and it requires a negative and significant error correction term (φ_i). Finally, PMG estimator is both consistent and efficient if and only if the long-run parameters are homogenous across countries.

2.4 Empirical Results

I report PMG, MG and DFE estimates as well as the Hausman test statistic which applied to the difference between PMG and MG estimators in order to test the long-run homogeneity restrictions. The MG estimator is consistent, albeit inefficient if the restrictions are valid. In this case, PMG estimator outperforms MG estimator in terms of efficiency since it exploits the common economic features across countries. On the other hand, the PMG estimator will be inconsistent when the true long-run parameters are heterogenous. Under the null hypothesis that cross-section parameters are homogenous in the long-run, Hausman test statistic must have high p-value in order to confirm the superiority of the PMG estimator over MG estimator.

Table 2.3 presents the estimation results of current account liberalization. In all the three estimates, the error correction terms fall into the dynamically stable range. This ensures that there exists strong evidence for cointegration between the explanatory variables and per capita GDP. Long-run coefficients are insignificant in MG estimation due to the high standard errors. The current account coefficient of DFE estimation is significant, and close to the PMG estimation coefficient as magnitude. Furthermore, the long run homogeneity restriction cannot be rejected at conventional levels by the Hausman statistic. Therefore we focus on the results obtained by using the PMG estimation.

According to the results of PMG estimation, the speed of adjustment from the deviation in the long run relationship between current account liberalization and per capita GDP is -0.124. The model implies high adjustment inertia; it converges to the equilibrium, with a 12.5 percent of discrepancy corrected in each period.

I find that current account reform is positively and significantly linked to real per capita GDP in the long-run. A one standard deviation rise in current account index is associated with an estimated increase of the per capita GDP by almost 26 percent for a developing country[6]. Finally, inflation is found to be insignificant; however, government consumption is, as expected, adversely related to the GDP per capita in the long-run.

[5]See Cavalcanti et al. (2012) for this method.

[6]In order to interpret the effects of current account, and later trade, capital account and domestic financial reform, I multiply each coefficient with standard deviations shown in table 1.

Table 2.3: Current Account Liberalization and Growth

	(1) PMG	(2) MG	(3) DFE
Long Run Coefficients			
Current Account	1.032***	0.514	1.021***
	(0.09)	(1.291)	(0.25)
Inflation	0.246	16.916	-1.738
	(0.301)	(13.780)	(1.09)
Government Consumption	-0.134***	0.049	0.152
	(0.056)	(0.789)	(0.190)
Error Correction Coefficient	-0.124***	-0.302***	-0.157***
	(0.025)	(0.038)	(0.04)
Short Run Coefficients			
Growth (-1)	0.014	0.015	0.038*
	(0.490)	(0.026)	(0.02)
Δ Current Account	0.439*	0.351**	0.493***
	(0.223)	(0.177)	(0.138)
Δ Inflation	0.199	0.249	0.213
	(0.332)	(0.351)	(0.213)
Δ Government Consumption	0.125*	0.221***	0.16
	(0.109)	(0.085)	(0.123)
Observations	1006	1006	1006
Joint Hausman Test		6.29	
		[0.10]	

Notes: The dependent variable is real GDP per capita. All regressions include a constant. Standard errors in parentheses. The p-value is presented next to the corresponding h-test in square-brackets. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

The short-run coefficient of current account reform is positive and significant, suggesting that on average, eliminating the restrictions on current account transactions stimulate the economic growth also in the short-run. A one standard deviation increase in the current account variable leads to 0.1 percentage point increase in real per capita GDP growth rate on impact.

Table 2.4 reports the estimations of the impact of trade liberalization on real per capita GDP. As in the case of current account reform, error correction coefficients are significantly negative and therefore there exists a long-run relationship. Although it is insignificant owing to high standard error, The DFE estimate of trade is very close to the

PMG estimate. Since the long-run homogeneity restriction is not rejected by Hausman test, once again I concentrate on PMG estimation results.

Table 2.4: Trade Liberalization and Growth

	(1) PMG	(2) MG	(3) DFE
Long Run Coefficients			
Trade	0.277***	-0.270	0.2661
	(0.04)	(0.899)	(0.385)
Inflation	-0.58***	0.146	1.2958
	(0.224)	(1.772)	(1.472)
Government Consumption	-0.007	-1.009	0.1817
	(0.27)	(0.911)	(0.237)
Error Correction Coefficient	-0.165***	-0.347***	0.145***
	(0.036)	(0.044)	(0.043)
Short Run Coefficients			
Growth (-1)	0.022	-0.017	0.0406***
	(0.031)	(0.03)	(0.0175)
Δ Trade	0.224**	0.146*	0.4364***
	(0.105)	(0.068)	(0.153)
Δ Inflation	0.489	0.373	0.179
	(0.406)	(0.361)	(0.337)
Δ Government Consumption	0.200*	0.099	0.1303
	(0.111)	(0.092)	(0.123)
Observations	896	896	896
Joint Hausman Test		3.08	
		[0.38]	

Notes: The dependent variable is real GDP per capita. All regressions include a constant. Standard errors in parentheses. The p-value is presented next to the corresponding h-test in square-brackets. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

In the long-run, a one standard deviation increase in the trade index leads to 7 percent increase in GDP per capita. The control variables have expected negative signs but only inflation is significantly related to real GDP per capita.

Regarding the short-run, the trade reform has positive and significant effect on impact. A one standard deviation rise in trade index raises real per capita GDP by 0.05 percent. As in the case of current account liberalization, government consumption raises the growth rate in the short-run.

Table 2.5: Capital Account Liberalization and Growth

	(1) PMG	(2) MG	(3) DFE
Long Run Coefficients			
Capital Account	0.432***	0.593	0.9016***
	(0.074)	(0.460)	(0.266)
Inflation	-0.226	-1.280	-1.361
	(0.203)	(1.286)	(1.142)
Government Consumption	0.033	-0.056	0.087
	(0.034)	(0.236)	(0.20)
Error Correction Coefficient	-0.12***	-0.36***	-0.14***
	(0.027)	(0.056)	(0.04)
Short Run Coefficients			
Growth (-1)	0.034	0.034	0.044
	(0.024)	(0.025)	(0.021)
Δ Capital Account	0.547***	0.404***	0.47***
	(0.188)	(0.352)	(0.16)
Δ Inflation	0.203	0.333	0.38*
	(0.288)	(0.293)	(0.23)
Δ Government Consumption	0.183*	0.157**	0.16
	(0.10)	(0.092)	(0.12)
Observations	973	973	973
Joint Hausman Test		1.58	
		[0.66]	

Notes: The dependent variable is real GDP per capita. All regressions include a constant. Standard errors in parentheses. The p-value is presented next to the corresponding h-test in square-brackets. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

The estimation results of capital account liberalization are reported in table 2.5. The error correction coefficients are significantly negative and within the unit circle, implying that there exists a long-run equilibrium relationship for PMG, MG and DFE estimates. On the basis of the Hausman test it is not possible to reject the hypothesis of that the PMG estimators are consistent and more efficient than the MG ones. The findings indicate that there is a positive and significant relationship between capital account liberalization and real GDP per capita both in the short and long-run. Considering the latter case, a one standard deviation increase in capital account index leads to 10 percent increase in real GDP per capita.

Table 2.6 displays the estimation results of domestic financial liberalization. The error correction terms are negative and significant; hence the null hypothesis of no long-run relationship is rejected. Furthermore, Hausman test indicates that the PMG estimators are consistent and more efficient than the MG ones. The results suggest that a one standard deviation increase in domestic finance index leads to 11 percent increase in real GDP per capita in the long-run. The long-run coefficients of the control variables have expected signs, however only inflation has significant effect. Finally, domestic financial reform has also positive effect on growth rate of real GDP per capita in the short-run.

Table 2.6: Domestic Financial Liberalization and Growth

	(1) PMG	(2) MG	(3) DFE
Long Run Coefficients			
Domestic Finance	0.404***	0.399	0.6021***
	(0.057)	(0.447)	(0.215)
Inflation	-0.941***	-3.920	-1.2038
	(0.333)	(4.632)	(1.63)
Government Consumption	-0.046	0.297	0.17
	(0.04)	(0.314)	(0.25)
Error Correction Coefficient	-0.12***	-0.303***	-0.14***
	(0.03)	(0.047)	(0.04)
Short Run Coefficients			
Growth (-1)	-0.005	-0.004	0.0358***
	(0.022)	(0.027)	(0.015)
Δ Domestic Finance	0.359**	0.304	0.543***
	(0.177)	(0.352)	(0.16)
Δ Inflation	-0.017	-0.051	-0.224
	(0.184)	(0.186)	(0.37)
Δ Government Consumption	0.082	0.098	0.08
	(0.06)	(0.092)	(0.127)
Observations	941	941	941
Joint Hausman Test		2.67	
		[0.44]	

Notes: The dependent variable is real GDP per capita. All regressions include a constant. Standard errors in parentheses. The p-value is presented next to the corresponding h-test in square-brackets. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

As I stated before, one of the conditions for consistent and efficient PMG is serially

Table 2.7: Economic Liberalizations and Growth

	(1)	(2)	(3)	(4)
Long Run Coefficients				
Current Account	0.656***			
	(0.099)			
Trade		0.275***		
		(0.032)		
Capital Account			0.402***	
			(0.062)	
Domestic Finance				0.776***
				(0.037)
Inflation	0.095	-0.482***	-0.852***	-0.182
	(0.367)	(0.149)	(0.342)	(0.162)
Government Consumption	-0.576***	-0.023	0.075	-0.270***
	(0.078)	(0.024)	(0.045)	(0.029)
Error Correction Coefficient	-0.175***	-0.311***	-0.161***	-0.217***
	(0.043)	(0.062)	(0.042)	(0.054)
Observations	1006	1006	1006	1006
Joint Hausman Test	6.02	1.03	0.48	10.51
	[0.11]	[0.77]	[0.92]	[0.01]

Notes: The dependent variable is real GDP per capita. All regressions include a constant. Standard errors in parentheses. The p-value is presented next to the corresponding h-test in square-brackets. Lag selection is carried out according to SBI criterion. All specifications are estimated by PMG. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

uncorrelated residuals, which requires appropriate lag selection. To test whether choosing the ARDL model by an optimal information criteria rather than imposing specific lag lengths significantly changes previous results, I estimate the baseline regressions in which lags are chosen on the basis of SIC and are allowed to vary across countries. Table 2.7 provides the PMG estimation output. The estimates for short-run coefficients are not reported for brevity. Results indicate that in all of the estimations, the error correction terms are negative and significant, suggesting that there is a long-run relationship between real GDP per capita and its determinants; structural reforms as well as the control variables. As in the previous tables, reforms have the expected positive impacts on real GDP per capita. All of the reform variables are highly statistically significant and positively signed. However in column 4, the long run homogeneity restriction cannot be rejected at conventional levels by the Hausman statistic. Considering the economic magnitudes of reforms under optimal lag selection, I find that a one standard deviation increase in

current account, trade, capital account and domestic financial reforms is associated with an estimated increase of output per capita by about 17%, 6%, 10% and 20% respectively.

Secondly, I probe whether structural reform variables survive inclusion of institutional quality and other indicators of liberalization. Strictly speaking, there are two approaches to measure liberalizations in the literature: by using *de jure* or *de facto* variables. The former has the advantage of reflecting policy levers, and thus results based on them may have clearer policy implications for reforms that a government might consider. On the other hand, they may capture quite poorly the actual degree of financial integration, either because the true nature of legal restrictions is mismeasured, or because these restrictions are imperfectly enforced (Levchenko et al., 2009). The latter instead, provides the actual level of liberalization of country at a given point of time. The logic to use a *de facto* variable is that a country might have much different level of openness from the *de jure* variable implies. Although my primary interest is using *de jure* variables, I also introduce *de facto* ones in order to check whether *de jure* variables capture the policy changes controlling the actual degree of openness. Furthermore, I want to isolate the effect of democracy on growth from that of structural reforms[7]. This way I can avert concerns about what structural reforms may actually capture the quality of democracy.

I examine these issues by including democracy as well as the corresponding *de facto* liberalization variables to the equation (2.5). The PMG estimation results, which are hosted in table 2.8, confirm the previous findings. In all of the estimations, the error correction coefficients are negative and statistically different from zero, which indicates the long-run relationship. All *de jure* and *de facto* reform variables are positive and statistically significant, suggesting that *de jure* and *de facto* reform variables capture different parts of liberalization possibly because the former reflects the policy changes, whereas the latter echoes the tangible developments of openness in different areas. The democracy variable is positively and significantly associated with real per capita GDP in the long-run in column 3 and 4; in the cases of financial reforms only. Finally inflation has always negative sign and negatively related to real per capita GDP in all estimations but one. Government consumption, on the other hand, is negatively linked to real per capita GDP in the long-run, whenever it is significant.

2.4.1 Analysis of Short-Run Coefficients

As mentioned above, the short-run coefficients are estimated by the unweighted average of individual country coefficients, and therefore they are not restricted to be the same

[7]I employ trade openness (sum of exports and imports as a share of GDP), the share of the gross capital flows and, private domestic credits to GDP as *de facto* variables for international trade reform, capital account reform and domestic financial reform respectively. The democratic quality of political regimes is measured by the polity2 indicator of quality of democracy from the Polity IV project (Teorell et al., 2011).

Table 2.8: Economic Liberalizations and Growth with Additional Controls

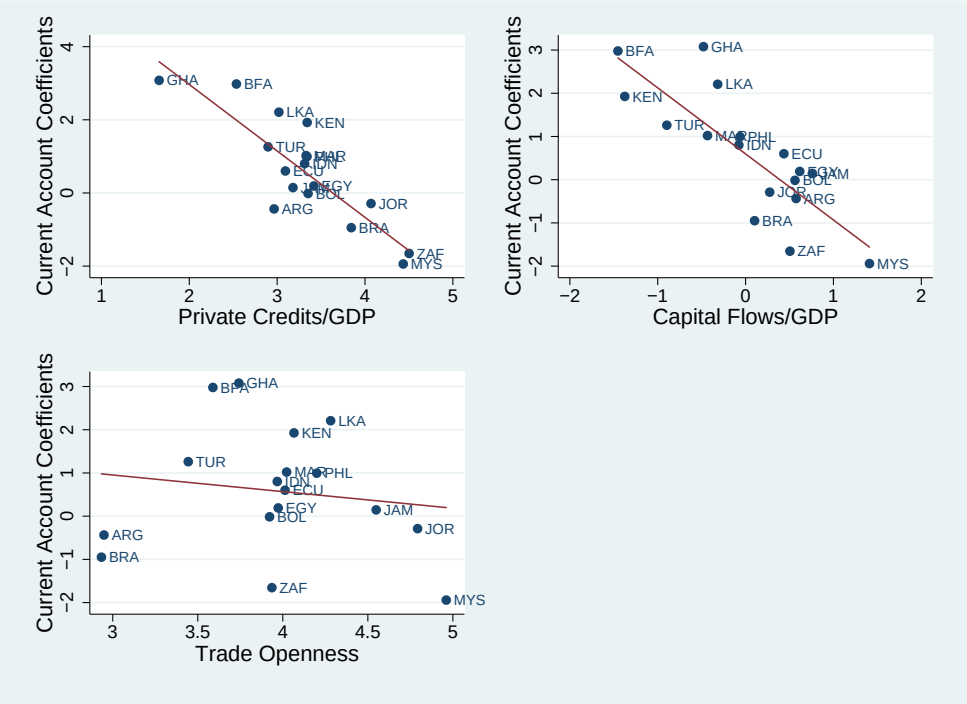
	(1)	(2)	(3)	(4)
De Facto Liberalization:	**Trade Openness**	**Trade Openness**	**INTFIN Openness**	**FIN Openness**
Long Run Coefficients				
Current Account	0.457***			
	(0.08)			
Trade		0.271***		
		(0.047)		
Capital Account			0.769***	
			(0.065)	
Domestic Finance				0.584***
				(0.066)
De Facto Liberalization	0.321***	0.178***	0.016***	0.257***
	(0.062)	(0.041)	(0.004)	(0.031)
Democracy	-0.001	-0.005	0.084***	0.061***
	(0.06)	(0.004)	(0.005)	(0.005)
Inflation	-0.744***	-0.348	-0.316***	-0.766***
	(0.360)	(0.236)	(0.142)	(0.372)
Government Consumption	0.092	0.044	-0.305***	-0.088***
	(0.06)	(0.031)	(0.025)	(0.044)
Error Correction Coefficient	-0.127***	-0.17***	-0.15***	-0.127***
	(0.022)	(0.032)	(0.037)	(0.028)
Observations	935	860	858	895
Joint Hausman Test	7.82	6.80	[a]	2.59
	[0.17]	[0.24]		[0.76]

Notes: ARDL(2,1,1,0,0,0). The dependent variable is the growth rate of real GDP per capita. All regressions include a constant. Standard errors in parentheses. The p-value is presented next to the corresponding h-test in square-brackets. INTFIN Openness is the share of gross capital flows to GDP. FIN Openness is the sahre of private domestic credits to GDP. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations. [a] The joint hausman test statistic is negative, which is interpreted as strong evidence of failure to reject the null hypothesis that the PMG estimator is consistent and efficient by Hausman and McFadden (1984). See also Dincecco (2010).

across countries. In this section, I investigate the short-run effects in a more detailed way. To this end, I regress the short-run coefficients of reforms (only the significant ones) on *de facto* liberalization variables and two institutional variables; property rights and time required to enforce a contract [8]. Then I plot the fitted values against those variables, which are defined as the mean values in the sample period.

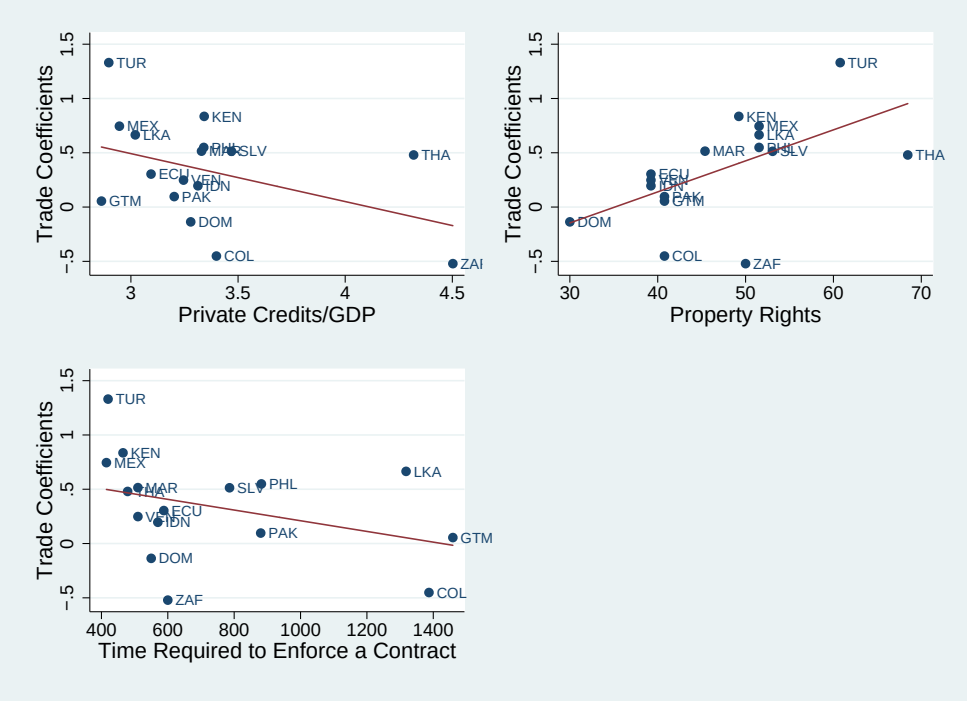
[8]The former ((hf-prights), derived from Teorell et al. (2011), measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. The latter is derived from WB (2011), and measures the number of calendar days from the filing of the lawsuit in court until the final determination and, in appropriate cases, payment.

Figure 2.4: The Effects of Current Account Reform on Growth



Source: Author's estimations.

Figure 2.5: The Effects of Trade Reform on Growth



Source: Author's estimations.

Figure 2.4 and 2.5 plot, respectively, the determinants of the effects of current account and trade reform on growth. According to the figures, being financially more open exacerbates the short-run adverse effects. One can explain this result with the optimal sequence of reform framework. If a country is already financially open (internationally) when it carries out the trade liberalization, the growth rate can be hampered in the short-run due to the increase the degree of vulnerability to external crises (Edwards, 2009). Moreover, Bhattacharya (1999) states that a higher probability of trade reform causes to lower investment in the importable sector while increasing investment in the exportable sector. Conversely domestic financial liberalization leads to higher investment in the importable sector, with an ambiguous impact on investment in the exportable sector. Since financial liberalization increases domestic capital formation, under the assumption of unchanged relative prices importable sector expands and exportable sector contracts by Rybczynski theorem. For this reason, financial market reforms should not precede trade liberalization.

In countries where property rights are better protected, the gain from international trade liberalization is higher. Furthermore, contract enforcement is negatively related to short-run growth impacts of trade reform. Therefore, countries where these institutions are more developed, allocation of resources can be adjusted more quickly, and the incumbent firms compete with the foreign firms easily, which makes the short-run losses disappear. For instance, Colombia and South Africa which performs poorly in institutional dimensions, has negative growth rates after trade reform. Turkey and Mexico, on the other hand, can benefit from trade liberalization already in the short-run.

Figure 2.6 shows evidence on how growth deteriorates more in financially more open economies following capital account liberalization. Trade openness, on the other hand, is positively linked to the short-run impacts of capital account reform. Countries which are more open to international trade benefit more from capital account liberalization which is consistent with the empirical framework of Edwards (2009).

Finally, figure 2.7 depicts the determinants of short-run growth effects of domestic financial liberalization. It appears that countries which are more financially open benefits less from the domestic financial liberalization. This negative relationship can be explained by two reasons. First, owing to the negative marginal returns, countries which are financially less open gain more than the financially more open. Second possible explanation is if financial liberalization brings about financial instability, countries which are financially more open suffer more in the short-run[9]. In addition, figure 2.7 reveals that bad property rights institutions increase the short-run cost of domestic financial reform.

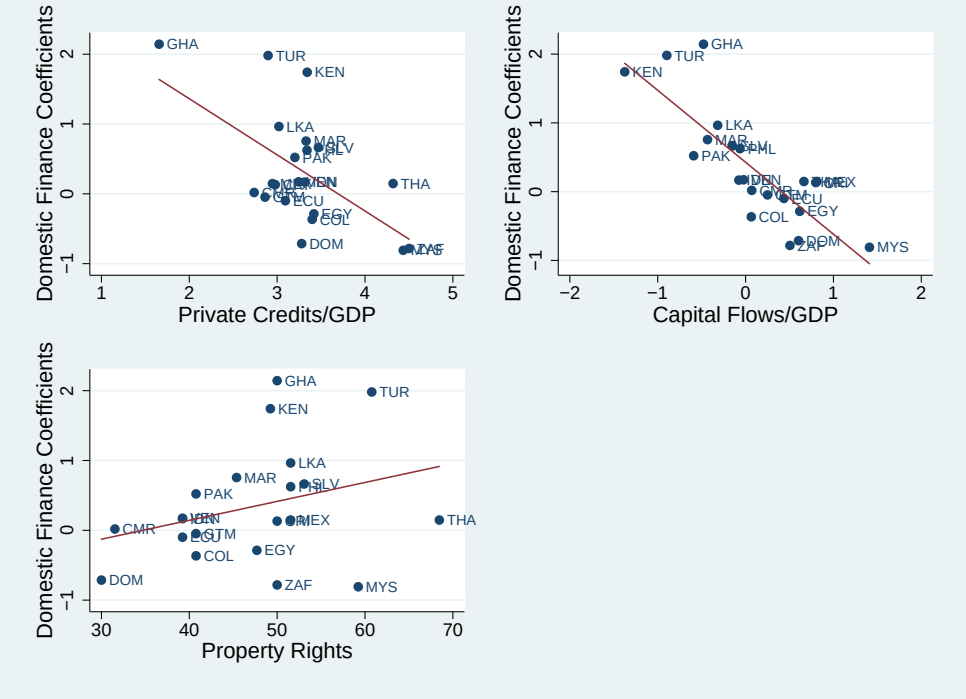
To sum up, it can be argued that financial openness might exacerbate the short-run negative effects of international trade reform, since financial reforms should follow trade

[9]I did not find any significant relationship between the number of crises occurred in the sample period and short-run impacts of domestic financial liberalization. Hence I cannot motivate any of the possible explanations.

Figure 2.6: The Effects of Capital Account Reform on Growth

Source: Author's estimations.

Figure 2.7: The Effects of Domestic Financial Reform on Growth



Source: Author's estimations.

reform rather than preceding it. Secondly, lack of institutional quality may generate dispute about the implementation of reforms, since it jeopardizes the adverse effects of all reforms in the short-run. Therefore fostering institutions is a prerequisite for reforms to be successful.

2.5 Concluding Remarks

Thanks to the overall trends toward real and financial sector liberalizations during the past decades, a large body of research has studied their growth effects. However, the empirical literature is mostly limited to developed countries and also fails to address the short-run effects of reforms. Motivated by such facts, this paper examines the relationship between international trade, capital account, and domestic financial reforms and real GDP per capita in the short and long-run. I make use of PMG estimator which accounts the cross-country heterogeneity and allows to capture the time varying relationship. I hypothesize that there might be a tradeoff between the initial and ultimate effects of reforms on growth. My hypothesis is shown to be extensively validated by the PMG estimator, suggesting the importance of optimal sequencing issue and institutions for complementing reforms.

I find that there exists a positive relationship between reforms and real GDP per capita in the long run. Specifically, a one standard deviation increase in current account, trade, capital account, and domestic finance variables leads to 26, 7, 13, and 11 percent increase in real per capita GDP in the long-run. However, short-run coefficients on growth tell a different story. Although the short-run effects are positive on average, there is a substantial heterogeneity among countries. Countries with better property rights and better contract enforcement benefit from reforms also in the short-run. Poor institutional quality exacerbates the adverse impacts of reforms though. Furthermore, letting international trade reforms precede financial reforms help countries mitigate the associated short-run adverse effects.

Finally, I present evidence that the results are not driven by *de facto* liberalization variables and quality of democracy. Therefore, reform variables reflect the economic policy changes conditional on the actual degree of openness and institutional structure.

Appendix A

Description of reform indices

Current Account Index: An indicator of how compliant a government is with its obligations under the IMF]s Article VIII to free from government restriction the proceeds from international trade in goods and services. The index represents the sum of two sub-components, dealing with restrictions on trade in visibles, as well as in invisibles (financial and other services). It distinguishes between restrictions on residents (receipts for exports) and on non-residents (payments for imports). Although the index measures restrictions on the proceeds from transactions, rather than on the underlying transactions, many countries in practice use restrictions on trade proceeds as a type of trade restriction. The index is scored between zero and 8 in half-integer units, with 8 indicating full compliance. Source: Quinn (1997), Quinn and Toyoda (2007), and Quinn and Toyoda (2008).

Trade Index: Average tariff rates, with missing values extrapolated using implicit weighted tariff rates. Index normalized to be between zero and unity: zero means the tariff rates are 60 percent or higher, while unity means the tariff rates are zero. Source: Various sources, including IMF, World Bank, WTO, UN, and the academic literature (Clemens and Williamson, 2004).

Capital Account Index: Qualitative indicators of restrictions on financial credits and personal capital transactions of residents and financial credits to nonresidents, as well as the use of multiple exchange rates. Index coded from zero (fully repressed) to three (fully liberalized). Source: Abiad et al. (2009), which follows the methodology in Abiad and Mody (2005). The original sources are mostly various IMF reports and working papers, but also central bank websites, etc. Resident/nonresident-specific indices are based on Quinn (1997), and Quinn and Toyoda (2007).

Domestic Finance Index: The index of domestic financial liberalization is an average

of six subindices. Five of them relate to banking : (i) interest rate controls, such as floors or ceilings; (ii) credit controls, such as directed credit, and subsidized lending; (iii) competition restrictions, such as limits on branches and entry barriers in the banking sector, including licensing requirements or limits on foreign banks; (iv) the degree of state ownership; and (v) the quality of banking supervision and regulation, including power of independence of bank supervisors, adoption of a Basel I capital adequacy ratio, and framework for bank inspections. The sixth sub index refers to the regulation of securities markets, including policies to encourage the development of bond and equity markets, and to permit access of the domestic stock market to foreigners. The sub-indices are aggregated with equal weights. Each sub-index is coded from zero (fully repressed) to three (fully liberalized). Source: Abiad et al. (2009), which follows the methodology in Abiad and Mody (2005). The original sources are mostly various IMF reports and working papers, but also central bank websites, etc. Resident/nonresident-specific indices are based on Quinn (1997), and Quinn and Toyoda (2007).

Appendix B

List of countries in the sample

Argentina	Morocco
Bolivia	Pakistan
Brazil	Paraguay
Burkina Faso	Peru
Cameroon	Philippines
Costa Rica	Senegal
Colombia	South Africa
Cote D'Ivoire	Sri Lanka
Dominican Republic	Thailand
Ecuador	Turkey
Egypt	Uruguay
El Salvador	Venezuela
Ghana	
Guatemala	
Indonesia	
Jamaica	
Jordan	
Kenya	
Madagascar	
Malaysia	
Mexico	

Source: World Economic Outlook Database.

Chapter 3

Structural Reforms and Political Outcomes in Developing Countries

Abstract

The political consequences of structural reforms have largely been ignored in the literature. This paper studies the effect of reforms on the probability of government turnover for developing countries over the period 1975-2006. Results indicate that on average, being reformist is associated with lower probability of government change. Analyzing each reform separately, suggest that trade reform is negatively and significantly related to government turnover whereas current account, capital account and domestic financial reforms do not have statistical effect on it. However political impact of reforms is found to differ strongly depending on the macroeconomic structure, political factors and sequencing of reforms. Stable macroeconomic conditions, being a strong government and optimal selection reforms significantly decrease the probability of turnover.

Keywords: Elections, Structural Reforms - Current Account, Trade, Capital Account, Domestic Finance -, Institutions.

JEL Classification Numbers: D72, E02, O16, O24

3.1 Introduction

For many years economists have argued that developing countries should follow free market principles and liberalize their economies to increase welfare and growth. However, in spite of the voluminous literature on the growth effects of economic liberalization, there has been very little empirical work addressing the political economic consequences associated with structural reforms. Given the concern about the detrimental effects of reforms

- at least in the short run and for some particular groups - a natural question is whether reforms help incumbent governments increase their probability of survival. This is an important question because political repercussions, in particular the probability of government turnover can influence the willingness to enact reforms, and therefore economic outcomes.

Developing countries liberalized their trade regimes, capital accounts and domestic financial system in the last quarter of twentieth century. This trend led economists to investigate whether and to what extent reforms spur economic growth. More importantly, restrictions are not removed linearly. Despite the overall trend toward liberalization, there are many reform reversals in the sample period due to, possibly, economic and/or political crises. In the sample, there is 65% reform attempts and 35% reform reversals. This observation makes reforms more interesting since especially reform reversals could be correlated with political outcomes.

A priori, it is not obvious whether voters reward or punish governments due to their reform implementations. Existing literature almost agrees that structural reforms foster growth in the long run. If this is the case, rational voters should reward governments as they expect that economic welfare will improve. However, for the investigated question the short run impacts of reforms are more likely to matter rather than the long run impacts. Despite the long run gains, reforms could be costly in the short run for many reasons. More importantly, individuals are more likely to make political decisions based on the distribution of gains and losses instead of overall benefit on society.

This study investigates the effect of structural reforms on incumbent government survival, a subject which has largely been ignored in the literature. It aims to explain how reforms shape political stability and under which conditions reforms payoff to incumbent governments. I first argue that being reformist decreases the probability of government turnover. However, I find out that the association between reform and government turnover differs with respect to specific reform area. Trade reform is negatively associated with government change while current account, capital account and domestic financial reforms do not have statistically significant effect on it. Second, I show that macroeconomic stability is a prerequisite for reforms as it significantly influence the probability of government turnover. Furthermore, the type of cabinet and voting system have been found to interact significantly with reforms in affecting the probability of government change. Stronger governments, namely single party governments and governments which have the majority of seats in the house, significantly increase the probability of survival when they enact economic reforms. In line with expectations, proportional voting system also helps reformist governments increase the survival probability. Finally I find that sequencing of reforms matters. Governments take far better advantage of enacting reforms if international trade reforms precede financial reforms, namely capital account reform and domestic financial reform.

This paper is, to my knowledge, the first study that investigates whether economic reforms affect probability of government turnover in developing countries. I seek to contribute to two strands of the literature. First this paper adds on the literature on determinants of reelection. The economic factors that make governments stay in charge or fall are widely examined in the literature. The underlying idea is that individuals attribute responsibility to governments for the situation of the economy, and consider the economic outcomes as the main indicator for electing governments. ale and Alesina et al. (2012) investigate the relationship between cabinet change and several economic indicators. They find that inflation has positively associated with cabinet change in OECD countries, while growth has not statistically significant effect on it. Moreover, they find no indication that budget deficits affect the probability of government turnover. Brender and Drazen (2008), on the other hand, examine the probability of reelection in place of government change and find that loose fiscal policies by governments are punished rather than rewarded in both developed and developing countries in contrast to the common wisdom. They also suggest that voters reward governments for economic growth only in developing countries and penalize government for high inflation only in developed countries. Despite the extensive effort to research issues of reelection, those studies do not take into consideration the inevitable political consequences of structural reforms.

This paper more closely relates to Buti et al. (2010). The authors draw attention to the importance of reforms in terms of electoral outcomes and examine to what extent structural reforms affect reelection. They find that reforms that are more likely to affect large groups of insiders, such as employment protection and pension, are more detrimental for governments. My paper firstly differs in terms of the sample and reforms which are analyzed. I consider developing countries with more broad set of reforms; international trade, capital account and domestic financial reforms. Although these reforms are widely debated in terms of their growth impacts, and their relationship with the probability of crises, very little is known about the political economic consequences associated with them. Moreover, I address the issues of whether macroeconomic conditions, political factors and sequencing are important to enact reforms, which drew little attention in the literature.

Second, I wish to contribute to the literature on the political economy of structural reforms. Existing literature speaks to some but not all aspects of political economy considerations. Studies on the determinants of structural reforms for instance state that domestic financial reforms are enacted by both right-wing and left-wing governments and both by presidential and parliamentary regimes (Abiad and Mody, 2005). Campos and Coricelli (2012) find a U-shaped relationship between political and financial liberalization, suggesting that there is not a unilateral relationship between democratization and economic reforms, and more importantly, lack of democratization might hinder reforms and bring about reform reversals. De Haan and Sturm (2003) and Giuliano et al. (2013) on

the other hand, state that democratic institutions lead to economic reforms for a sample of developing and all countries respectively. Drazen and Easterly (2001) point out that high inflation and black market premium spur reforms while Lora and Olivera (2004) find that crises induce reforms in Latin America. The literature seems much more silent on the issue of the consequences of structural reforms for governments. Yet, the capability of governments to carry out their important role in removing rigidities depend on the survival prospects. As such, the analysis of reforms and government change undertaken in this paper is essential to reaching a full understanding of why countries differ in reform initiation, as well as in reversals and magnitudes of reforms.

The rest of the paper is organized as follows. Section 3.2 presents the data and motivating evidence. Section 3.3 describes the empirical specification and discusses the results on the effects of structural reforms on government change. In section 3.4, I consider some alternative explanations of baseline results by taking into consideration the underlying macroeconomic environment, political factors and reform sequencing. The last section concludes.

3.2 Data and Descriptive Analysis

3.2.1 Data

The dataset used in this study comes from different sources. Structural reform data compiled by Research Department of IMF, and provides information on regulations for different sectors. For economic variables I use World Banks World Development Indicators (WB, 2011). For political and institutional variables I use the Database of Political Institutions (Keefer, 2012) and Quality of Government Teorell et al. (2011). The combination of data sources enables me to employ data up to 83 democratic developing countries over the period 1975-2006.

Following Alesina et al. (1998) and Alesina et al. (2012), I employ change of prime minister (pmch) as dependent variable. I consider that changing the prime minister indicates that voters are not pleased with current policy. Pmch is a binary variable with a value of 1 if an election takes place in year t and county i and the current prime minister is not in the office in year $t+1$.

The first reform I consider is international trade, which is measured by average tariff rates and restrictions on current account transactions. The former measures average tariffs and normalized between 0 and 1, where a 0 means that tariff rates are 60 percent or higher and 1 means that tariff rates are 0. The latter captures the extent to which a government is compliant with its obligations under the IMFs Article VIII to free from government restriction the proceeds from international trade in goods and services.

There are two financial sector reforms; domestic financial reform and capital account

reform. The domestic financial reform index is derived from Abiad et al. (2009). The index is constructed as the average of six sub-indices: (i) credit controls, such as subsidized lending and directed credit; (ii) interest rate controls, such as floors, ceilings or interest rate bands; (iii) entry barriers, such as restrictions on the participation of foreign banks, and restrictions on the scope of the banks activities; (iv) the degree of state ownership in the banking sector; (v) the quality of banking supervision and regulation, such as risk-based capital adequacy ratios based on the Basle I capital accord, and independent banking supervisory agency; (vi) securities market policy, which includes the auctioning of government securities, establishment of debt and equity markets, and policies to encourage development of these markets, such as tax incentives or development of depository and settlement systems. The capital account reform index measures a broad set of restrictions on financial credits and personal capital transactions of residents and financial credits to nonresidents, as well as the use of multiple exchange rates. Each reform variable is a continuous variable between 0 and 1, with a higher values indicating greater degree of liberalization.

One approach in the empirical literature is to construct an aggregate index by taking simple average of different indices (Duval, 2008; Buti et. al. (2010); and Guiliano (2013)). Following these contributions, I will also check the political consequences of overall reform. In addition, I include change in the real GDP per capita and inflation among the macroeconomic factors which might affect the probability of government change[1]. I expect voters in developing countries to reward governments if they achieve high growth rates and macroeconomic stability. In line with previous studies, I employ political variables to control for different characteristics of cabinet: the number of year the cabinet has been in power (Durat), whether it is composed of a coalition of parties (Coal) and whether it has the majority in the parliament (Maj).

3.2.2 Motivating Evidence

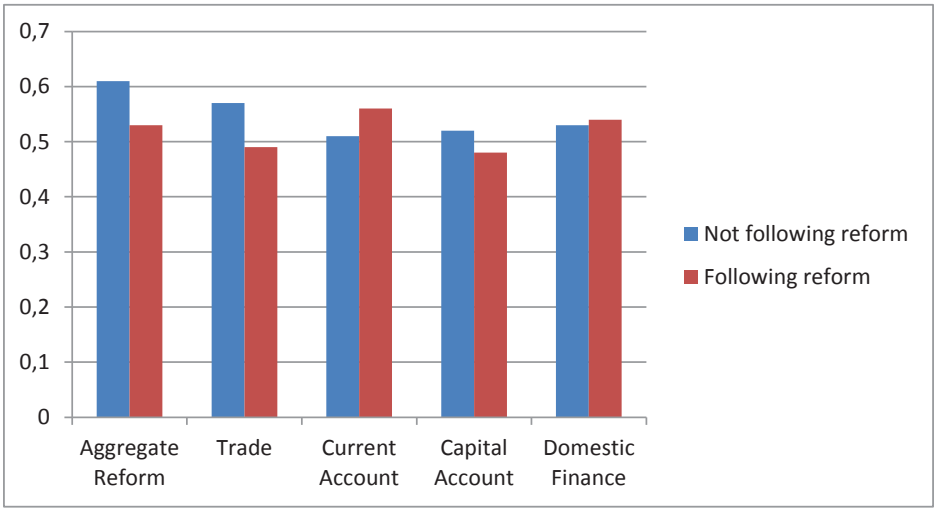
Considering the average of all developing countries, overall reform index shows steady increase from 0.34 in 1975 to 0.74 in 2005 in the last quarter of twentieth century. Domestic financial sector has been the highest deregulated area across all sectors. The domestic finance index rose from 0.12 to 0.74. The progress in other sectors are more limited. Trade index rose from 0.52 to 0.80; current account index rose from 0.44 to 0.75; and capital account index rose from 0.44 to 0.67. More importantly, developing countries experienced many reform reversals in these sectors while there are much fewer reform failures in domestic financial sector. Finally, it is worth noting that in spite of the fact that all countries in the sample liberalized their economies compared to the beginning of the sample period, each country's reform attempts vary significantly in terms of accompanying

[1]Inflation is defined as $\log(1 + \Delta \text{ CPI})$.

macroeconomic conditions, institutional environment and sequencing.

Figure 3.1 displays the frequency of government change following reforms and not following reforms. Considering the aggregate reform variable, it appears that enacting reform is associated with lower probability of government change. The probability of government turnover following reform and not following reform is 52% and 63% respectively. Hence, voters in developing countries seem to reward reformist governments. However, different reforms might lead to different political outcomes. For this reason, the frequencies of government change associated with each reform are also depicted in figure 3.1. In regards to trade reform, the probability of government change is lower following trade reform than not following trade reform. In contrast, the probability of government change is higher following current account reform then not following current account reform. Capital account reform, on the other hand, is associated with lower probability of government turnover. Voters seem to reward the incumbent government that enact trade and capital account reforms compared to the non-reformist governments. Finally, in terms of domestic financial reform, there is no difference between government change following reform and not following reform.

Figure 3.1: Frequency in Changes of Prime Minister and Reforms



Source: Author's calculation based on (Keefer, 2012).

Table 3.1 shows the frequencies of reforms and reform reversals by cabinet type. There appears to be significant difference between the frequencies of single party governments and coalition governments as well as the ideology of the cabinet (Table 1, first row). In the sample, 63% of the governments consist of coalitions and the remaining 37% is composed of single party governments. Moreover, left wing governments have the highest frequency with 51%, while the probability of a centralist party to be in government is only 10%. Do the cabinet type or ideological orientation of the government significantly

affect the frequency of reforms and reform reversals? The answer is yes, since at least 53% of each reform is enacted by single party governments. As they are more active in reforms, single party governments have also higher frequency in the reform reversals. It appears that although coalition governments dominate the political environment, they avoid conducting economic policies in these areas possibly because they are more unstable than single party governments (See Alesina et. al., 1998). In addition to this, left wing governments enact reforms as often as right wing governments. However, the probability of international trade reforms is higher for left wing governments, while the probability of financial reforms is higher for right wing governments. Therefore, there is an ideological choice of reforms depending on the government characteristic.

Table 3.1: Frequency of Reforms and Reform Reversals by Cabinet Type

Cabinet type	Frequency of Cabinet type in all observations	Trade Reform	Trade Reform Reversal	Current Account Reform	Current Account Reform Reversal	Capital Account Reform	Capital Account Reform Reversal	Domestic Finance Reform	Domestic Finance Reform Reversal
Coal	0.63	0.40	0.347	0.346	0.353	0.45	0.394	0.465	0.35
Sing	0.37	0.60	0.653	0.656	0.667	0.55	0.606	0.534	0.65
Right	0.39	0.42	0.41	0.396	0.427	0.45	0.46	0.446	0.567
Left	0.51	0.495	0.51	0.504	0.427	0.43	0.39	0.436	0.243
Center	0.10	0.085	0.08	0.10	0.146	0.12	0.15	0.118	0.19

Notes: Author's calculation based on (Keefer, 2012).

3.3 Empirical Specification and Results

An important issue for the empirical analysis is to identify the reforms. One possibility is to use the levels of the indices as Prati et al. (2013). However, using levels of the indices might not capture government policies. Second approach is to create a binary variable when the reform index changes substantially, namely by one (Christiansen et al., 2012) or two standard deviation (Duval, 2008). I use changes rather than levels of reforms and do not define a dummy as I believe that changes better reflect government's policy choices and allow me to identify the magnitude of reform reversals as well as reforms.

A change over time in each index s, in country c, and time t is therefore defined as reform as in Buti et al. (2010) and Giuliano et al. (2013):

$$Reform_{s,c,t} = Index_{s,c,t} - Index_{s,c,t-1} \tag{3.1}$$

To analyze whether and to what extent reforms lead to government changes within countries, I consider the following latent variable formulation:

$$Pmch_{c,t} = \begin{cases} 1 & \text{if } Pmch^*_{c,t} > 0 \\ 0 & \text{if } Pmch^*_{c,t} \leq 0 \end{cases}$$

where $Pmch_{c,t}$ is the binary government change variable and $Pmch^*_{c,t}$ is the unobservable (latent) variable. The estimation equation is thus:

$$Pmch^*_{c,t} = \beta_0 + \beta_1 Reform_{s,c,t-1} + \sum_k \beta_k Z^k_{ct} + u_{ct} \tag{3.2}$$

where $Reform_{s,c,t-1}$ indicates each reform variable, Z^k_{ct} denotes the set of economic, and political control variables and u_{ct} indicates the error term. I make use of the lagged value of reform variable as I expect reform to affect the economic and political outcomes with some certain lag.

Table 3.2 presents the baseline estimation results using pooled probit estimation. Column 1 in table 3.2 reports the results for overall reform variable. Results reveal that reform variable is not statistically significant, suggesting that being reformist does not have any influence on the change of incumbent government. Regression coefficients for control variables have expected signs, but not all are statistically significant. The positive sign of inflation indicates that voters dislike inflation and punish governments owing to high price instability. Moreover, Maj is negative and significant, indicating that a government is less likely to change if it has the majority of seats in the house.

In column 2, I check the robustness of the baseline results to the alternative macroeconomic and political control variables. There is vast literature investigating the association between fiscal performance of governments and their reelection chances. Although there

Table 3.2: Probit Coefficients: Baseline Model

Dependent Variable: 1 if prime minister changes	(1)	(2)	(3)
Aggregate Reform (t-1)	0.69	-0.02	-5.91***
	(0.96)	(1.24)	(3.15)
Inflation	0.06**	0.04	0.28***
	(0.03)	(0.04)	(0.09)
Growth	-0.004	-0.006	-0.04**
	(0.008)	(0.01)	(0.02)
Coal	0.03	0.09	-0.71**
	(0.08)	(0.10)	(0.28)
Maj	-0.29***	-0.19*	0.20
	(0.08)	(0.11)	(0.26)
Durat	0.003	0.02	0.18**
	(0.02)	(0.03)	(0.09)
Deficit during		-0.04	
the tenure		(0.05)	
Parliamentary System		-0.02	
		(0.12)	
Proportional Representation		0.37***	
		(0.12)	
Democratic History		-0.002	
		(0.005)	
Country FE			YES
Year FE			YES
Pseudo R-squared	0.09	0.17	0.36
Observations	195	117	79

Notes: Probit estimation, standard errors robust for heteroscedasticity are in brackets. Coefficients are marginal probability effects computed at sample mean. Aggregate reform is defined as the change in the aggregate reform index. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

is not a consensus about the effects of fiscal stance on reelection in the literature, the conventional wisdom is that incumbent governments spend excessively to attract votes. In order to measure the fiscal performance of the government, I add the average change in central governments budget deficit to GDP during the tenure of the current government into the regression. The first political variable measures the political system. It is a dichotomous variable which is equal to 1 for parliamentary system, and 0 for presidential system. The second variable captures the voting system, whether it is proportional or not. Finally, I add democratic history variable which measures how long parties and prime ministers have been elected competitively. Results indicate that fiscal performance variable does not have statistically significant effect on government change. Alesina et al. (2012) find a similar result for OECD countries. They casts doubt on the common wisdom that fiscal adjustment affect government change. In my baseline specification, I do not

detect this relationship as well. Political control variables are also found to be statistically insignificant, except positive proportional representation variable. Adding these variables do not affect the significance level of the overall reform variable.

Finally, I probe whether results are driven by unobserved country and year characteristics which are possibly correlated with both some of the explanatory variables and the probability of government change. To this end, I add country and year fixed effects to the baseline specification and summarize the results in column 3. I find that overall reform is negatively associated with the government change. Adding the fixed effects improves the estimation as the goodness of fit increases from 9% to 36%. With regards to the control variables, estimates reported in table 3.2 show that voters are likely to punish incumbent governments for price instability and reward them for economic growth. While coalition has unexpected negative sign, durat is positively associated with government turnover, suggesting that the probability of government turnover increases with the length of its tenure.

Although the baseline specification suggests that governments increase the probability of remaining in power by enacting reform, the effect is more likely to be different for different types of reforms. As suggested by figure 1, different reforms lead to different political outcomes. Therefore I check which reform is positively or negatively associated with government change. Results, summarized in column 1-5 of table 3.3 are based on the baseline specification for each reforms separately with country and year fixed effects (column 3 in table 3.2). I find that current account, capital account and domestic financial reforms are not significantly associated with government change. Trade reform, on the other hand, has statistically significant negative effect on government turnover. Finally in column 5, I include each indicator of structural reform at the same time in order to check whether results suffer from high correlation between reforms. As can be seen, results are substantially the same as those obtained in the previous columns. Reform in trade sector maintain a negative and statistically significant association with government change. The coefficient estimates for current account, capital account and domestic financial sectors remain statistically not different from 0.

Table 3.3: Probit Coefficients: Impact of Different Reforms

Dependent Variable: 1 if prime minister changes	(1)	(2)	(3)	(4)	(5)
Trade (t-1)	-2.27***				-2.67**
	(1.00)				(1.37)
Current Account(t-1)		-0.63			-1.50
		(1.04)			(1.51)
Capital Account(t-1)			-0.29		0.49
			(0.76)		(1.99)
Domestic Finance(t-1)				2.18	1.09
				(2.08)	(2.25)
Inflation	0.31***	0.25***	0.25***	0.32***	0.32***
	(0.07)	(0.06)	(0.06)	(0.09)	(0.08)
Growth	-0.02	-0.04***	-0.01***	-0.04***	-0.02
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Coal	-0.04	-0.14	-0.13	-0.33	-0.30
	(0.18)	(0.17)	(0.17)	(0.22)	(0.23)
Maj	-0.16	-0.01	-0.03	0.01	0.29
	(0.21)	(0.19)	(0.19)	(0.21)	(0.25)
Durat	0.09	0.10*	0.09	0.22***	0.20***
	(0.05)	(0.06)	(0.06)	(0.08)	(0.08)
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Pseudo R-squared	0.33	0.32	0.32	0.35	0.34
Observations	114	139	139	93	84

Notes: Probit estimation, standard errors robust for heteroscedasticity are in brackets. Coefficients are marginal probability effects computed at sample mean. Reform variables are defined as changes in corresponding indices. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

In order to check the robustness of the main findings, I estimate logit fixed effect model and present the results in table 3.4. The estimations I obtained are virtually the same. The evidence suggests that trade reform is negatively related with government change, while current account, capital account and domestic financial reforms do not have statistically significant effect on it. Results also indicate that, inflation is positive and statistically significant while growth is always negative but statistically significant in 3 out of 4 specifications.

When estimating the specification in table 3.3, I employ reform as the change in each reform index one year before the election. One might think that individuals take into consideration the overall reform implementation of governments instead of the last year of the term when they evaluate the governments' performances via elections. Moreover, governments might avoid enacting reforms before elections in order not to risk the reelection prospects. Alternatively, they might carry out costly reforms in the very beginning

Table 3.4: Logit Fixed Effect Model Coefficients

Dependent Variable: 1 if prime minister changes	(1)	(2)	(3)	(4)
Trade (t-1)	-7.53*			
	(4.07)			
Current Account(t-1)		-2.13		
		(3.77)		
Capital Account(t-1)			-1.17	
			(3.90)	
Domestic Finance(t-1)				12.43
				(9.90)
Inflation	0.99**	0.77**	0.78***	0.94**
	(0.42)	(0.34)	(0.34)	(0.43)
Growth	-0.07	-0.13**	-0.14**	-0.18**
	(0.06)	(0.06)	(0.07)	(0.09)
Coal	-0.31	-0.45	-0.44	-1.55
	(0.75)	(0.70)	(0.71)	(1.03)
Maj	0.51	-0.10	-0.17	0.29
	(0.99)	(0.79)	(0.81)	(1.12)
Durat	0.32	0.32	0.29	0.66*
	(0.27)	(0.25)	(0.24)	(0.39)
Year FE	YES	YES	YES	YES
Observations	155	168	168	124

Notes: Standard errors robust for heteroscedasticity are in brackets. Reform variables are defined as changes in corresponding indices. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

of their terms and implement only the ones which payoff immediately before elections. This will bias the results because the costless reforms will be over-represented in the sample. To test whether the association between reforms and government change differ with respect to timing of reform, I add the average reform during the tenure of the current government to the baseline specification. Results are summarized in table 3.5. I find that trade reform has statistically significant negative effect on government change irrespective of the measure I use, suggesting that reforming trade policies are on average rewarded at the following election. Current account, capital account and domestic financial reforms are insignificant as in the baseline model. To sum up, the idea that governments select certain types of reforms with respect to the distance from election is not supported by the results in table 3.5.

In table 3.6, I address the question of whether voters attach more importance to overall macroeconomic performance of governments than to the performance in election year. To this end, I include average inflation and growth during the tenure of the government instead of election year inflation and growth in table 3.6. A related concern is that per-

Table 3.5: Probit Coefficients: The Role of Reform During Tenure

	(1)	(2)	(3)	(4)
Reform during the tenure:	**Trade**	**Current Account**	**Capital Account**	**Domestic Finance**
Trade (t-1)	-1.72*			
	(1.01)			
Current Account (t-1)		-1.03		
		(1.01)		
Capital Account (t-1)			0.96	
			(1.07)	
Domestic Finance (t-1)				2.43
				(3.05)
Reform during	-6.07**	2.24	1.51	6.03
the tenure	(2.64)	(1.54)	(1.81)	(4.29)
Inflation	0.36***	0.23***	0.25***	0.35***
	(0.08)	(0.06)	(0.06)	(0.10)
Growth	-0.03*	-0.04***	-0.05***	-0.06***
	(0.01)	(0.01)	(0.01)	(0.02)
Coal	-0.07	-0.13	-0.17	-0.55**
	(0.20)	(0.17)	(0.18)	(0.25)
Maj	0.35	-0.03	-0.06	0.05
	(0.23)	(0.18)	(0.19)	(0.25)
Durat	0.09	0.09*	0.10*	0.19**
	(0.06)	(0.05)	(0.06)	(0.09)
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Pseudo R-squared	0.37	0.33	0.34	0.37
Observations	114	139	141	87

Notes: Probit estimation, standard errors robust for heteroscedasticity are in brackets. Coefficients are marginal probability effects computed at sample mean. Reform variables are defined as changes in corresponding indices. Competence is the difference between national growth rate and developed countries' average growth rate. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

haps voters are affected by the overall performance of the world economy. Voters might penalize governments not for their performance per se but with respect to their performance relative to the world average (Alesina et al., 2012). Leigh (2009), for instance, states that voters are inclined to reelect incumbent governments when the world economy grows. Furthermore, world economic growth could be more important than the national economic growth on incumbent reelection probabilities. To test whether the results are robust to including world economic growth, I also add the difference between each country's growth rate and developed countries' average growth rate (competence). Estimates reported in table 3.6 show that reforms in current account and capital account maintain insignificant association with the probability of government change. The coefficient esti-

Table 3.6: Probit Coefficients: Different Controls

Dependent Variable: 1 if prime minister changes	(1)	(2)	(3)	(4)
Trade (t-1)	-1.57*			
	(0.87)			
Current Account (t-1)		-0.46		
		(1.08)		
Capital Account (t-1)			0.67	
			(1.07)	
Domestic Finance (t-1)				7.87***
				(2.61)
Inflation during	0.13	-0.003	0.03	0.02
the tenure	(0.12)	(0.11)	(0.11)	(0.15)
Growth during	-0.04	-0.08***	-0.07***	-0.09**
the tenure	(0.04)	(0.03)	(0.03)	(0.04)
Competence	-0.01	-0.02	-0.02	-0.04*
	(0.02)	(0.02)	(0.01)	(0.02)
Coal	0.0004	-0.10	-0.11	-0.48**
	(0.19)	(0.16)	(0.16)	(0.20)
Maj	0.10	-0.03	0.03	-0.27
	(0.22)	(0.02)	(0.20)	(0.25)
Durat	0.08*	0.08	0.07	0.14*
	(0.05)	(0.05)	(0.05)	(0.08)
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Pseudo R-squared	0.31	0.36	0.30	0.39
Observations	114	141	141	87

Notes: Probit estimation, standard errors robust for heteroscedasticity are in brackets. Coefficients are marginal probability effects computed at sample mean. Reform variables are defined as changes in corresponding indices. Competence is the difference between national growth rate and developed countries' average growth rate. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

mates for trade and domestic financial reforms are statistically significant, with negative and positive signs respectively. Regarding the new control variables, results indicate that competence is negatively associated with government turnover in 1 out of 4 specifications while average inflation during the tenure of the government is insignificant in each specification and average growth during the tenure of the government is significantly related with government change in 3 out of 4 specifications. Hence average growth during the tenure of the government is as important as election year growth. Whereas, voters are more likely to deem average inflation as an insignificant issue for elections. Finally, each country's own growth performance seems to matter more than the relative performance[2].

[2]There are other important control variables which could affect the relationship between reforms and government turnover. Economic crisis, for instance, is one of the most important determinants of reforms

3.4 Alternative Explanations

My baseline estimation results suggest some empirical regularities between reforms and government change. A question that comes to mind is the possible heterogeneity of the relationship between reforms and government turnover. There could be some factors which increase or decrease the probability of government turnover or alter the direction of the effect of reform on government change. To this end, in this section, I address the question of whether some the association between reforms and government turnover differ with respect to some specific factors. I first check whether macroeconomic conditions matter for electoral consequences of reforms. Second, I examine to what extent political factors are important. Finally, I investigate whether sequencing of reforms plays a role in explaining the issue of reforms and government turnover.

3.4.1 The Role of Macroeconomic Conditions

Macroeconomic stabilization is considered as *sine qua non* for successful economic reforms. In the literature, many studies agree that macroeconomic stabilization should be given priority and should be carried out early in the reform process. High volatility or high propensity to crises are associated with greater uncertainty, which eventually might affect the investment decisions. More importantly, unstable macroeconomic environment might cause uneven distribution of costs and benefits associated with reforms. The high risk, high cost and unequal distribution of reform gains and losses might also increase the political opposition against governments. Hence I scrutinize the question of whether political consequences of structural reforms are related to macroeconomic instability. To this end, I employ the standard deviation of the ratios of gross capital flows to GDP and government consumption to GDP over the sample period. I divide the sample of countries according to whether they are above or below the mean of each indicator.

Table 3.7 reports the estimation results for each group of countries. The specification is the baseline specification without country and year fixed effects, but cabinet characteristics are not reported owing to space limitations. Column 1 and 2 consider countries with more and less international financial volatility respectively. Results indicate that in countries with large capital flows volatility, enacting overall reform increases the probability of government change though it is significant with p-value 0.12. Considering the individual reforms, it is found that the positive association is driven by current account and capital account reforms.

I consider government consumption volatility in column 3 and 4. Overall reform is

and at the same time could influence the electoral outcomes. Moreover, reforms might affect elections by altering income inequality. Finally government change could be more likely in more institutionally developed countries. Empirical results that have not been reported to save space are robust to these alternative sets of control variables. Results are available upon request.

Table 3.7: Probit Coefficients: The Role of Macroeconomic Conditions

Conditions:	(1) **More INTFIN Volatility**	(2) **Less INTFIN Volatility**	(3) **More Government Consumption Volatility**	(4) **Less Government Consumption Volatility**
Aggregate Reform (t-1)	3.04	-0.14	6.91***	-2.40***
	(1.99)	(1.19)	(2.52)	(1.32)
Pseudo R-squared	0.33	0.05	0.14	0.20
Observations	48	147	73	122
Trade (t-1)	-0.78	0.23	1.70**	-0.45
	(1.05)	(0.48)	(0.84)	(0.52)
Pseudo R-squared	0.29	0.05	0.06	0.17
Observations	81	184	107	158
Current Account (t-1)	3.01**	-0.51	0.97	-0.82
	(1.50)	(0.59)	(0.75)	(0.75)
Pseudo R-squared	0.28	0.05	0.08	0.16
Observations	89	189	105	173
Capital Account (t-1)	0.94*	-0.76	1.28*	-0.52
	(0.55)	(0.77)	(0.70)	(0.65)
Pseudo R-squared	0.24	0.05	0.08	0.16
Observations	89	189	105	173
Domestic Finance (t-1)	-0.61	0.99	2.11	-0.65
	(2.21)	(1.05)	(1.41)	(1.27)
Pseudo R-squared	0.25	0.06	0.07	0.18
Observations	51	156	80	127

Notes: Probit estimation, standard errors robust for heteroscedasticity are in brackets. Coefficients are marginal probability effects computed at sample mean. Reform variables are defined as changes in corresponding indices. INTFIN is the ratio of gross capital flows to GDP. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

positively associated with government turnover in countries with high government consumption volatility, while reformist governments significantly decrease the probability of turnover in stable economies. Similar to the previous results, the main positive effect of reforms on government change is driven by current account and capital account reforms. Domestic financial reform has also positive effect on government turnover, albeit with high p-value (0.13). These findings suggest that voters are likely to penalize reformist governments in countries that are devoid of macroeconomic stability.

3.4.2 The Role of Political Factors

The previous findings point out that the characteristics of the cabinet and proportional voting system are correlated with reformist government's survival probability. It might be the case that these factors are also important in explaining the effect of reforms on the probability of government turnover. A reformist government could be more vulnerable to punishment stemming from the unpopularity among the public, especially when power

is shared between different parties in a coalition or the party of the executive does not have an absolute majority in the house(s) with lawmaking powers. Moreover, survival probability of reformist government might depend on the electoral system. For these reasons, I add the interactions of reform variables with coalition, majority and proportional representation dummies in table 3.8.

Table 3.8: Probit Coefficients: The Role of Political Factors

	(1)	(2)	(3)
Political Factors:	**Coal**	**Maj**	**Proportional Representation**
Aggregate Reform (t-1)	-12.26***	7.40***	6.31*
	(2.84)	(4.13)	(3.62)
Political Factor	-0.70**	0.11	-2.63***
	(0.26)	(0.30)	(0.44)
Aggregate Reform (t-1)× Political Factor	16.01***	-48.56***	-5.97
	(4.39)	(10.26)	(3.87)
Pseudo R-squared	0.43	0.55	0.21
Observations	84	84	106
Trade (t-1)	-8.99***	1.12	2.12*
	(1.69)	(1.26)	(1.15)
Political Factor	-0.24	0.17	-2.54***
	(0.19)	(0.22)	(0.44)
Trade (t-1)× Political Factor	9.77***	-8.77***	-2.48*
	(2.11)	(2.33)	(1.44)
Pseudo R-squared	0.43	0.42	0.16
Observations	114	114	129
Current Account (t-1)	-4.72***	1.68	12.28***
	(1.24)	(1.49)	(4.19)
Political Factor	-0.17	0.01	-1.13***
	(0.17)	(0.19)	(0.45)
Current Account (t-1)× Political Factor	6.05***	-7.53***	-12.89***
	(1.79)	(2.08)	(4.34)
Pseudo R-squared	0.36	0.37	0.44
Observations	139	139	114
Capital Account (t-1)	-2.06***	0.29	-0.12
	(1.32)	(1.07)	(2.55)
Political Factor	-0.16	-0.04	-0.97*
	(0.18)	(0.19)	(0.58)
Capital Account (t-1)× Political Factor	2.70	-3.30	-2.56
	(1.71)	(2.24)	(2.81)
Pseudo R-squared	0.32	0.33	0.42
Observations	139	139	114

Table 3.8. Probit Coefficients: The Role of Political Factors (*Continued*)

Political Factors:	(1) **Coal**	(2) **Maj**	(3) **Proportional Representation**
Domestic Finance (t-1)	0.73	7.19*	4.25
	(3.00)	(4.04)	(4.39)
Political Factor	-1.16**	0.15	-0.90
	(0.45)	(0.24)	(0.84)
Domestic Finance (t-1)× Political Factor	27.64***	-5.32	-5.17
	(6.38)	(4.29)	(5.27)
Pseudo R-squared	0.48	0.36	0.58
Observations	87	87	81

Notes: Probit estimation, standard errors robust for heteroscedasticity and residual correlation within countries. Coefficients are marginal probability effects computed at sample mean. Reform variables are defined as changes in corresponding indices. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

The results are based on the baseline specification with country and year fixed effects (Column 3 in Table 2). The first, second and third columns present the interaction of reforms with coal, maj and proportional representation respectively. In column 1, I find that being reformist increase the probability of government turnover if the incumbent is a coalition government. Considering each reform area separately, I find that the relationship is applied to the all reforms except capital account reform which is marginally insignificant. Hence, regardless of the type of the reform they enact, coalition governments are more likely to be voted out of office. This results indicate that being reformist in developing countries is a political minefield for governments.

In column 2, the interaction between aggregate reform variable with majority dummy has statistically significant negative effect on government change. Since aggregate reform is positively associated with government change, a stronger reformist incumbent is more likely to be reelected if it has the majority in the house. In regards to individual reform areas, the negative and significant interactions of trade and current account reform with majority dummy is in line with the expectations though reform variables are insignificant. Moreover, I do not find significant relationship between financial reforms and majority.

In column 3, I find that government change is less probable in proportional voting system in 4 out of 5 specifications, which is in agreement with the results of Buti et al. (2010). The interaction of aggregate reform with proportional representation is negative but marginally insignificant (with p-value 0.12). Considering the reforms separately, it appears that the negative effect of aggregate reform is driven by international trade reforms. The interactions of proportional representation with capital account reform and domestic financial reform enter with statistically insignificant coefficients.

3.4.3 The Role of Reform Sequencing

Another issue that I want to tackle is the role of reform sequencing. Assuming that voters are short-sighted, they take the short-run losses of reforms into account rather than long-run benefits when they elect governments. Hence I expect the probability of government change to increase if reforms cause short-run losses. In Aksoy (2013a), I find that the short-run negative growth effects of domestic financial reform and capital account reform decrease and become positive in some cases if these financial reforms follow trade reforms. Spilimbergo et al. (2009) also points out that reforming trade sector before capital account yield better growth outcomes than the alternative sequencing. Hence I expect that financial reforms are also less costly in terms of political consequences provided that countries are open to trade when they are enacted[3]. To test this hypothesis and detect whether alternative sequencing strategies can be advocated for the governments, I interact each reform variable with different openness indicators and include them in the specification[4]. I employ the share of exports plus imports to GDP for trade openness, the ratio of gross capital flows to GDP for international financial openness and the share of private domestic credits to GDP for domestic financial openness.

The results are reported in table 3.9. The first, second and third columns present the interaction of reforms with trade openness, international financial openness and domestic financial openness respectively. Regarding the trade reform, its interaction with trade openness is positive and significant. Since individual trade reform is negative and much bigger in terms of magnitude, the positive interaction shows that the marginal effects of trade reform is decreasing in more trade open countries. I find that the interaction of trade reform with international financial openness in column 2 is positive and significant, suggesting that trade reform is more costly for governments if the country is already open to international capital markets. The finding is also in line with the arguments in Edwards and Van Wijnbergen (1986) that if the obtained foreign resources thanks to the capital inflows are used for investment, then the existing trade restrictions are amplified and consequently welfare decreases and in Edwards (2009) that relaxing capital controls before trade liberalization increases the probability of external crisis more that the alternative strategy. Hence I argue that liberalizing international trade in ahead of capital account alleviates the short-run negative impacts of reforms(See, among others, McKinnon (1973) and Edwards (1989)) and therefore voters reward governments. Finally, it appears that the sequence of trade reform and domestic financial openness does not significantly affect government change as the interaction variable in column 3 is statistically insignificant.

In regards to current account reform, I find that its interaction with trade openness

[3]Note that there might be some distributional costs specific to different sectors of the economy, which are not captured by overall economic growth.

[4]I run the baseline specification with country and year fixed effects (Column 3 in Table 2) but control variables are not reported due to space limitations.

Table 3.9: Probit Coefficients: The Role of Reform Sequencing

	(1)	(2)	(3)
Openness:	**Trade Openness**	**INTFIN Openness**	**FIN Openness**
Trade (t-1)	-3.40**	-7.47***	-3.04
	(1.64)	(2.60)	(1.98)
Openness	0.003	-0.02	0.007
	(0.003)	(0.05)	(0.005)
Trade (t-1)× Openness	0.05**	1.68***	0.02
	(0.02)	(0.55)	(0.03)
Pseudo R-squared	0.18	0.49	0.38
Observations	155	96	110
Current Account (t-1)	-11.42***	-2.18*	-6.89***
	(2.72)	(1.17)	(1.72)
Openness	-0.02***	-0.08***	0.01***
	(0.005)	(0.02)	(0.004)
Current Account (t-1)× Openness	0.12***	0.61*	0.09***
	(0.03)	(0.33)	(0.03)
Pseudo R-squared	0.47	0.42	0.41
Observations	134	119	134
Capital Account (t-1)	0.84	-0.36	-1.45
	(3.40)	(1.86)	(1.82)
Openness	-0.02	-0.06**	0.01***
	(0.005)	(0.03)	(0.004)
Capital Account (t-1)× Openness	-0.01	-0.32	0.001
	(0.03)	(0.35)	(0.04)
Pseudo R-squared	0.42	0.41	0.37
Observations	134	119	134
Domestic Finance (t-1)	20.51***	2.23	-0.50
	(6.07)	(2.82)	(3.14)
Openness	-0.03***	-0.01	0.03***
	(0.007)	(0.03)	(0.008)
Domestic Finance (t-1)× Openness	-0.85**	-0.61*	0.003
	(0.07)	(0.33)	(0.08)
Pseudo R-squared	0.53	0.49	0.50
Observations	88	82	88

Notes: Probit estimation, standard errors robust for heteroscedasticity and residual correlation within countries. Coefficients are marginal probability effects computed at sample mean. Reform variables are defined as the percentage point change. Trade openness is the share of exports plus imports to GDP, INTFIN openness is the ratio of gross capital flows to GDP FIN openness is the share of private domestic credits to GDP. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

is positive and significant as in the case of trade reform. Hence I interpret it the same manner, the marginal benefit of current account reform is decreasing in trade openness. Interaction of current account reform with capital account openness is positive and significant in column 2. As in the case of trade reform, enacting current account reform is electorally more costly the more the country is open to international capital flows. Fur-

thermore, I find that the interaction of current account reform with domestic financial openness has statistically significant positive effect of government change. In line with expectations, the probability of government turnover increases with current account reform if the country is more open in terms of domestic financial depth.

Concerning the capital account reform, I find no indication that any type of openness significantly affects the probability of government turnover when capital account reform is undertaken. Finally the last panel of table 9 presents the results for domestic financial reform. Results in column 1 indicate that the interaction of domestic financial reform with trade openness is negative and significant, suggesting that governments decrease the probability of turnover if they enact domestic financial reform in more trade open economies.

To sum up, sequencing of reforms lead to political as well as economic outcomes. Optimal sequence makes voters reward the reformist governments possibly because there is less uncertainty and cost associated with reforms.

3.5 Concluding Remarks

In this paper, I investigate the effects of structural reforms on the probability of government change, an issue which did not draw enough attention in the literature. I find that overall, reformist governments increase the probability of survival at the following election. Analyzing each reform separately, on the other hand, point out that trade reform is negatively and significantly associated with government turnover whereas current account, capital account and domestic financial reforms do not have statistical effect on it. However, the baseline regressions mask considerable heterogeneity related to countries' macroeconomic structure, political factors and sequencing of reforms. First, stable economic conditions help governments increase the probability of survival. Voters are more likely to punish reformist governments if international capital flows and government consumption are highly volatile. Second, political conditions are important on the relationship between structural reforms and government change. Stronger reformist governments have more chance to stay in the office compared to the weaker ones. Moreover, the probability of government change decreases following international trade reform in countries with proportional voting system. Finally I have provided evidence that voters are more likely to accept reforms if optimal sequence of reforms is considered. In particular, voters reward reformist governments if international trade reforms precede financial reforms.

I also find that strong macroeconomic performance, low inflation and high growth rates are associated with lower probability of government turnover. Average growth during the tenure of the government is as important as growth in the election year whereas voters

attach more blame to parties for inflation only in the election year. Finally I found weak indication that voters punish governments for growth relative to the developed countries' average growth rate.

Appendix C

Description of reform indices

Current Account Index: An indicator of how compliant a government is with its obligations under the IMF]s Article VIII to free from government restriction the proceeds from international trade in goods and services. The index represents the sum of two sub-components, dealing with restrictions on trade in visibles, as well as in invisibles (financial and other services). It distinguishes between restrictions on residents (receipts for exports) and on non-residents (payments for imports). Although the index measures restrictions on the proceeds from transactions, rather than on the underlying transactions, many countries in practice use restrictions on trade proceeds as a type of trade restriction. The index is scored between zero and 8 in half-integer units, with 8 indicating full compliance. Source: Quinn (1997), and Quinn and Toyoda (2007; 2008).

Trade Index: Average tariff rates, with missing values extrapolated using implicit weighted tariff rates. Index normalized to be between zero and unity: zero means the tariff rates are 60 percent or higher, while unity means the tariff rates are zero. Source: Various sources, including IMF, World Bank, WTO, UN, and the academic literature (particularly Clemens and Willamson, 2004).

Capital Account Index: Qualitative indicators of restrictions on financial credits and personal capital transactions of residents and financial credits to nonresidents, as well as the use of multiple exchange rates. Index coded from zero (fully repressed) to three (fully liberalized). Source: Abiad et. al., (2008), which follows the methodology in Abiad and Mody (2005). The original sources are mostly various IMF reports and working papers, but also central bank websites, etc. Resident/nonresident-specific indices are based on Quinn (1997), and Quinn and Toyoda (2007).

Domestic Finance Index: The index of domestic financial liberalization is an average of six subindices. Five of them relate to banking : (i) interest rate controls, such as

floors or ceilings; (ii) credit controls, such as directed credit, and subsidized lending; (iii) competition restrictions, such as limits on branches and entry barriers in the banking sector, including licensing requirements or limits on foreign banks; (iv) the degree of state ownership; and (v) the quality of banking supervision and regulation, including power of independence of bank supervisors, adoption of a Basel I capital adequacy ratio, and framework for bank inspections. The sixth sub index refers to the regulation of securities markets, including policies to encourage the development of bond and equity markets, and to permit access of the domestic stock market to foreigners. The sub-indices are aggregated with equal weights. Each sub-index is coded from zero (fully repressed) to three (fully liberalized). Source: Abiad and others (2008), which follows the methodology in Abiad and Mody (2005). The original sources are mostly various IMF reports and working papers, but also central bank websites, etc. Resident/nonresident-specific indices are based on Quinn (1997), and Quinn and Toyoda (2007).

Product Market Index: Simple average of the electricity and telecom markets sub-indices, which are constructed, in turn, from scores along three dimensions. For electricity, they capture: (i) the degree of unbundling of generation, transmission, and distribution; (ii) whether a regulator other than government has been established; and (iii) whether the wholesale market has been liberalized. For telecom, they capture: (i) the degree of competition in local services; (ii) whether a regulator other than government has been established; and (iii) the degree of liberalization of interconnection changes. Indices are coded with values ranging from zero (not liberalized) to two (completely liberalized). Based on national legislation and other official documents.

Appendix D

Description of political variables

Term: Government termination: dummy variable equal to 1 in any year in which a government ends, regardless of the reason. A termination may or may not involve a "change" in cabinet ideology or prime minister.

Durat: Duration: integer number of years that a cabinet has been in power, up to the current year. A cabinet that falls during its first year in power is counted as 1. Every time there is a government termination (*TERM=1*), *DURAT* is reset to 1 the year after the termination.

Sing: Single party: dummy variable equal to 1 if a single party cabinet is in power.

Coal: Coalition: dummy variable equal to 1 if a coalition cabinet (including ministers from two or more parties) is in power.

Maj: Majority: dummy variable equal to 1 if the cabinet has majority support in parliament.

Pmch: Change of prime minister: dummy equal to 1 if an election takes place in year t and county i and the current prime minister (or president) is not in the office in year t + 1.

Parliamentary System: Binary variable. It is equal to 1 for parliamentary system, and 0 for presidential system.

Proportional Representation: Binary variable. It is equal to 1 if candidates are elected on the basis of the percent of votes received by their party. 0 otherwise.

Democratic History: This variable records how long parties and prime ministers have

been elected competitively.

Appendix E

List of countries in the sample

Angola	Czech Republic	Cambodia	Nigeria	Ukraine
Albenia	Ecuador	Laos	Nepal	Uruguay
Argentina	Egypt	Lebanon	Panama	Venezuela
Armenia	Estonia	Liberia	Peru	South Africa
Bangladesh	Fiji	Sri Lanka	Philippines	Zambia
Benin	Gabon	Lithuania	Poland	Zimbabwe
Bolivia	Georgia	Latvia	Paraguay	
Botswana	Ghana	Moldova	Russia	
Brazil	Guinea	Madagascar	Senegal	
Bulgaria	Gambia	Mexico	Singapore	
Burkina Faso	Guatemala	Macedonia	Sierra Leone	
Cameroon	Honduras	Mali	El Salvador	
Central African Republic	Hungary	Mongolia	Slovakia	
Chile	Indonesia	Mozambique	Tanzania	
Costa Rica	India	Mauritius	Thailand	
Colombia	Israel	Malawi	Tajikistan	
Cote D'Ivoire	Jamaica	Malaysia	Trinidad Tobago	
Crotia	Kenya	Namibia	Tunusia	
Cyprus	Krgyzstan	Niger	Turkey	

Source: World Economic Outlook Database.

Chapter 4

Union Wage Compression and Skill Acquisition

Abstract

In this paper, I examine the relationship between unionization and total output in an economy with dual labor market, heterogeneous agents, and human capital investment. More importantly, I establish the channel -skill acquisition- through which unionization affects total output. First I show that if there exists unions in high skill intensive sector and the low skill intensive sector is perfectly competitive, then effective skilled labor in the economy decreases, and therefore high skill intensive sector contracts while low skill intensive sector grows. Instead, if the unions exist in low skill intensive sector and high skill intensive sector remains competitive, then the net skill premium increases. As a result, both the effective skilled labor and total output of skill intensive sector rise whereas low skill intensive sector shrinks. Secondly, I investigate the effects of unionization on total output by exploiting the differences in skill intensity across industries. Empirical results indicate that unionization is negatively associated with total output disproportionally in industries with lower skill intensity.

Keywords: Occupational choice, unions, dual labor market, human capital.
JEL Classification Numbers: E24, J24, J31, J51.

4.1 Introduction

Macroeconomic consequences of labor market institutions (LMIs) in developed countries have been heated debates for several decades. A vast volume of research has investigated the effects of LMIs on employment and total factor productivity (TFP), and concluded that governments should carry out labor market reforms to foster technological change and reduce unemployment. A further question, which did not draw enough attention in the economic literature however, is the impact of wage setting LMIs on skill composition. This question is yet important for two reasons. First, despite of the fact all LMIs distort the labor demand decisions of firms, wage compressing LMIs also influence the labor supply decisions of individuals. Furthermore, these institutions do not only affect the decision of being employed or not, but they shape the human capital investment decision of individuals as well. In a recent paper, Samaniego (2008) suggest that the skill distribution of a firm is not affected by the firing cost. The main reason is that firing cost does not affect the skill premium, since it is the same both for low and high skilled workers. Therefore, this type of LMIs is absolutely irrelevant for the workforce composition. The impact of unions, on the other hand, is likely to be different among the labor force that has different skills due to the wage compressing effect of unions. Unions are inclined to pursue egalitarian wage policies, reducing wage differentials by education and skill level (Boeri and van Ours, 2013). Through decreasing the skill premium, unions might provide sizeable disincentives for individuals to acquire human capital. Moreover, human capital has been identified as the engine of growth in the era of Information and Communication Technologies (ICT) revolution. Since technology is skill biased, any LMI that has detrimental impact on human capital accumulation will consequently lead to lower level of output.

The consensus of the literature has long been that unions decrease the inequality between low skilled and high skilled workers at the cost of unemployment among the former group[1]. Unionization decreases the dispersion of wages and inequality which eventually alters incentives. While reduced skill premium induces fewer workers to invest in skills since marginal return of getting education decreases, unionization has positive impact on the decision to acquire skills by threatening the individual with unemployment. Hence there are two channels which work in opposite directions and the net effect depends on whether the former or the latter channel overwhelms the other one. There will be larger number of high skilled workers in the economy, should probability of being unemployed outweighs compressed skill premium. In fact, figure 4.1 shows that skilled labor force

[1]Among others, DiNardo et al. (1996), Lemieux (1998), Kahn (2000), Card et al. (2004) and Koeniger et al. (2007) find that unionization is negatively associated with wage inequality. On the contrary, Checchi and Garcia-Penalosa (2010) do not detect any significant effect of wage setting institutions such as union density, wage bargaining conditions and the minimum wage on income inequality.

tends to be higher in countries that were characterized by higher unionization[2].

Figure 4.1: Unionization and Skilled Labor Force

Source: Author's estimations.

This paper examines how unions, by changing the skill premium, influence skill composition and total output of certain sectors. To identify the causal relationship between them, I make use of a theoretical mechanism through which unions affect total production. The model predicts that unionization has heterogeneous effects across sectors, where heterogeneity arises from their skill intensities. After identifying the hypotheses, I empirically investigate the relationship between total output and unionization.

In this paper, I develop a general equilibrium model with two sectors and two types of workers; high-skilled and low-skilled. I consider that a final good is produced by two sectors which employ both types of workers. Individuals opt whether or not to invest in human capital, and therefore, labor supplies are endogenously chosen. I first analyze the competitive equilibrium, in which schooling decision is purely a positive function of skill premium. The higher skill premium implies the larger number of skilled labor in equilibrium. Then I introduce unions that relates only to the low skilled workers. More importantly, I assume dual labor market structure; low skilled workers in one sector is unionized however the labor market of low skilled workers in the other sector remains perfectly competitive[3]. Accordingly, when unionized sector lays off a certain amount of

[2]Figure 4.1 depicts the correlation between labor force with tertiary education and unionization for some OECD countries between 1985 and 2003. Regression controls real GDP per capita of countries. The data are 5 year averages and countries therefore appear more than once.

[3]In principle, unions may cover high skilled workers as well. However, the assumptions are not at

low skilled workers, they will migrate to the non-unionized sector and decrease (increase) the wage (skill premium) in that sector. Different from other studies, there is not unemployment in equilibrium thanks to the existence of perfectly competitive non-unionized sector. Notice however that, the reduced skill premium in this sector plays exactly the same role with unemployment since both are positively associated with skill acquisition.

I can summarize the results as follows. Let's suppose that there exist unions in the high skilled intensive (HSI) industry, and the low skill intensive (LSI) industry is perfectly competitive. In spite of the fact that unionization decreases the skill premium regardless of the sector characteristic, the decrease is dramatically larger in HSI sector. The increased skill premium, on the other hand, in the competitive sector (LSI) is much lower. In this case, the latter channel dominates the former one and therefore the number of skilled workers decreases in equilibrium. On the contrary, if union exists in LSI industry, the unionized wage increases less owing to the higher output elasticity of low skilled workers. Therefore, the skill premium in the unionized sector does not decrease much. However, the wages of low skilled workers decrease substantially after they move to HSI industry and skill premium widens. Since increased skill premium in perfectly competitive sector overwhelms the decreased skill premium in unionized one, the effective skilled labor increases in equilibrium. This leads to a higher output in HSI industry while the output in the LSI industry contracts. Most importantly, these results hold irrespective of the union bargaining power.

Having identified the theoretical mechanism, I employ the skill intensity measures of industries in order to test for the differential effect of unionization across industries. Using data on the sectoral level of unionization over the 1994-2005 period and the measure of skill intensity at the sector level, I first observe that union density is negatively correlated with skill intensity, suggesting that unions exist mainly in LSI industries. Then I provide evidence that unionization decreases total output disproportionally in industries with lower skill intensity. Main novelty of this paper, however, lies in a more specific issue. To my knowledge, this is the first study to examine how and to what extent, union density and skill intensity of an industry interact in determining the total output. Estimation results indicate that the negative influence of unionization on total output is decreasing in the skill intensity. In particular, the value added share difference between an industry at the 75th percentile of the skill intensity distribution and an industry at the 25th percentile is 1.07% in an industry at the 75th percentile of the union density share distribution with respect to an industry at the 25th percentile. The effect estimated for output share is however rather small, 0.86%.

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odds with the evidence since union coverage tends to be concentrated at the bottom and/or middle of the skill distribution. Hence unionization has greater adverse employment effects on the low-skilled workers. See Kahn (2000), Card et al., (2004), and Checci et al., (2010) among others.

Empirical findings are robust to alternative procedures of critical evaluation. First, I probe whether the interaction between unionization and skill intensity picks up other interactions of unionization with industry characteristics which might be correlated with skill intensity, such as physical capital intensity and layoff intensity. In addition, I test the sensitivity of the baseline results against including a set of alternative determinants of industry growth, such as the interaction of skill intensity with real GDP per capita growth and secondary school enrollment. Finally, I examine whether the relationship between unionization and total output survives inclusion of skill intensity and other relevant LMIs interactions, such as employment protection legislation (EPL), unemployment benefit coverage, tax wedge, bargaining level and bargaining coordination. The variables of interests remain statistically significant with expected signs in all these specifications.

The rest of the paper is organized as follows. In the next section, I relate the paper to the existing literature. In section 4.3, I develop the model under perfect competition. In section 4.4, I introduce dual labor market structure and compare its main results with competitive equilibrium ones. In section 4.5, I describe the data. Section 4.6 provides main empirical results and a number of robustness checks. Finally, section 4.7 concludes.

4.2 Related Literature

This paper contributes to a vast literature that analyzes the relationship between LMIs and growth. The primary focus has been on skill acquisition. Cahuc and Michel (1996), Agell and Lommerud (1997) and Ravn and Sorensen (1999) study the effects of minimum wages on skill accumulation and find a positive relationship between them. In Cahuc and Michel (1996), minimum wage does not affect skill premium, but only increases the probability of being unemployed. Not surprisingly, under this setup minimum wage increases the incentive to accumulate human capital since it implies a larger threat of becoming unemployed. Their argument relies on the presence of a strong positive externality associated with the accumulation of human capital. Although in their extended model skill premium does not stay constant, the ultimate result does not change, provided that the channel going through the externality and the threat of facing unemployment dominates the falling skill premium. Similarly, Agell and Lommerud (1997) point out that owing to the wage floors, firms are no longer profitable with the existing workers since firms require larger productivity for non-negative profit. Hence, minimum wage, by compressing the wage distribution from below, creates an incentive for workers to increase their educational investment. Ravn and Sorensen (1999) take into consideration schooling and on-the-job training as well for human capital accumulation. In a dynamic perspective, the setting of minimum wage has two opposing effects on productivity growth. On the

one hand, firms' reaction to the increase in labor cost is to reduce other payments, on-the-job-training for example. On the other hand, low skilled workers tend to improve their skills when their wages increase. Therefore, the net effect of minimum wage is ambiguous and depends on whether schooling or training dominates the other channel. Schooling contributes more to the productivity, to the extent that training has very little impact on the productivity, and/or minimum wage is sufficiently larger than the market clearing level, and labor productivity growth increases.

My work more closely relates to Doppelhofer (2002), Lindquist (2005), and Cardona and Sanchez-Losada (2006). Lindquist (2005) examines the effect of wage compression on welfare and suggests that compressing wages via union leads to welfare losses due to the increase in unemployment. However, the effect of wage compression on the supply of skilled labor is rather small owing to the large threat of being unemployed. Therefore, he has the similar intuition of Cahuc and Michel (1996) and Agell and Lommerud (1997). He also points out that abolishing the union induces welfare gain only if government's budget surplus -arising from lower unemployment expenditures- efficiently transferred to the workers. Instead, if the workers do not benefit from the budget surplus, then eliminating the wage compression makes the unskilled workers worse off. Doppelhofer (2002), on the other hand, argues that the stylized facts do not support the premise that more compressed skill premium is associated with greater skill accumulation. In his two period overlapping generations model, there is a single sector which employs skilled and unskilled labor. Individuals inherit human capital from previous generations and they can augment it via schooling. Growth occurs in his model, since a marginal increase in skills improves the productivity of all existing skilled workers in the economy thanks to the externality in human capital accumulation. Imposing union to the economy, the skill premium decreases which consequently reduces the incentives to accumulate skills. He shows that competitive equilibrium achieves higher fraction of skilled workers, and therefore higher economic growth than the equilibrium with union. Finally, Cardona and Sanchez-Losada (2006) examine the effect of unions' bargaining power on production. In an economy with skilled and low skilled intermediate sectors, higher bargaining power of both the former and the latter sectors might lead to greater final good production then competitive equilibrium. If there is an increase in bargaining power of one sector, workers in that sector earn more and the price of the intermediate good of that sector increases. As a result, final good production is negatively affected. The unemployed workers migrate to the alternative sector by modifying their qualifications. Then wages and price of the intermediate good of this sector will decline, which will induce a positive change in the demand of intermediate goods. Under some specific parameter conditions and bargaining process, the latter channel dominates the former one and final good production increases.

My paper differs from these contributions in several important respects. First, I theoretically identify a specific channel, skill acquisition, through which unionization affects total output. Given that unions and their wage setting policies are at the core of debates, providing the mechanism is important in terms of policy implications. In addition, I draw attention to the role of unions playing a central part in determining total output. This contributes to better comprehension of the links between unions and macroeconomic outcomes. Second, I analyze the role of unions in a dual labor market. In this framework, I compare the effects of the union in HSI industry while the other sector is perfectly competitive and LSI, with the effects of the union in LSI industry when there is a perfectly competitive HSI industry. This extension allows me to find out the certain conditions under which one of the channels dominate the other one. Under the dual labor market scenario, the net effect of the union on skill acquisition and total output depends on the skill intensities of industries irrespective of the union bargaining power. Considering that the previous literature provides mixed results, suggesting which channel dominates under which conditions has crucial importance in terms of policy implications. In particular, this paper sheds some light on the issue of how to reform unions. Furthermore, the endogenous nature of the skill intensity of industries, stemming from endogenous skill acquisition of individuals, is the crucial feature of the model since the differential effect of unionization on total output is obtained by its interaction with unionization. Hence, incorporating it into the dual labor market framework allows to comprehend what drives firms' total output and how they are affected by unionization. Finally, the literature lacks empirical evidence. Although the foregoing papers provide clear theoretical mechanisms, their implications remained overlooked and no author ever put it into rigorous testing. This paper, based on the predictions inferred from the model, tests the relationship between unionization and total output. This produces a more complete picture of the unionization, together with better understanding of real world facts.

4.3 Competitive Model

Let's consider a closed economy with two industries and two types of worker. I assume that representative firms in each industry operate with Cobb-Douglas production function and employ both high-skilled and low-skilled workers.

4.3.1 Agents

Inspired by Casarico and Devillanova (2008), I model skill heterogeneity as follows: I consider static model of a closed economy populated by a continuum of heterogeneous agents indexed by j. Agents decide whether or not to invest in human capital: if they do,

they become skilled workers (type H agents); if they do not, they remain low skilled (type L agents). The human capital investment decision depends on the idiosyncratic ability parameter a_j: the latter denotes the time required to become skilled and it is distributed on the interval $[0, 1]$ with continuous density function $\varphi(.)$; the more able the agent is, the less time she has to spend investing in human capital, and the lower are her foregone earnings.

Individuals consume a unique final good which is the numeraire. Since the model is static, they consume all their income:

$$u(c_j) = w_j$$
$$w_j = \begin{cases} w_H(1 - a_j) & \text{if } j \in H \\ w_L & \text{if } j \in L \end{cases}$$

where w_H and w_L represent competitive wages of skilled and low skilled labor, and a_j denotes the time required to become skilled. w_j is linearly decreasing in a_j for skilled agents since in order to become a skilled worker each individual bears a cost, while it is independent of a_j for low skilled agents. By equating the indirect utility functions, I can obtain the education cutoff under competitive equilibrium, a^{CE}:

$$a^{CE} = 1 - \frac{w_L}{w_H} \tag{4.1}$$

Defining the skill premium as $z^* = \frac{w_H}{w_L}$, we can rewrite the above equation

$$a^{CE} = 1 - \frac{1}{z^*} \tag{4.2}$$

All those whose cost of investing is below a^{CE} will become skilled workers while those whose cost is above a^{CE} will remain low skilled. Notice that the number of skilled individuals is positively related to the skill premium. It follows that the effective supply of skilled and low skilled labor are:

$$\widetilde{H} = \int_0^{a^{CE}} (1 - a)\varphi_a da \tag{4.3}$$

$$\widetilde{L} = \int_{a^{CE}}^1 \varphi_a da \tag{4.4}$$

The high skilled workers devote a percentage of their time to become skilled and work in the remaining $(1 - a)$ percentage of time. Instead, low skilled workers's effective time to work is exactly equal to 1.

Assume for simplicity that ability is uniformly distributed on the unit interval: $a_j \sim U[0, 1]$. Then I can calculate:

$$\widetilde{H} = a^{CE} - \frac{(a^{CE})^2}{2} \tag{4.5}$$

$$\widetilde{L} = 1 - a^{CE} \tag{4.6}$$

Notice that the sum of effective skilled and low skilled labor is, $\left(1 - \frac{(a^{CE})^2}{2}\right)$, lower than 1 since human capital investment requires a certain percentage of time to be spent.

4.3.2 Firms

Firms in both sector face competitive output markets, where the good prices are normalized to unity. The technologies of the representative firms in two industries are given by the following Cobb-Douglas production functions:

$$Y_1 = L_1^{\alpha} H_1^{1-\alpha} \tag{4.7}$$

$$Y_2 = L_2^{\beta} H_2^{1-\beta} \tag{4.8}$$

where $\alpha + \beta < 1$. The variables Y_1 and Y_2 are productions, L_1 and L_2 stand for low skilled labor and, H_1 and H_2 stand for skilled labor in sector 1 and 2 respectively.

Proposition 1 *Assuming perfect competition in the market together with perfect mobility of workers among sectors, equilibrium levels of wages, low-skilled workers, high-skilled workers, and skill intensities of the industries are given by:*

$$w_{L1} = \alpha \left(\frac{H_1}{L_1}\right)^{1-\alpha}, w_{H1} = (1-\alpha)\left(\frac{H_1}{L_1}\right)^{-\alpha} \tag{4.9}$$

$$w_{L2} = \beta \left(\frac{H_2}{L_2}\right)^{1-\beta}, w_{H2} = (1-\beta)\left(\frac{H_2}{L_2}\right)^{-\beta} \tag{4.10}$$

$$L_1 = \frac{\left(a^{CE}\right)^2 - 2a^{CE} + 2S_2(1-a^{CE})}{2(S_2 - S_1)}, L_2 = \frac{2a^{CE} - \left(a^{CE}\right)^2 - 2S_1(1-a^{CE})}{2(S_2 - S_1)} \tag{4.11}$$

$$H_1 = S_1 L_1, H_2 = S_2 L_2 \tag{4.12}$$

$$S_1 \equiv \frac{H_1}{L_1} = \left(\frac{\beta}{\alpha}\right)^{\frac{\beta}{\beta-\alpha}} \left(\frac{1-\beta}{1-\alpha}\right)^{\frac{1-\beta}{\beta-\alpha}}, S_2 \equiv \frac{H_2}{L_2} = \left(\frac{\beta}{\alpha}\right)^{\frac{\alpha}{\beta-\alpha}} \left(\frac{1-\beta}{1-\alpha}\right)^{\frac{1-\alpha}{\beta-\alpha}} \tag{4.13}$$

where S_1 and S_2 are the skill intensities of first and second sector respectively.

Proof. See appendix. ■

Technology is such that marginal productivity of a representative high skilled worker is greater than marginal productivity of a representative low skilled worker in both industries. If it were otherwise, no individual who has to decide on the occupation would choose to be skilled and therefore a^{CE} would be zero.

The aforementioned assumptions also provide the following relationship between skill intensities of the industries:

$$\frac{H_1}{L_1} = \left(\frac{\beta}{\alpha}\right)\left(\frac{1-\alpha}{1-\beta}\right)\left(\frac{H_2}{L_2}\right) \tag{4.14}$$

If the output elasticity of low skilled worker in the first sector is lower than the output elasticity of low skilled worker in the second sector ($\alpha < \beta$), then the first sector is more skilled intensive than the second sector.

Using the skill intensity definitions, I can write down the equilibrium output levels in terms of education cutoff of the economy:

$$Y_1 = L_1^{\alpha} H_1^{1-\alpha} = L_1^{\alpha} \left(S_1 L_1\right)^{1-\alpha} = S_1^{1-\alpha} L_1 \tag{4.15}$$

$$Y_2 = L_2^{\beta} H_2^{1-\beta} = L_2^{\beta} \left(S_2 L_2\right)^{1-\beta} = S_2^{1-\beta} L_2 \tag{4.16}$$

Proposition 2 *The reaction of output to a change in education cutoff a^{CE} depends on the skill intensity S of associated industry. If the industry is skill intensive, then its total output Y is positively related with education cutoff a^{CE}, and therefore the economy wide effective skilled labor. Instead if an industry is low skill intensive, its total output is decreasing in a^{CE}.*

Proof. See appendix. ■

Finally, I can get the education cutoff by substituting S_1 and S_2 into the equation (4.1):

$$a^{CE} = 1 - \left(\frac{\beta}{1-\beta}\right)\left(\frac{\alpha}{\beta}\right)^{\frac{\alpha}{\alpha-\beta}} \left(\frac{1-\alpha}{1-\beta}\right)^{\frac{1-\alpha}{\alpha-\beta}} \tag{4.17}$$

The number of agents who opt to invest in skills is decreasing in α and β as they represent the output elasticities of low skilled workers in the first and second industry respectively.

4.4 Union Model

In this section, I introduce the unions to the second sector, to set the minimum wage for low skilled workers[4]. Unions mostly cover low skilled workers as explained in the introduction. Moreover, unionization is a sectoral rather than country-wide issue and unionization rates vary significantly from sector to sector. For these reasons, and simplicity of computation, labor market for low skilled workers in the first sector as well as the labor market for all high skilled workers are assumed to stay perfectly competitive. Since unions set the wage above the competitive equilibrium one, firms in the second sector will lay off a certain amount of low skilled workers. However, the laid off workers will be hired by the perfectly competitive sector 1. Therefore we do not observe unemployment in equilibrium. What we observe, instead, is a higher wage for low skilled workers in unionized sector, and a lower wage for low skilled workers in perfectly competitive sector. More importantly, high skilled workers earn the same wage in both of the sectors, since their labor market stays competitive. Therefore the skill premium in the unionized sector is compressed whereas the skill premium in the perfectly competitive sector widens.

4.4.1 Agents

Individuals still consume the unique final good and maximize the same lifetime utility, but the budget constraint changes since low skilled workers earn different wages:

$$u(c_j) = w_j$$

$$w_j = \begin{cases} w_h(1-a_j) & \text{if } j \,\epsilon\, H \\ w_{l1} & \text{if } j \,\epsilon\, L \text{ in sector 1} \\ w_{l2} & \text{if } j \,\epsilon\, L \text{ in sector 2} \end{cases}$$

[4]Unions might have many different aspects depending on the assumptions underlying the questions asked. According to the standard view, union is an economic agent whose goal is like any other monopolist to maximize the utility of members by appropriating the employers rents. While changing the wage profiles in favor of their members, unions, at the same time, reduce employment opportunities for the rest of the workers. They also usually endorse employment protection legislation which makes entry and reentry to the labor market harder. Hence they are defined as pure rent-seeking organizations. On the other hand, unions may improve efficiency in the imperfect/incomplete markets through providing services to members. Unions may provide unemployment benefits in the presence of job loss (as in Scandinavian countries), they can force employers for the implementation of on-the-job training and they can improve the efficiency by reducing transactions costs involved in individual bargaining (Boeri and van Ours, 2013). In spite of the critical difference, exploring how the role of the union affects individuals skill acquisition behavior is beyond the scope of this paper. Thus, I will follow the standard view on the unions. The second critical assumption is that high-skilled workers are not unionized. If I assume that they can also be members of unions, than the results of the model might change dramatically. High skilled workers would also benefit from higher wages and therefore skill premium may not be compressed as much as it is done in my case. See Acemoglu et al. (2001) for this type of analysis.

An employed worker earns wage w_h or w_l depending the skills she acquired. As in the previous section subscript h stands for high-skilled and l for low-skilled workers[5]. Due to unionization, a fraction u of low-skilled workers will be dismissed from sector 2 and only a fraction $(1-u)$ of low skilled workers will stay in the second sector. The laid off low skilled workers will migrate to the perfectly competitive sector 1 and decrease the wage until there is no unemployment in equilibrium.

Representative worker makes her decision on acquiring skill by comparing her utilities derived from becoming skilled and low skilled worker. If she invests in education, she becomes skilled and earns w_h. Instead if she does not invest in education, she remains low skilled. However, her wage will be different depending on in which sector she works. Notice that I assume free mobility for both high and low skilled workers among the two sectors. Therefore, high skilled workers earn the same wage. Low skilled workers, however, earn less in the first sector compared to their counterparts in the second sector since the unionization that we consider relates only to the low skilled workers in the second sector. The new employment levels of low skilled workers will be as follows:

$$l_1 = L_1 + uL_2, l_2 = (1-u)L_2 \tag{4.18}$$

In equation (4.18), l_1 and l_2 represent the number of low skilled workers in the presence of union in the first and second sector respectively. Union causes layoffs in the second sector and therefore low skilled employment in the second sector is less compared to employment in the competitive equilibrium. Whereas low skilled employment of first sector is larger compared to employment in the competitive equilibrium since the laid off workers migrate to the sector 1. Moreover, a representative low skilled worker will work in the first sector with probability $\left(\frac{L_1+uL_2}{L_1+L_2}\right)$ and she works in the second sector with probability $\left(\frac{(1-u)L_2}{L_1+L_2}\right)$. The indirect utility functions are therefore:

$$V_h = (1-a^U)w_h \tag{4.19}$$

$$V_l = \left(\frac{L_1+uL_2}{L_1+L_2}\right)w_{l1} + \left(\frac{(1-u)L_2}{L_1+L_2}\right)w_{l2} \tag{4.20}$$

where a^U stands for the education cutoff in the presence of union and u stands for the fraction of workers those move from sector 2 to sector 1.

[5]Notice that in order to make the union model comparable with competitive model, I use small letters for the former.

The marginal individual derives the same utility from becoming skilled or low skilled workers. I can obtain the ability of marginally skilled individual by equating the indirect utilities:

$$a^U = 1 - \left(\left(\frac{L_1 + uL_2}{L_1 + L_2}\right)\frac{1}{z_1} + \left(\frac{(1-u)L_2}{L_1 + L_2}\right)\frac{1}{z_2}\right) \tag{4.21}$$

where z_1 and z_2 are the skill premiums in sector 1 and 2 respectively. As in equation (4.2), higher skill premiums induce more people to invest in education, which in turn raises the effective skilled labour of the economy. Notice however that, the skill premiums in sector 1 and 2 are different owing to the existence union. Education cutoff is now functions of not only α and β, but also u, which will later be determined by the collective bargaining model.

4.4.2 Firms

Firms behave as in the competitive case and maximize profits taking prices as given. The presence of unions in the labor market of low-skilled workers generates a wage above the market clearing level which leads to decrease in employment of low-skilled workers in the second sector. Hence, in equilibrium only a fraction $(1-u)L_2$ of low-skilled workers in the second industry will find work whereas uL_2 fraction of workers will move to perfectly competitive sector and thus, there is still full employment among low skilled workers. Then the production functions can be written as:

$$y_1 = (L_1 + uL_2)^{\alpha} H_1^{1-\alpha} \tag{4.22}$$

$$y_2 = ((1-u)L_2)^{\beta} H_2^{1-\beta} \tag{4.23}$$

The new wages are:

$$w_{l1} = \alpha\left(\frac{H_1}{L_1 + uL_2}\right)^{1-\alpha} = w_L^*\left(\frac{L_1}{L_1 + uL_2}\right)^{1-\alpha} \tag{4.24}$$

$$w_{h1} = w_{h2} \tag{4.25}$$

$$w_{l2} = \beta\left(\frac{H_2}{(1-u)L_2}\right)^{1-\beta} = w_L^*(1-u)^{\beta-1} \tag{4.26}$$

where w_L^* denotes the wages of low and high skilled workers in the competitive equilib-

rium. Thanks to the perfect mobility, high-skilled workers will be reallocated from second to first sector and therefore they earn the same wage. Low-skilled workers, however, will get different wages as one sector is unionized while the other one remains perfectly competitive.

4.4.3 Union Equilibrium

We assume that in the first sector, labor market for low skilled workers is perfectly competitive while in the second sector, they are represented by unions. Following the right-to-manage (RTM) model, unions and firms bargain over the wage level, and the firm decides its own labor demand. All the unions' objective is to maximize the sum of utilities of all its members. Therefore the objective function of the unions is given by:

$$V = (w_U - w_c)L_2 \tag{4.27}$$

where w_U is the unionized wage, w_c is the competitive equilibrium wage (reservation wage) respectively. In the case of disagreement, firms do not employ any worker and the utility of unions falls to zero. When the wage w_U is fixed, the firm's profit take the form $\Pi = Y_2 - w_U L_2$, with the zero disagreement profit. The outcome of the bargaining process comes from the maximisation of the following generalized Nash function:

$$\begin{aligned} &max_{\{w_U\}}\ \Omega = (Y_2 - w_U L_2)^{1-\gamma}[(w_U - w_c)\, L_2]^{\gamma} \\ &\text{s.t } w_U = \beta \left(\frac{H_2}{L_2}\right)^{1-\beta} \end{aligned} \tag{4.28}$$

where γ and $(1-\gamma)$ denote the bargaining power of unions and rms, respectively. I assume that $\gamma\ \epsilon\ [0,1]$, despite there is no bargaining over wages if $\gamma = 0$ or $\gamma = 1$. Namely if $\gamma = 0$ unions have no bargaining power and therefore mimics the perfectly competitive equilibrium. On the other hand, if $\gamma = 1$, union has the highest bargaining position. In this case, the solution mimics monopoly union wage.

Solving this maximization problem provides the following relationship:

$$w_U = \mu w_c \tag{4.29}$$

where $\mu = \left(\frac{\gamma+\beta(1-\gamma)}{\beta}\right) > 1$

Equation (4.29) shows that there is a wedge between the wages of hired workers and the wages of a laid off workers. Therefore the term μ represents the markup indicating the gap between the utility of a hired worker and that of a laid off person. Notice that, the markup is an increasing function of γ. If the union's bargaining power is null, then the markup variable is equal to one and the unionized wage is equal to the competitive

equilibrium wage.

From the profit maximization problem of firm, we can write firm's demand for low skilled workers in the second industry.

$$(1-u)L_2 = H_2\,(\beta)^{\frac{1}{1-\beta}}\,(w_U)^{\frac{-1}{1-\beta}} \tag{4.30}$$

Substitution of the union wage equation (4.29) in the labor demand equation (4.30) together with competitive equilibrium wage $w_{L1} \equiv w_c = \alpha\left(\frac{H_1}{L_1}\right)^{1-\alpha}$ immediately entails:

$$u = 1 - \mu^{\frac{-1}{1-\beta}} \tag{4.31}$$

Therefore, $\left(\mu^{\frac{-1}{1-\beta}}\right) L_2$ low skilled workers will be employed in the unionized industry, and $\left(1-\mu^{\frac{-1}{1-\beta}}\right) L_2$ number of workers will migrate to the perfectly competitive industry.

Figure 4.2 below illustrates how the main mechanism of the model works. In the absence of union, low-skilled workers earn the same wage w_c thanks to the perfect mobility assumption between the two sectors. Employment in the two sectors are l_1 and l_2 respectively. When the union in the second sector sets the wage as w_U, workers who cannot find a job in that sector will move to the first sector and depress the wage to w_{l1} there. Then, the new employment levels will be equal to $l_1 = L_1 + uL_2$ and $l_2 = (1-u)L_2$ in the nonunion and unionized sector respectively. Since there is no unemployment benefits, economy reaches full employment with the wage discrepancy between the two sectors.

Using the wage equations (4.24), (4.25), and (4.26), I can write the down the expression for the education cutoff in the presence of unions as follows:

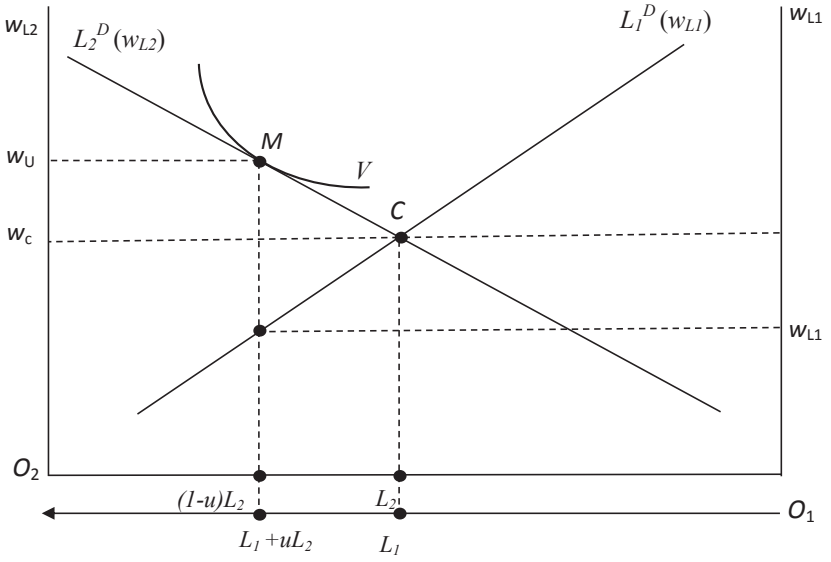
$$a^U = 1 - \left(\left(\frac{L_1+uL_2}{L_1+L_2}\right)\frac{1}{z_1}\left(\frac{L_1}{L_1+uL_2}\right)^{1-\alpha} + \left(\frac{(1-u)L_2}{L_1+L_2}\right)\frac{1}{z_2}\,(1-u)^{\beta-1}\right) \tag{4.32}$$

Proposition 3 *Education cutoff in unionized economy, a^U, is increasing in union bargaining power γ.*

Proof. See appendix. ■

Notice that if union chooses the wage level in a way that unemployment becomes 0, then competitive equilibrium result is replicated: $a^{CE} = a^U$. However, union sets the higher minimum wage, the greater its bargaining power. This increases the number of low skilled workers migrating to the perfectly competitive industry and widens the skill premium there. Through this channel, union stimulates the demand for skill acquisition. On the other hand, greater minimum wage compresses the skill premium in the second

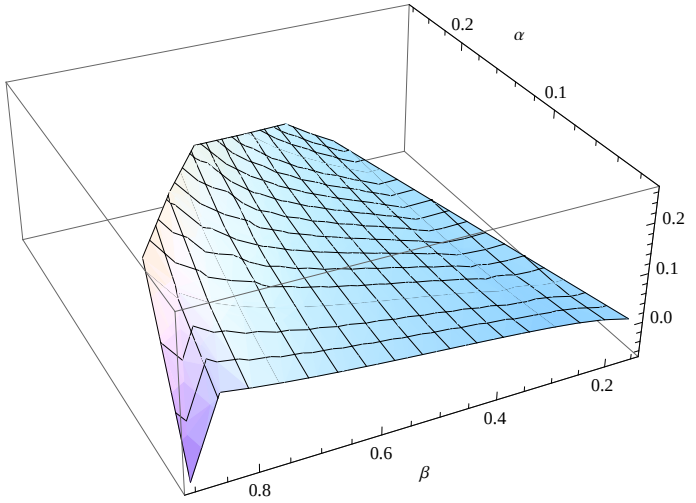
Figure 4.2: Union in Dual Labor Market



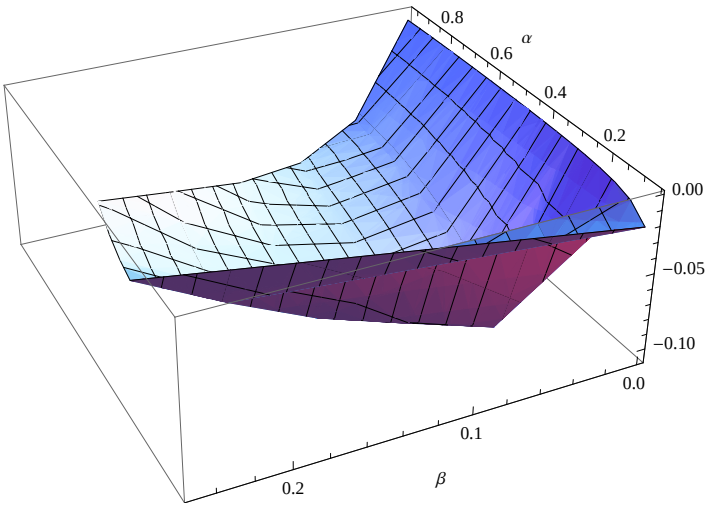
industry and hence provides disincentives to individuals for investing in education. Since it is not possible to analytically determine the relationship between schooling levels in competitive and union equilibriums, three-dimensional graphs below present this relationship for different values of alpha, beta and gamma. The x, y and z axes represent values for α and β and the difference between a^U and a^{CE} respectively.

Figure 4.3: Schooling difference between Union and Competitive Equilibrium ($\gamma = 0.1$)

(a) α is smaller than β



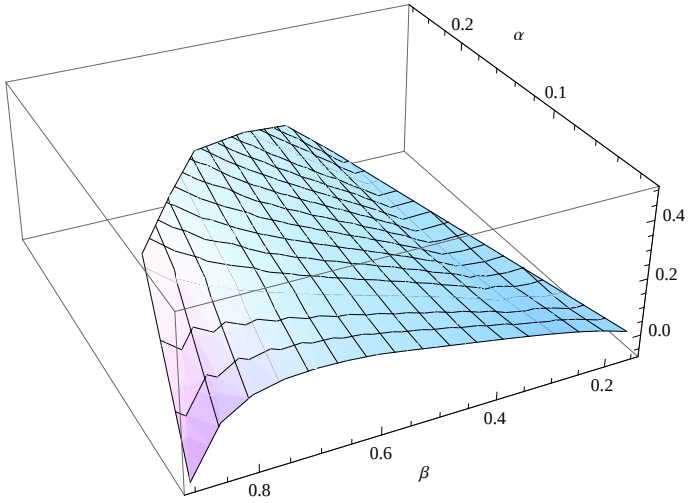
(b) α is bigger than β



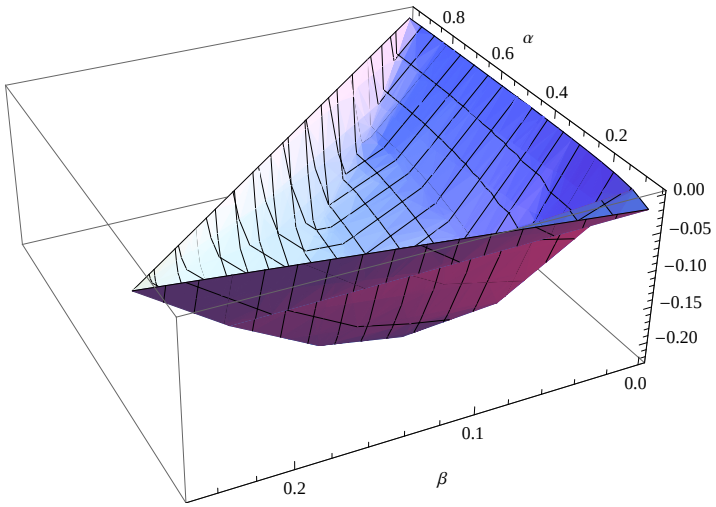
Panel (a) and (b) in figure 4.3 plot the education cutoff difference between union and competitive equilibrium for $\alpha < \beta$ and $\alpha > \beta$ respectively. For union bargaining power $\gamma = 0.1$, effective skilled labor of the economy is always greater if $\alpha < \beta$ and it is always lower if $\alpha > \beta$. In order to check whether this result is not driven by union bargaining power, I draw figure 4.4 and 4.5 for $\gamma = 0.5$ and $\gamma = 0.9$ respectively. Both figures show evidence in favor of the previous result. Although the magnitudes change, I observe the same relationship for different union bargaining powers. Hence irrespective of the bargaining power of the union, I find the following result. If $\alpha > \beta$, then $S_1 < S_2$ therefore union exists in the HSI industry whereas the perfectly competitive industry is LSI. In this case, compressed skill premium in the former dominates the expanded skill premium in the latter industry. Therefore unionization has negative impact on the

Figure 4.4: Schooling difference between Union and Competitive Equilibrium ($\gamma = 0.5$)

(a) α is smaller than β



(b) α is bigger than β

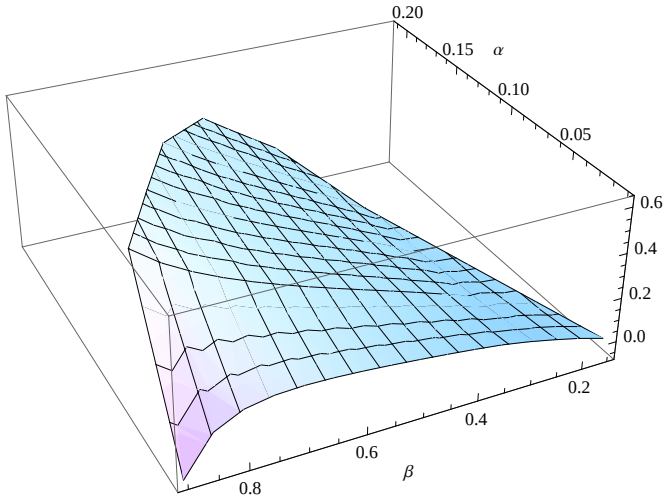


decision of investing in education. Instead, if $\alpha < \beta$ then $S_1 > S_2$ and union exists in the LSI industry while perfectly competitive industry is HSI. Under this setup, unionization has positive impact on schooling since the laid of workers move to the HSI industry and increases the skill premium there which is dominated by the reduced skill premium in unionized LSI industry.

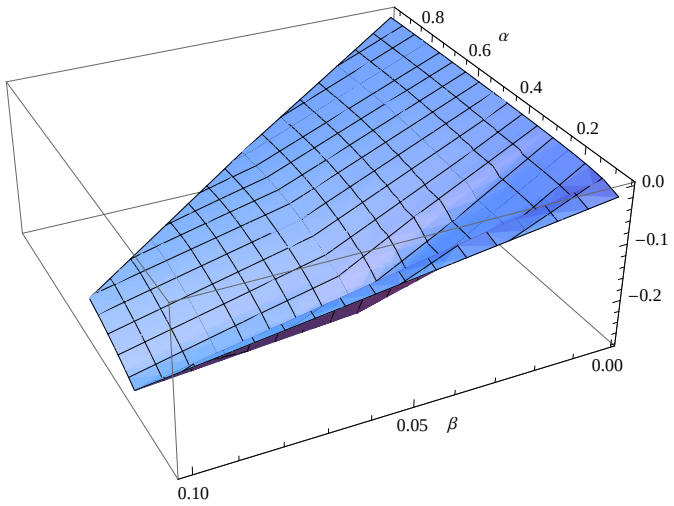
The intuition for this result is the following: There are fewer low skilled workers in the HSI sector by construction. When there is a union in this sector, the number of laid-off low skilled workers is not very high. As they move to the competitive sector, the skill premium does not grow much. Therefore there is a decrease in the skill premium in HSI industry accompanied with lower increase in skill premium in LSI sector, which lead to lower skilled labor force in equilibrium. However, when there is a union in the LSI sector,

Figure 4.5: Schooling difference between Union and Competitive Equilibrium ($\gamma = 0.9$)

(a) α is smaller than β



(b) α is bigger than β



the number of laid-of low skilled workers is so large. Migrating to the competitive HSI sector, they expand the skill premium substantially and give rise to higher skilled workers.

4.5 Data

4.5.1 Country-Industry Level

Data on real value added and output at the country-industry level come from EU KLEMS Growth and Productivity Accounts database. The database (O'Mahony and Timmer, 2009) provides information on wide variety of industry data based on International Standard Industrial Classification (ISIC) Rev. 3.1 for 29 countries for the period 1970-2005.

Since my theoretical arguments are based on different level of unionization in different industries, I make use of sectoral unionization data set, which is drawn from Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) database of Amsterdam Institute for Advanced Labour Studies (AIAS) (Visser, 2011). This database contains union density data, defined as union membership as a proportion of wage and salary earners in employment, for 8 aggregate industries; mining and quarrying; manufacturing; electricity, gas and water supply (utilities); construction; wholesale and retail trade; hotels and restaurants; transport and storage and communication; and financial intermediation. I extract available data for Australia, Denmark, Finland, Ireland, Netherlands, Sweden, and United Kingdom over the 1994 - 2005 period. I drop other countries as data were not available for the complete covered period and the US, since it is used for industry benchmarking. Limited availability of the sectoral unionization measure leaves me with a sample of 7 countries and 507 observations for both real value added output regressions.

Table 4.1 reports the average values of our variables of interest, giving a first summary of the descriptive statistics by industry. It appears that there are significant differences in terms of union density share and employment share across industries. Real Estate, Renting and Business Activities industry, which is the highest skill intensive one, has the largest unionization share and lowest skill ratio as expected. The least skill intensive sector (mining and quarrying) is not the most unionized sector, however, is the one with lowest employment share.

Table 4.1: Unionization and Employment in different industries

Industries	Union Density Share	Employment Share	Skill Ratio	Skill Intensity
Mining and Quarrying	15.3	0.89	13	10.87
Manufacturing	20.7	33.5	9.5	11.73
Utilities	24.3	1.7	14.2	12.15
Construction	19.7	10.2	5.1	11.26
Wholesale and Retail Trade	12.8	24.3	7.2	11.87
Hotels and Restaurants	8.3	5.7	6.7	11.07
Transport and Storage and Communication	20.5	10.7	7.6	12.07
Real Estate, Renting and Business Activities	5.5	12.9	34.7	13.34

Notes: Value added, output, union density and employment shares are defined as the shares in total value added, output, union density and employment respectively. Skill ratio is the ratio of high skilled workers to medium and low skilled workers. Skill intensity stands for the time and country invariant industry characteristic.

4.5.2 Industry Level

The measure of skill intensity at the industry level is derived from Conti and Sulis (2010). The data source for the industry-level measure of skill intensity is the Integrated Public Use Microdata Series database which gathers individual level data on hours worked and years of education from US census. Conti and Sulis (2010) constructs skill intensity measure for 51 sectors. Since I need to match the skill intensity data with the aggregate industry level data of (ICTWSS), I calculate the median value of skill intensity for each aggregate industry and employ it for the estimation. Moreover, physical capital intensity (PCI) and layoff intensity variables are also derived from Conti and Sulis (2010) and Bassanini et al. (2009) respectively.

4.5.3 Country Level

I make use of country level control variables which are taken from different sources. Real per capita GDP come from Penn World Tables. Tertiary school enrollment is taken from World Development Indicators. I extract unemployment benefit coverage from Aleksynska and Schindler (2011) and Fondazione Rodolfo Debenedetti. From OECD, I extract EPL data, which is defined as the average of employment protection for regular and temporary contracts. Finally, coordination and level of bargaining variables come from (ICTWSS) database and tax wedge come from IMF reports and working papers.

4.6 Empirical Specification and Results

Table 4.2 summarizes the predictions of my model. I expect union to have a positive impact on aggregate education if it exists in LSI industry. In this case, union has negative impact on the output of LSI industry. However, thanks to the increase in the effective skilled labor force, unionization is positively related to the output of HSI industry. Instead, if union is present in HSI sector, the effective skilled labor declines in equilibrium, causing the HSI sector to contract. The output of LSI industry, on the other hand, grows as there are more low skilled workers in the economy.

According to the model constructed, the ultimate consequences of unionization depends on the type of the industry in which union is present. Hence I need to identify the region the data correspond to. For this reason, I present in table 4.3, the correlations of the key variables. Union density is found to be negatively correlated with value added share and output share. It appears that unions exist mainly in lower value added industries. Union density share is also negatively correlated with the skill intensity (the time and country invariant industry characteristics) and skill ratio (the number of high skilled

Table 4.2: Comparative Statics of Unionization

Effect of introducing union in $\Longrightarrow$ on $\Downarrow$	LSI industry	HSI industry
a^u	+	-
Y_{LSI}	-	+
Y_{HSI}	+	-

Notes: a^U is the education cutoff in the presence of union. LSI stands for low skill intensive industry, HSI stands for high skill intensive industry, and Y is the total output.

workers over medium skilled and low skilled), suggesting that unions are more present in low skill intensive sectors.

Table 4.3: Bivariate Correlations

Correlations	Value Added Share	Output Share	Union Density Share	Skill Ratio	Skill Intensity
Value Added Share	1				
Output Share	0.93 (0.00)	1			
Union Density Share	-0.29 (0.00)	-0.23 (0.00)	1		
Skill Ratio	-0.03 (0.13)	-0.03 (0.23)	-0.16 (0.00)	1	
Skill Intensity	-0.25 (0.00)	-0.20 (0.00)	-0.10 (0.02)	0.48 (0.00)	1

Note: Value added, output, union density and employment shares are defined as the shares in total value added, output, union density and employment respectively. Skill ratio is the ratio of high skilled workers to medium and low skilled workers. Skill intensity stands for the time and country invariant industry characteristic. p-values are in parentheses.

According to the model, unionization should be negatively associated with the output of LSI industry. However, HSI industries benefit from it thanks to the increase in effective skilled labor in the economy. Based on this prediction, my identification strategy for estimating the causal impact of the unions on growth will consist of exploiting cross-

industry differences in both unionization and skill intensity. To test for the differential effect of unionization across industries, I follow the methodology of Rajan and Zingales (1998). My estimation equation is the following:

$$y_{cit} = \beta_1 UD_{cit} + \beta_2 \left(UD_{cit} * SI_i\right) + \eta_{ct} + \eta_{ci} + \varepsilon_{cit} \tag{4.33}$$

where the dependent variable measures the gross value added/output share of industry i, $y_{ci} = \left(\frac{valueadded_{ci}}{\sum_i valueadded_{ci}}\right)$ or $y_{ci} = \left(\frac{output_{ci}}{\sum_i output_{ci}}\right)$; UD_{cit} stands for the share of industry is union density in country c and year t; SI_i denotes the skill intensity and ε_{cit} represents unobserved characteristics of industry i, in county c, at period t. The specification also includes a full set of country×year and country×industry fixed effects.

Considering the fact that data varies over time, industry, and country dimensions, inclusion of country×year and country×industry fixed effects are notably important. The country×year fixed effects capture the effects of time-varying country characteristics, such as the macroeconomic and institutional structure. Country×industry fixed effects control for characteristics that are specific to each industry in a particular country. Among others, these include the effect of persistent differences in the size, concentration, or government intervention and support, derived from different factor endowments, market size, or institutional characteristics that may generate different growth patterns across industries and countries (Braun and Larrain, 2005).

Table 4.4 presents the baseline estimation results. In column 1, the dependent variable is value added share, whereas in column 2 it is the gross output share of an industry. It appears that, union density is statistically significant and negatively associated with both value added and output shares. The coefficient of the interaction between the share of union density and human capital intensity is, however, positive and statistically significant at the 1% level. Thus estimation results suggest that while total output/value added of LSI industries contract due to unionization, HSI industries benefit from higher degree of union density[6].

The estimates imply that, the value added share difference between an industry at the 75th percentile of the skill intensity distribution and an industry at the 25th percentile is 1.07% in an industry at the 75th percentile of the union density share distribution with respect to an industry at the 25th percentile. The effect estimated for output share is however rather small, 0.86%.

In column 3 and 4, I add the rest of the fixed effects (country, year, industry and industry × year) to check whether estimation results are robust inclusion of these variables[7].

[6]I do not add the SI variable individually, since I employ country by year and country by industry fixed effects to control for all observable and unobservable industry characteristics. In fact the skill intensity variable turns out to be statistically insignificant.

[7]Estimations results are also robust to inclusion of time trend instead of year dummies. Results are

Table 4.4: Baseline Model

	(1)	(2)	(3)	(4)
Dependent Variable	Value Added	Output	Value Added	Output
UD	-1.42***	-1.12***	-0.65**	-0.72*
	(0.29)	(0.34)	(0.32)	(0.39)
UD × SI	0.12***	0.09***	0.05**	0.06*
	(0.02)	(0.03)	(0.02)	(0.03)
Country × year fixed effects	YES	YES	YES	YES
Country × industry fixed effects	YES	YES	YES	YES
Country fixed effects			YES	YES
Year fixed effects			YES	YES
Industry fixed effects			YES	YES
Year × industry fixed effects	YES	YES	YES	YES
R-squared	0.66	0.64	0.87	0.81
Observations	507	507	507	507

Notes: The table presents the estimates of the effect of unionization on value added (column (1) and (3)), and output (column (2) and (4)). The dependent variable is the value added (output) share of an industry in total value added (output). UD is union density share and SI is skill intensity. Ghent countries include Denmark, Finland, and Sweden. Robust standard errors (clustered at country-industry level) in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

Results are not substantially different from the previous ones. The empirical estimates demonstrate that both the share of union density and the interaction between share of union density and skill intensity are statistically significant with their expected signs.

In table 4.5, I check the robustness of the main results to alternative determinants of industry growth by including the relevant country and sector interactions. I test whether the positive effect of unionization on the value added/output share of HCI industries is maintained when I include the interaction between the share of union density and PCI in column 1 and 2 respectively, and the interaction between the share of union density and layoff intensity in column 3 and 4. If these two other industry characteristics are correlated with skill intensity, then the estimated coefficients in 4.4 will be biased. The interaction of PCI and union density share has statistically significant effect neither on value added share nor output share. In both cases, the magnitudes and significance levels of the coefficients of the variables of interest remain similar to the baseline estimation. In columns 3 and 4, I interact the layoff intensity with the share of union density. The interaction of layoff intensity and union density share is negatively associated with value added and output share. However, unionization and the interaction of skill intensity and

available upon request.

unionization variables remain statistically significant in spite of the small changes in their sizes.

Table 4.5: Additional Industry Level Control Variables

	(1)	(2)	(3)	(4)
Dependent Variable	Value Added	Output	Value Added	Output
UD	-1.41***	-1.12***	-1.17**	-1.01*
	(0.28)	(0.33)	(0.49)	(0.56)
UD × SI	0.11***	0.09***	0.10**	0.09*
	(0.02)	(0.02)	(0.04)	(0.04)
UD × PCI	0.01	0.004		
	(0.02)	(0.02)		
UD × LI			-0.03*	-0.02**
			(0.02)	(0.009)
Country × year fixed effects	YES	YES	YES	YES
Country × industry fixed effects	YES	YES	YES	YES
R-squared	0.67	0.64	0.71	0.69
Observations	507	507	437	437

Notes: The table presents the estimates of the effect of unionization on value added (column (1) and (3)), and output (column (2) and (4)). The dependent variable is the value added (output) share of an industry in total value added (output). UD is union density share, SI is skill intensity, PCI is the physical capital intensity, and LI is the layoff intensity. Robust standard errors (clustered at country-industry level) in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

In table 4.6, I probe whether the relationship between unionization and value added/output survive inclusion of HCI and relevant country characteristics interactions. In columns 1 and 2, I include the interaction between HCI and real per capita GDP growth. Growth enters positively to both value added and output regressions though the interaction variable has statistically significant positive effect only on value added. Results indicate that aggregate growth in the economy increases value added and output shares disproportionally in industries with greater skill intensity. However, sizes and significance levels of coefficients on unionization and the interaction of skill intensity and unionization remain similar to the baseline model. In columns 3 and 4, I add the interaction of secondary school enrollment and skill intensity. Ciccone and Papaioannou (2009) points out that skill intensive industries tend to grow greater in countries with higher initial levels of schooling. Thus it could be the case that, the benchmark interaction is capturing the higher share of value added/output in skill intensive industries in countries with higher level of human capital. In both columns, secondary school enrollment is positive and significant, suggesting that human capital leads to greater value added and output share. Interaction

variable however positive but statistically insignificant owing to the high standard errors. The variables of interests, union density and its interaction with skill intensity continues to be positive and significant at the 1% level.

Table 4.6: Additional Country Level Control Variables

	(1)	(2)	(3)	(4)
Dependent Variable	Value Added	Output	Value Added	Output
UD	-1.23***	-1.08***	-1.44***	-1.14***
	(0.28)	(0.33)	(0.29)	(0.34)
UD × SI	0.10***	0.09***	0.12***	0.09***
	(0.02)	(0.03)	(0.02)	(0.03)
Growth	0.007**	0.008		
	(0.003)	(0.003)		
Growth × SI	0.0004*	0.00009		
	(0.0002)	(0.0001)		
Education Level			0.001***	0.0008***
			(0.0002)	(0.0002)
Education Level × SI			0.00004*	0.0004
			(0.00004)	(0.0003)
Country × year fixed effects	YES	YES	YES	YES
Country × industry fixed effects	YES	YES	YES	YES
R-squared	0.67	0.64	0.67	0.64
Observations	507	507	502	502

Notes: The table presents the estimates of the effect of unionization on value added (column (1) and (3)), and output (column (2) and (4)). The dependent variable is the value added (output) share of an industry in total value added (output). UD is union density share, SI is skill intensity, growth is real GDP percapita growth, and education level is the secondary school enrollment. Robust standard errors (clustered at country-industry level) in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

Finally in 4.7, I address the question of whether unionization is picking up the effects of other labor market institutions on value added/output share. To tackle this issue, I include interaction terms between skill intensity and employment protection legislation, unemployment benefit coverage and the tax wedge from column 1 to 6. Empirical estimates indicate that the interactions of skill intensity with all labour market institutions are insignificant. Whereas the coefficients of unionization and the interaction between unionization and skill intensity variables have the expected signs and they are statistically significant at either 1% or 5% level.

There are substantial differences in bargaining coordinations and levels across countries. While in Anglo-Saxon countries negotiations mainly occur at firm levels, in Scan-

dinavian countries industry level bargaining is more common. If the coordination and/or level of bargaining are the main determinants of wage compression, union density will loose its significance in the regressions which include the former controls. For that reason, I test the robustness of results to the inclusion of the interaction of bargaining coordinations and levels with skill intensity in the other columns of table 6. While the interactions are negative and significant in column 8 and 10, union density and its interaction with skill intensity remain to be significant in both value added and output regressions.

Table 4.7: Additional LMIs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable	Value Added	Output	Value Added	Output	Value Added	Output	Value Added	Output	Value Added	Output
UD	-1.45***	-1.14***	-1.37***	-1.10**	-1.36**	-1.06**	-1.30***	-1.02***	-1.30***	-1.02***
	(0.29)	(0.34)	(0.30)	(0.35)	(0.26)	(0.33)	(0.38)	(0.44)	(0.38)	(0.44)
UD × SI	0.12***	0.09***	0.11***	0.09***	0.11***	0.09***	0.11***	0.08**	0.11***	0.08**
	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.03)	(0.02)
EPL × SI	0.002	0.0007								
	(0.002)	(0.001)								
UB × SI			-0.01	-0.007						
			(0.01)	(0.009)						
Tax Wedge × SI					-0.001	0.0002				
					(0.01)	(0.007)				
Coordination of bargaining × SI							-0.001***	-0.0004*		
							(0.0003)	(0.0002)		
Level of bargaining × SI									-0.001**	-0.0004
									(0.0006)	(0.0003)
Country × year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country × industry fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
R-squared	0.67	0.64	0.68	0.65	0.67	0.67	0.68	0.90	0.68	0.90
Observations	507	507	496	496	402	402	411	411	411	411

Notes: The table presents the estimates of the effect of unionization on value added (column (1) and (3)), and output (column (2) and (4)). The dependent variable is the value added (output) share of an industry in total value added (output). UD is union density share, SI is skill intensity, EPL employment protection, and UB is unemployment benefit. Robust standard errors (clustered at country-industry level) in parentheses. *** significant at 1%; ** significant at 5%; * significant at 10%. Source: Author's estimations.

4.7 Concluding Remarks

This paper develops a two-sector, two-labor general equilibrium model in an economy with dual labor market, heterogeneous agents, and human capital investment. Under this framework, I analyze the effects of unionization on total output. Unionization generates different channels that affect total output, which work in opposite directions. While the previous literature focused on documenting these channels, it provides mixed results about the net effect of unionization. Furthermore, the empirical analyses of the channels remained overlooked and no author ever put it into rigorous testing. For these reasons, here I study the conditions under which one channel dominates the other one in addition to empirically estimating the theoretical predictions of the model.

The mechanism through which unions influence total production is the following. When one sector is unionized, the laid off workers due to unionization migrate to the other sector and decrease the wage there until full employment is satisfied. If the unionized sector is LSI, and perfectly competitive sector is HSI, then the decrease in skill premium in LSI sector overwhelms the increase in the skill premium in HSI sector. Since the net effect is negative, individuals will have less incentives to invest in education. Due to the decrease in the effective labor supply of high skilled workers, total output of HSI sector declines while total output of LSI grows. On the contrary, if HSI is unionized and LSI remains nonuniozied, the rise of the skill premium in the latter sector dominates the reduction of the skill premium in the former one as there are fewer low skilled workers in the HSI sector. Hence, increase in the net skill premium induce more people to invest in education which consequently leads to a rise in the effective skilled labor of the economy as well as the total output of HSI sector. As another result, total production of LSI contracts.

Furthermore, by employing data for eight aggregate industries in seven countries over the period 1994-2005, I find that unionization is negatively associated with the total output of LSI sectors, while this negative effect is decreasing in skill intensity. The link between unionization and skill intensities of sectors is robust to controls for the other determinants of industry growth such as real GDP per capita and secondary school enrollment. The effect also prevails when I control other industry characteristics (PCI and layoff intensity) and other LMIs such as EPL, unemployment benefit coverage, tax wedge, coordination of bargaining and level of bargaining.

Appendix F

Appendix: Proofs

F.0.1 Proof of Proposition 1

Under perfect competition, workers get wages equal to their marginal revenue products. Since workers are mobile between the two sectors, they earn the common wage which clears the market. Therefore:

$a^{CE} = 1 - \frac{w_{L1}}{w_{H1}} = 1 - \frac{w_{L2}}{w_{H2}}$

$a^{CE} = 1 - \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{H_1}{L_1}\right) = 1 - \left(\frac{\beta}{1-\beta}\right)\left(\frac{H_2}{L_2}\right)$

Using the wage equations and effective labor supplies, I obtain the following four equations:

(i) $\alpha\left(\frac{H_1}{L_1}\right)^{1-\alpha} = \beta\left(\frac{H_2}{L_2}\right)^{1-\beta}$

(ii) $(1-\alpha)\left(\frac{H_1}{L_1}\right)^{-\alpha} = (1-\beta)\left(\frac{H_2}{L_2}\right)^{-\beta}$

(iii) $H_1 + H_2 = a^{CE} - \frac{\left(a^{CE}\right)^2}{2}$

(iv) $L_1 + L_2 = 1 - a^{CE}$

Equations (i) and (ii) are derived by using the wage equality of low-skilled workers and high-skilled workers among the two industries. Dividing (i) by (ii), I get:

$$\frac{H_1}{L_1} = \left(\frac{\beta}{\alpha}\right)\left(\frac{1-\alpha}{1-\beta}\right)\left(\frac{H_2}{L_2}\right) \tag{F.1}$$

By using equation (F.1) and (i), the skill intensities in two sectors are derived as follows:

$$\frac{H_1}{L_1} = \left(\frac{\beta}{\alpha}\right)^{\frac{\beta}{\beta-\alpha}}\left(\frac{1-\beta}{1-\alpha}\right)^{\frac{1-\beta}{\beta-\alpha}} \tag{F.2}$$

$$\frac{H_2}{L_2} = \left(\frac{\alpha}{\beta}\right)^{\frac{\alpha}{\alpha-\beta}} \left(\frac{1-\alpha}{1-\beta}\right)^{\frac{1-\alpha}{\alpha-\beta}} \tag{F.3}$$

Let's define the followings for simplicity:

$S_1 \equiv \frac{H_1}{L_1} = \left(\frac{\beta}{\alpha}\right)^{\frac{\beta}{\beta-\alpha}} \left(\frac{1-\beta}{1-\alpha}\right)^{\frac{1-\beta}{\beta-\alpha}}$

and $H_1 = S_1 L_1$

$S_2 \equiv \frac{H_2}{L_2} = \left(\frac{\alpha}{\beta}\right)^{\frac{\alpha}{\alpha-\beta}} \left(\frac{1-\alpha}{1-\beta}\right)^{\frac{1-\alpha}{\alpha-\beta}}$

and $H_2 = S_2 L_2$

Then I have the following two equations with two unknowns:

i) $S_1 L_1 + S_2 L_2 = a^{CE} - \frac{\left(a^{CE}\right)^2}{2}$

ii) $L_1 + L_2 = 1 - a^{CE}$

Solving the above system gives me the number of low skilled workers in first and second sector respectively:

$$L_1 = \frac{\left(a^{CE}\right)^2 - 2a^{CE} + 2S_2(1-a^{CE})}{2(S_2 - S_1)} \tag{F.4}$$

$$L_2 = \frac{2a^{CE} - \left(a^{CE}\right)^2 - 2S_1(1-a^{CE})}{2(S_2 - S_1)} \tag{F.5}$$

F.0.2 Proof of Proposition 2

The productions functions can be written as:

$$Y_1 = S_1^{1-\alpha} \frac{\left(a^{CE}\right)^2 - 2a^{CE} + 2S_2(1-a^{CE})}{2(S_2 - S_1)} \tag{F.6}$$

$$Y_2 = S_2^{1-\beta} \frac{2a^{CE} - \left(a^{CE}\right)^2 - 2S_1(1-a^{CE})}{2(S_2 - S_1)} \tag{F.7}$$

The derivatives of Y_1 and Y_2 with respect to a^{CE} is given by:

$$\frac{\partial Y_1}{\partial a^{CE}} = \frac{S_1^{1-\alpha}}{S_2 - S_1} \left(a^{CE} - (1 + S_2)\right) \tag{F.8}$$

$$\frac{\partial Y_2}{\partial a^{CE}} = \frac{S_2^{1-\beta}}{S_2 - S_1} \left((1 + S_1) - a^{CE}\right) \tag{F.9}$$

If the skill intensity of first industry is greater than skill intensity of the second industry, then the first derivative is less than zero whereas the second one is larger than zero. Thus,

total outputs of the first (low-skill intensive) and second (high-skill intensive) industries are decreasing and increasing in the share of skilled labor (a^{CE}) respectively.

F.0.3 Proof of Proposition 3

Equation (4.21) can be written as:

$$a^U = 1 - \left(\frac{1}{L_1 + L_2}\right)\left((L_1 + uL_2)\,\frac{w_{l1}}{w_h} + (1-u)L_2\frac{w_{l2}}{w_h}\right) \tag{F.10}$$

Substituting the wage equations (4.24), (4.25), and (4.26) into equation (F.10) yields:

$$a^U = 1 - \left(\frac{1}{L_1 + L_2}\right)\frac{w_L^*}{w_h}\left((L_1^{1-\alpha}(L_1 + uL_2)^{\alpha} + L_2(1-u)^{\beta}\right) \tag{F.11}$$

Differentiating a^U with respect to u, I obtain:

$$\frac{\partial a^U}{\partial u} = -\left(\frac{1}{L_1 + L_2}\right)\frac{w_L^*}{w_h}L_2\left(\alpha\left(\frac{L_1}{L_1 + uL_2}\right)^{1-\alpha} - \beta(1-u)^{\beta-1}\right) \tag{F.12}$$

Since (1-u) is between 0 and 1, $(1-u)^{\beta-1}$ is bigger than 1. Whereas $\left(\frac{L_1}{L_1+uL_2}\right)^{1-\alpha}$ is positive and between 0 and 1. Therefore the second parentheses in the right hand side is negative and $\frac{\partial a^U}{\partial u} > 0$.
It is also straightforward to show the relationship between γ and u. Differentiating u with respect to γ, I obtain:

$$\frac{\partial u}{\partial \gamma} = \beta^{\frac{1}{1-\beta}}\left(\gamma(1-\beta) + \beta\right)^{\frac{\beta-2}{1-\beta}} \tag{F.13}$$

Both of the terms in the RHS are positive. Therefore $\frac{\partial a^U}{\partial \gamma} > 0$.
Total differentiation of a^U with respect to γ:

$$\frac{da^U}{d\gamma} = \frac{\partial a^U}{\partial \gamma} + \frac{\partial a^U}{\partial u}\frac{\partial u}{\partial \gamma} \tag{F.14}$$

Since $\frac{\partial a^U}{\partial \gamma} = 0$, and both equations (F.12) and (F.13) are positive, I find that $\frac{da^U}{d\gamma} > 0$.

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