Analysis of Legal Institutions, Conflict and Trade

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Résumé

Le premier papier étudie les effets du commerce international et des risques de conflits sur les inégalités de revenus. Les résultats montrent que l'effet du commerce sur les inégalités dépend du niveau de risques de conflits. Il existe un *effet de seuil* montrant que le commerce international accroît les inégalités de revenus dans les pays à risques de conflits élevés. Par ailleurs, si les inégalités augmentent dans les pays ethniquement très diversifiés, cependant, les pays démocratiques paraissent plus égalitaires. Le deuxième papier analyse les conditions d'équilibre général de l'exécution des droits de propriété dans le secteur des ressources naturelles. Nous comparons les pays qui diffèrent selon leur aptitude à fournir des services de protection. Cette aptitude est considérée comme *"capacité de l'état"*. Nous obtenons que les services de protection publique et privée peuvent être des *substituts* ou des *compléments* et que cette relation dépend fortement du niveau de capacité de l'état. Lorsque la capacité de l'état est faible, une augmentation de la protection publique réduit le revenu national, étant donné que la main d'oeuvre est retirée des activités directement productives. Cependant, dans les pays à forte capacité de l'état, les services de protection publique ont un effet ambigu sur le revenu national, même s'ils augmentent les rentes des exploitants des ressources. Le troisième papier argumente que la législation de la double citoyenneté a des impacts sociaux et économiques importants. Utilisant une nouvelle base de données de la double citoyenneté, nous trouvons que l'adoption de la double citoyenneté par les pays en développement accroît en moyenne les transferts de fonds de $1,19$ milliard de dollars US. Elle accroît le PIB, les dépenses des ménages, et réduit la mortalité des enfants de moins de 5 ans. Dans les pays développés, elle réduit les transferts de fonds de $1,44$ milliard de dollars US. Cependant, elle accroît les investissements étrangers de 828 milliards de dollars US, la formation du capital brut et le commerce. Enfin, elle permet aux travailleurs qualifiés de circuler librement.

Abstract

In the first paper, the effects of trade openness and conflict risk on income inequality are investigated. I obtain that the effect of trade openness on inequality depends on the level of conflict risk. More precisely, there exists a *threshold effect*: trade openness worsens income inequality in countries where the risk of internal and external conflicts is high. Moreover, I find that countries with higher risk of conflicts are more unequal, and that more ethnically diverse countries increase income inequality. Finally, I obtain that democratic regimes decrease inequality. In the second paper, we analyze the general-equilibrium consequences of property right enforcement in the natural resource sector. Assuming that exclusion requires both private and public enforcement efforts, we compare states that differ by their ability to provide protection services. This ability is referred to as *state capacity*. We obtain that public protection services can effectively act as either *substitutes* or *complements* to private enforcement, and this strongly depends on state capacity. Under low state capacity, an increase in state protection services leads to a drop in national income as labor is drawn away from the directly productive activities. The opposite holds for high-capacity states. As a result, public protection services have an ambiguous effect on national income even though they can unambiguously increase resource rents. In the third paper, we argue that the right to hold dual citizenship can generate important social and economic benefits beyond its political dimension. We assemble a large panel dataset on dual citizenship. We find that in developing countries, dual citizenship recognition increases remittance inflows by US$1.19 billion, GDP and household consumption, and improves child survival. In developed countries, however, dual citizenship recognition decreases remittance inflows by US$1.44 billion, but increases FDI by US$828 billion, raises household consumption, gross capital formation and trade, and provides incentives for skilled workers to move to other countries.

À ma femme, Ruth.

À mon fils, David.

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General Introduction

This thesis, titled "Analysis of Legal Institutions, Conflict and Trade", is composed of three independent chapters. It is well documented that in developing countries, the capacity of the state to mobilize resources for key objectives such as –territorial control, ability to implement sound policies and enforce property rights, and effective exercise of political power– is very weak. This weakness creates conflict environment. Even though developing countries, permanently open their economies in this weak institutional environment, previous papers assessing the impacts of trade openness on income inequality do not take into account the interaction effect between conflict and trade openness. In this first chapter, I try to shed light on this question by studying the effect of trade openness on income inequality in the presence of conflict risk. In the second chapter, we analyze the effects of institutions, through public and private protection policies, on natural resource management. In the third chapter, we study the impacts of dual citizenship legislation, which is an important legal institution, on workers' remittances and child mortality rate in both developing countries and developed countries, and we compare the effects of dual citizenship legislation and other institutional variables on child mortality.

The first chapter, titled "*Trade Openness, Conflict Risk and Income inequality in Developing Countries*", studies the effect of trade openness on income inequality and how this effect is shaped by the presence of conflict in developing countries. Empirical studies analyzing the distributional effects of trade openness on income inequality find mixed results. In this paper, I argue that this mixed empirical evidence is likely to arise because the conflict environment, characterizing mostly developing economies, has been ignored. To the best of my knowledge, no study has looked at the presence of conflict risk as a factor that can affect the effect of trade openness on income inequality. Two main reasons can be

mentioned to justify the inclusion of conflict risk into the trade model. First, according to the political economy of conflict literature, conflict may affect, differently, the structure of the economy. When the risk of conflict is high, war-vulnerable activities may contract and war-invulnerable activities may expand (Collier, 1999). Second, conflict risk may cause a redistribution of trade gains. Deininger (2003) finds that persistent civil conflict in Uganda during the 1990s reduces agricultural investments, leading to a change of economic activities towards subsistence agriculture. McKay and Loveridge (2005) reveal that, after the 1994 genocide period in Rwanda, the poorest groups are powerless to gather gains from trade openness.

To test whether the effect of trade openness on income inequality depends on the level of conflict risk, I estimate a dynamic panel specification model. In order to correct for endogeneity issues, I use the bias-corrected least squares dummy variable estimator (LSDVC) and the System Generalized Method of Moments (System-GMM) provided by Kiviet (1995) and Blundell and Bond (1998), respectively. The results suggest the existence of a threshold effect, that is the effect of trade openness depends on the level of conflict risk, meaning that trade openness worsens income inequality in countries where the risk of internal and external conflicts is high. The reason is that during the periods of higher risk of conflict, the traditional mechanisms of transmission through which exported and imported goods and services operate work only for a minority of well informed and connected people who are very close to the regime in power. So, they control most of the *commercial-activities*, and enjoy the situation of rents created by the conflict environment, excluding, consequently, the large majority of the *already vulnerable population*. This exacerbates income inequality. These results are close to the finding of Barro (2000) who argues that the rich groups will be most able to take advantage of the opportunities offered by global commerce, leading to

the fact that an increased trade would be most likely to raise inequality in poor countries.

In order to test for the non-linear relationship hypothesis between conflict risk and income inequality, I include the squared variables for both external and internal conflict risks. The results suggest a non-monotonous relationship, implying that inequality worsens in countries experiencing higher risk of conflicts, and this result is in line with Bircan et *al.* (2010) who argue that conflicts may alter, negatively, social programs that benefit mostly the poor households. I also find that more ethnically diverse countries are likely to endure greater inequality. This result is consistent with Montalvo and Reynal-Querol (2005) who argue that public infrastructure, government expenditures and trade may favor some ethnic groups. The results also suggest that democratic regimes are more likely to decrease income inequality. Finally, it is found that past levels of income inequality appear to be a good predictor of current inequality by increasing it.

The main motivation of the second chapter titled "*State Capacity and the Enforcement of Property Rights in the Natural Resource Sector*" is that exclusion requires both private and public protection efforts. For this reason, it is argued that the state can complement the individual protection efforts through public protection policy. In this chapter, we deal with the management of natural resources when property rights and rules of exclusion are required. We build on Hotte (2005) and consider a small open economy composed of two sectors: the manufacturing sector and the natural resource sector where property rights are costly to enforce. Because property rights are not well defined, this leads the resource manager to decide on the level of resource exploitation and the amount of enforcement to be used in order to exclude illegal users. We posit that the effectiveness of the private enforcement efforts depends on the level of public protection services provided by the states, local institutions and governments. It is important to highlight that the public protection services provided

through the justice system are also costly and must be paid for by a tax. The main objective of this chapter is to analyze the implications of combining public and private enforcement efforts when states have differing abilities to provide enforcement support, and we refer to this ability as state capacity.

We first show that for a given level of public protection services, private enforcement is inefficiently high because of the presence of a negative externality. The reason is that even though higher private enforcement leads to a better management of the resource through a decrease in the number of resource workers, it forces other resource managers to over-exploit their resources.

In order to assess the general-equilibrium impacts of the enforcement of property rights in the natural resource sector, we run three sets of simulations corresponding to high, intermediate and low capacity states that differ exogenously to provide public protection services. In the case of high-capacity state, we find a non-monotonous relationship between real national income and the size of the justice system. National income increases at first, reaches a certain maximum, and then decreases thereafter. A rise in national income is explained by two mechanisms. The first mechanism is related to the fact that an increase in the size of the justice system allows resource managers to reduce their enforcement labor: public and private enforcements act as substitutes. Moreover, resource managers, because of a better enforced exclusion, have incentives to reduce also resource workers, leading to a net addition to the directly productive workforce. The second mechanism is associated with the movement of workers from the resource sector to the manufacturing sector with a higher marginal product. For higher level of the justice system, however, any additional public officer does not bring much contribution, leading to a decrease in national income. Furthermore, we also obtain that the total amount of public and private officers varies non-monotonically with the

size of the justice system. Finally, we show that even though public enforcement is entirely financed by a tax on resource rents, resource managers demand more public enforcement than would be efficient.

For an intermediate-capacity state, we find that national income initially decreases with the size of the justice system, and this results in a net draw of labor away from directly productive activities. Thus, with an intermediate-capacity state, public and private enforcements are initially effective complements. This effect disappears when the justice system reaches a certain size, after which public officers act as substitutes to private enforcers and national income begins to increase. We find that, in comparison to a high-capacity state, the efficient size of the justice system in an intermediate-capacity state requires the use of more non-directly productive labor.

In the case of the low-capacity state, the national income decreases as the public protection increases. Indeed, we obtain that with a low-capacity state, public and private enforcements are effective complements throughout. For low-capacity state, open access to the resource is preferable to exclusive access at any level of public protection. It should be noted that this inefficiency result holds despite the fact that public enforcement does contribute to raise resource rents. There is therefore a private demand for public enforcement by resource managers even though it contributes to lower the national income level.

The third chapter, titled "Sharing Citizens: Economic Gains from Dual Citizenship Institution", assesses the social and economic impacts of dual citizenship institution. Dual citizenship is a status in which a person is legally recognized as a citizen of more than one country. Legislation on dual citizenship varies widely across countries and time. Most of the studies on dual citizenship have focused their analysis on its implications for the patriotism, cultural assimilation, and political participation of dual citizens in their new countries

(Staton et *al.*, 2007; Renshon, 2004; Blatter et *al.*, 2009; Iheduru, 2011). Dual citizenship is primarily viewed by lawyers and political scientists as a political institution (Staton et *al.*, 2007) and is being adopted by an increasing number of countries (see Figures 3-a and 3-b). In this study, arguing that dual citizenship is also likely to have important social and economic impacts beyond its political dimension, we focus on the role of dual citizenship in connecting diasporas with origin countries, as well as its implications for the development of transnational solidarity and business networks, and the associated benefits for households and national economies. In order to exploit cross-country and cross-time variation in the timing of dual citizenship recognition, we assemble new panel data on dual citizenship legislation to investigate some of these economic impacts for both developed and developing countries in three main parts. First, we consider the sets of variables reflecting the economy and allocation of government funds to social programs. In the second part, we consider remittances and child mortality. Finally, in the third part, we assess the effects of dual citizenship and workers' remittance inflows on child mortality. We also compare dual citizenship with other institutional variables such as government stability, the absence of internal and external conflicts in terms of their effects on child mortality.

In the assessment of the macroeconomic and political impacts of dual citizenship legislation, the results obtained from the fixed effect models suggest, for developing countries, that dual citizenship recognition raises GDP and household consumption expenditures. For developed countries, dual citizenship recognition raises the net inflows of foreign direct investments (FDI) by over US$877 billion, gross capital formation by US$11.7 trillion, and trade volume by US$12.8 trillion. It also has a positive but not statistically significant effect on GDP. Furthermore, it increases household consumption expenditures. The results also indicate that dual citizenship recognition by a country operates as an incentive for low and

high skilled emigrants to move to other countries, showing that dual citizenship recognition as a political institution improves a country's ability to compete for talent on the international labor market. Finally, dual citizenship recognition plays little role in homeland politics, as it has no effect on public spending on health and education.

Moreover, we find that recognition of dual citizenship raises remittance inflows by US$1.190 billion in developing countries. However, for developed countries, the coefficient related to the dual citizenship variable becomes negative and statistically significant. This can be explained by the fact that emigrants from developed countries who become citizens of their host countries remit less once they reunite their close family members with them in their new countries. This behavior is in contrast with that adopted in many developing countries where emigrants are characterized by collectivistic cultures.

Finally, our analysis suggests that dual citizenship has a greater effect on child survival than other institutional variables both in developing and developed countries.

Chapter 1

Trade Openness, Conflict Risk and Income Inequality in Developing Countries

1.1 Introduction

I study the effect of trade openness on income inequality and how this effect is shaped by the presence of conflicts. There has been a large literature on the relationship between trade openness and income inequality. The first group of studies, in line with the Heckscher-Ohlin (HO) prediction, finds a negative relation between trade openness and income inequality (Bourguignon and Morrisson, 1990; Calderon and Chong, 2001; Dollar and Kraay, 2002); the second group highlights that trade openness increases inequality (Barro, 2000; Ravallion, 2001; Lundberg and Squire, 2003; Milanovic and Squire, 2003). Finally, the third group finds no empirical evidence of the effect of trade openness on income inequality (Edwards, 1997;

Li et *al.*, 1998).

In this paper, I argue that this mixed empirical evidence likely arises because the conflict-affected environment through which countries are called upon to open their economies has been ignored in the literature. Why is it so important to include conflict risk into the trade theory model specification?

Two mechanisms can be mentioned. First, conflict risk may affect, differently, the structure of the economy. According to the political economy of conflict literature, economic activities can be classified into three main groups: the war-invulnerable activities including arable subsistence agriculture, war-vulnerable activities such as construction, transport, distribution, finance and manufacturing, and an unclassified group including other activities. Thus, during conflicts, while the war-vulnerable activities may contract, the war-invulnerable activities can expand relative to GDP (Collier, 1999). In war-affected countries, farmers often lose their access to markets and the ability to gain from market exchange (Bircan et *al.*, 2010). For example, Deininger (2003) finds that persistent civil conflict in Uganda during the 1990s reduces agricultural investments, leading to a shift of economic activities towards subsistence and less integration into the market. Furthermore, McKay and Loveridge (2005) exploit national representative surveys that provide the sources of income among agricultural households in Rwanda. They find that, after the 1994 genocide period, the poorest groups are unable to derive benefits from agricultural commercialization because they are pulled out of the markets, leading to a decrease in agricultural income of many rural households. They argue that this income decrease can be one driver of increasing inequality in rural areas. Second, conflict risk may act as a factor that shifts a redistribution of the gains from trade towards connected and well informed people, and then exacerbates income inequality of already poor groups. This happens because if fragile countries characterized by higher

risk of conflict attempt to increase their openness to trade, it may favor a minority of people close to a regime in power by concentrating all the gains generated by the trade openness.

Since the conflict dimensions of trade distributional effects have been largely ignored in the literature, I argue that an accurate assessment of the effect of greater openness on income inequality must take into account the conflict risks occurring in developing countries. Furthermore, the number of countries engaged in conflicts has highly increased, culminating to over 20 percent during the 1990s (Blattman and Miguel, 2010), and most of those conflicts took place in Sub-Saharan Africa (34) and Asia (33), followed by North Africa and the Middle East (17), Latin America (15), Eastern Europe and the former Soviet Union (13) (Fearon and Laitin, 2003).

I begin by assessing the effects of both trade openness and conflict risk on income inequality, and I refer to this model as the additive model. I then move on by showing that the effect of greater openness may depend on the level of conflict risk, the objective of this process is to capture the interaction effect on income inequality after controlling for a wide range of macroeconomic, demographic and institutional variables, and I refer to this model as the interactive model.

This study departs from the previous papers that proxy civil wars as internal conflicts that count for more than 1000 battle deaths in a single year (Collier and Hoeffler, 2004; Bircan et *al.*, 2010), and civil conflicts as those counting 25 battle deaths per annum (Blattman and Miguel, 2010). I view this way of proxying the concept of conflict as too restrictive and may under-estimate their real effects on income inequality. This issue has been recently raised by Esteban and Ray (2011) when they said that:

> "...But social conflict need not manifest itself in civil war alone, and there are various other measures (that incorporate, for instance, strikes, demonstrations,

riots, assassinations, political prisoners, and the like)."

Therefore, I rather use two variables - internal and external conflict risks - drawn from the Political Risk Services/International Country Risk Guide (PRS/ICRG) database that captures a wider concept of conflict. For instance, internal conflict risk, which is an assessment of an armed or political violence and civil opposition to the government, includes not only a civil war/coup threat, terrorism/political violence, but also civil disorder. External conflict risk captures war, cross-border conflict as well as foreign pressures. It measures the risk to the incumbent government from foreign action through non-violent external pressure (diplomatic pressures, trade restrictions, sanctions, withholding of aid) and violent external pressure (ranging from cross-border conflicts to all-out war). Notice that internal conflict risk can be local in nature, and may not affect all the country's economic activities.

Examining empirically the effects of trade openness, conflict risks and their interaction on income inequality, I use a sample of 39 developing countries[1] for the period 1984-1999[2]. I start the estimations by applying the biased-corrected Least Squares Dummy Variable estimator (LSDVC), as suggested by Kiviet (1995) and Bruno (2005), which eliminates the unobserved individual heterogeneity. It is particularly suitable for small samples and appropriate to unbalanced panel data. I deal with the endogeneity issues of some explanatory variables such as conflict risk and trade openness by using the System-Generalised Method of Moments (Sys-GMM) dynamic panel-data estimation technique suggested by Blundell and Bond (1998). This technique allows for the instrumentation of endogenous variables by their lagged values.

[1]Lundberg and Squire (2003) used a panel of 38 countries to analyze the simultaneous relationship between inequality and growth; Spilimbergo et *al.* (1999) used a panel of 34 countries to find that the effects of trade openness on inequality can be influenced by factor endowments; and Ravallion (2001) used a panel of 50 developing countries to show the correlation between growth, inequality and poverty.

[2]This period is motivated by the fact that the estimated household income inequality database ends in 1999 and that the data on internal and external conflict risks drawn from the ICRG database are available from 1984.

The empirical results suggest the existence of a threshold effect; that is, the impact of trade openness on income inequality depends on the level of conflict risk. More precisely, trade openness worsens income inequality in countries where the risks of internal and external conflicts are high, but decreases inequality when the risks are low. The results also suggest a non-monotonous relationship between income inequality and conflict risk, indicating that countries with higher risk of external and internal conflicts are more unequal. Furthermore, I find consistently that the coefficient related to the lagged dependent variable is always positive and significant. This suggests the presence of high persistence phenomenon in income inequality. While ethnic tensions appear to increase income inequality, democratic regimes are more egalitarian.

The remainder of the paper is organized as follows. Section 1.2 lays out a literature review relating theoretical and empirical studies that concern the subject. In Section 1.3, I present an econometric strategy by describing the data and the methodology employed to test the main hypotheses of the paper, and discuss about endogeneity issues. The results are also reported. In Section 1.4, the robustness of the results is checked by including some additional control variables such as the institutional quality, ethnic tensions, natural resource abundance, and financial development variables. I conclude and make some policy recommendations in Section 1.5.

1.2 Literature Review

1.2.1 Trade Openness and Income Inequality

The traditional model employed by researchers to study the distributional effects of greater openness on income inequality is the Heckscher-Ohlin (HO) model. As reported in Anderson

(2005), the model predicts for developing countries that greater openness boosts the demand for unskilled relative to skilled labor, which raises their wage and share of national income relative to skilled labor. This decreases an overall income inequality because unskilled labor is more equally distributed than skilled labor. One of the problems is that the outcomes of the HO model are based on many restrictive assumptions that are far from the real world (Meschi and Vivarelli, 2009).

A number of papers, departing from some of the main assumptions of the HO model, find interesting additional results which conflict with the standard prediction. For instance, Leamer (1987) used a *3-n* model where there are 3 factors of production (capital, labor and land) and *n goods* produced by allowing the inclusion of natural resources into the model, and showed that greater openness may increase income inequality in developing countries that have relatively abundant supplies of those resources. The argument is that greater openness will raise the relative returns to natural resources which are less equally distributed than other assets.

Furthermore, one of the main hypotheses of the HO theory is that all countries have equal access to the best available production technology. In Pissarides (1997), this assumption is relaxed and greater openness to technology may well increase the relative demand for skilled labor, even in developing countries. The reason is that learning and adapting to a new technology always requires the use of skilled labor, whose wages rise. In line with the outcome of Pissarides (1997), Feenstra and Hanson (1999) pointed out that the wage gap between skilled and unskilled workers in developing countries increases if globalization is characterized by the transfer of production technology from developed to developing countries.

In recent years, there has been a growing interest for empirical studies on the distributional effects of trade openness. Among the authors finding that openness increases income

inequality, we have Barro (2000) who studied a relationship between inequality and growth and used a panel of countries to estimate a Kuznets curve. After adding an interaction term between the openness ratio and the per capita GDP, Barro (2000) pointed out that the inequality increasing effect of trade openness is most pronounced in poor countries. Also, Lundberg and Squire (2003), estimating simultaneously the evolution of growth and inequality, found that trade liberalization goes along with higher income inequality.

However, other empirical papers support the prediction of the HO model by asserting a decrease in inequality after trade openness (Bourguignon and Morrisson, 1990; Calderon and Chong, 2001; Dollar and Kraay, 2002). In a cross-sectional analysis, the empirical findings obtained by Bourguignon and Morrisson (1990) suggest that differences in income inequalities within developing countries are determined by the endowments in mineral resources, trade protection and land concentration in agricultural exports. They obtain a significant and large effect of comparative advantages and the foreign trade structure on income inequality. Using a panel of countries, Calderon and Chong (2001) find that an increase in the volume of trade leads to a long-run decline of income inequality.

Alternatively, other scholars show that the effects of trade on inequality are contingent upon the level of countries' factor endowments. Spilimbergo et *al.* (1999) obtained that the link between trade liberalization and inequality depends on the level of human capital and arable land per capita. They found that trade openness reduces inequality in capital-abundant countries, whereas it increases inequality in skill-abundant countries.[3]

Finally, several studies do not find any significant and systematic impact of greater openness on income inequality (Edwards, 1997; Li et *al.*, 1998). The next section reviews

[3]Fischer (2001) has also tested his theoretical *2x2* factor abundance model related to the dynamic effects of trade liberalization on income distribution and found that the outcomes of trade openness on inequality are based on whether the country is land-abundant or capital-abundant.

studies that focus on the relationship between conflict and income inequality.

1.2.2 Conflict Risk and Income Inequality

Most of the studies related to the link between conflict and income inequality have analyzed the effect of inequality on the risk of conflict. Cross sectional analysis suggests that horizontal inequality, defined as inequality between ethnic groups or regions, positively and significantly affects conflict risk (Ostby, 2008). Furthermore, in their econometric analysis of complex humanitarian emergencies, defined as a human-made crisis leading to physical violence, displacement, hunger and disease of the populations, Auvinen and Nafziger (1999) obtain that high income inequality is associated with emergencies.

However, a number of authors find no significant correlation between income inequality and the likelihood of conflict (Fearon and Laitin, 2003; Collier and Hoeffler, 2004). Collier and Hoeffler (2004) develop an econometric model which predicts the outbreak of civil conflict. They obtain that income inequality has no explanatory power on the risk of civil conflict.

Recently, Bircan et *al.* (2010) analyze the potential relationship between conflict and income inequality in the other direction. They use a cross-country panel data to estimate war-related changes in income disparities, and reveal that violent conflict increases inequality, and this increase is further reinforced in the first post-conflict years. While this paper has displayed many interesting results, it does not account for the interaction effect between trade openness and conflict in the analysis of the distributional impact of conflict on income inequality.

1.2.3 Trade Openness and Conflict

There are a number of authors who have put some efforts into examining the link between conflict and trade openness (Oneal and Russet, 1999; Hegre et *al.*, 2010). All these authors try to answer the following two questions: Do conflicts influence the volume of goods and services traded in countries? Or are conflicts the consequence of trade openness? Evidence on these issues yields mixed results. A first series of papers finds that trade has important benefits by reducing, significantly, the likelihood of conflicts between commercial partners (Oneal and Russett, 1999). While using a game-theoretic model of conflict to argue that trade prevents conflicts because of the possible loss of trade gains, Morrow (1999) found that the effect of trade flows on the initiation and escalation of international conflict is indeterminate. Recently, Hegre et *al.* (2010) adopt a simultaneous analysis to capture the reciprocal effects between trade and conflict, and show that trade promotes peace and conflict reduces commerce.

Nonetheless, other studies, following Oneal and Russett (1999), have argued that there is no significant correlation between trade and conflict (Fearon and Laitin, 2003).

It follows from these literatures that no study has looked at the presence of conflict risk as a factor affecting the effect of trade openness on income inequality. To better understand the effect of trade openness on income inequality in developing countries, it makes sense to analyze whether the interaction effect between trade openness and conflict risk influences income inequality. To the best of my knowledge, it is the first study to analyze the interaction effect of trade openness and conflict risk on income inequality.

1.3 Empirical Analysis

1.3.1 Model Specification

Following Asiedu and Lien (2011), Michaud and Soest (2008), Meghir and Pistaferri (2004), and Calderon and Chong (2001) who use similar dynamic panel data model, I estimate the Equation (1.1) in order to test whether the impact of trade openness on income inequality depends on the level of external conflict risk and internal conflict risk.

$$EHII_{(i,t)} = \gamma_0 + \gamma_1 EHII_{(i,t-1)} + \gamma_2 TO_{(i,t)} + C_{(i,t)}\gamma_3 + (TO_{(i,t)} * C_{(i,t)})\gamma_4 + X'_{(i,t)}\gamma_5 + \phi_{(i,t)} \quad (1.1)$$

where $\phi_{(i,t)} = \phi_i + \tau_{(i,t)}$. i and t represent the country and year dummies, respectively; ϕ_i is the idiosyncratic individual and time invariant country effect and $\tau_{(i,t)}$ represents the usual error term.

Dependent Variable: Estimated Household Income Inequality (EHII)

EHII is an index ranging from 0 to 100, with 0 corresponding to complete equality and 100 corresponding to complete inequality. It is drawn from the University of Texas Inequality Project (UTIP) database built by Galbraith and Kum (2003). They use the United Nations International Development Organization's (UNIDO) data source to compute the between-group component of the Theil's T statistic as a measure of inequality and the corresponding database is called the UTIP-UNIDO data set. The EHII is then computed by combining the information provided by the Deininger and Squire (1996) data with the UTIP-UNIDO database. Even though the Deininger and Squire (1996) data are the standard reference for inequality studies, as argued by Meschi and Vivarelli (2009), the coverage of their data

is sparse and comes from different sources, leading to a variety of income and population definitions. Also, Atkinson and Brandolini (2001) pointed out that differences in definitions may be quantitatively important and note that their preference calls for the alternative approach allowing for the use of data sets where the observations are as consistent as possible. Thus, the EHII, offering information that covers the period 1963-1999, has been constructed to solve for serious data inconsistency and problems of comparability. In this paper, due to data availability concerning some variables, I restrict the sample to 39 developing countries covering the period 1984-1999.

Independent Variables

TO, the trade openness variable measured as the ratio of exports plus imports to Gross Domestic Product (GDP), is used in this analysis, following Barro (2000).

C refers to a vector of external conflict risk (EC) and internal conflict risk[4]. As described earlier, these two variables capture the risk for the incumbent government to face external and internal conflicts. For internal conflict risk, a maximum of four points and a minimum of 0 point are assigned to each subcomponent. So, the index of internal conflict risk is the sum of the scores assigned to the three subcomponents, and ranges from 0 (very high risk of internal conflict) to 12 (very low risk of internal conflict) corresponding to countries where there are no armed or civil opposition to the government and the government does not indulge in arbitrary violence against its own people. External conflict risk ranges also from 0 to 12. The highest rating, corresponding to very low risk of external conflict, is assigned to countries where there are no war, cross-border conflict and foreign pressures.

*TO*C* is the interaction terms between trade openness and external conflict risk *(TO*EC)*

[4]Gupta et *al.* (2009) use this index to account for the role of non-economic factors in financial development among low-income countries. Recently, internal and external conflicts have also been used by Asiedu and Lien (2011) in their paper that analyzes the interaction effect of natural resources and democracy on foreign direct investments (FDI).

and internal conflict risk *(TO*IC)*.

X denotes a set of some control variables found in previous studies that can affect income inequality and includes:

GDPpc, the Gross Domestic Product per capita, captures the stage of economic development. Data are drawn from the World Development Indicators (WDI) database (World Bank, 2006).

Inflation rate, defined as the annual percentage change in the consumption price index, is included to apprehend the fluctuations of economic activities, which are likely to affect income inequality. Since a number of papers find that higher inflation is associated with higher inequality (Lundberg and Squire, 2003; Gourdon et *al.*, 2008), I expect that inflation coefficient would be positive.

"*Population aged 65 and above (% of total population)*" is incorporated into the model, following Deaton and Paxson (1997), to capture the *age structure of the population*. This variable may affect income inequality, since it is argued that a higher elderly population suggests lower productivity, lower savings rates, and smaller intergenerational transfer of income.

Educational Attainment refers to gross enrollment of secondary education and is drawn from the Barro and Lee (2000) database. It measures the average number of years of secondary schooling and is included into the model to control for the effect of human capital on income inequality. A negative coefficient is anticipated.

I also include *Military in Politics* as a control variable. It summarizes the degree of military participation in politics, and is drawn from the PRS/ICRG database. It ranges from 0 (indicating that the level of military participation in politics is higher, leading to a higher level of political risk) to 6 (indicating that the level of political risk is very low).

It may affect income inequality because a preponderant presence of militaries in politics can increase the defense budget by reducing the level of allocations attributable to social programs.

To check the robustness of the results, I use a set of variables such as institutions (corruption and democracy) and ethnic tensions that are drawn from the PRS/ICRG database, and financial development variable proxied by liquid liabilities (M3) as a percentage of GDP, which is drawn from the World Development Indicators (WDI) database of the World Bank (2006). Liquid liabilities, considered as the broadest measure of financial intermediation, are the sum of currency and deposits in the central bank (M0) plus deposits, demand and interest of non-bank financial intermediaries (M1 and M2). Natural resource abundance, which is the sum of ores, metal and fuel exports as % of merchandise exports, is also included into the model. It is provided by the World Development Indicators (WDI) database, World Bank (2006)[5].

Table 1.1 in the Appendix 1 summarizes descriptive statistics of the data used in this chapter. Columns 1 and 2 report mean values and standard deviations for all countries. Columns 3 and 4 report mean values and standard deviation for a sub-sample of African countries. Columns 5 and 6 show the same data for the Latin American countries. The last two columns provide parallel data for a sub-sample of Asian countries. The data reveal some important disparities across regions. For example, it appears from Table 1.1 that African countries have, on average, higher income inequality than other countries.

Now, to assess the marginal effect of trade openness on income inequality, the interactive model (Equation 1.1), which incorporates the interaction term, is used. This effect is

[5]For more detailed information about variables, see: http://data.worldbank.org/indicator/

computed by deriving the partial derivative of Equation (1.1) with respect to trade openness:

$$\frac{\partial EHII_{(i,t)}}{\partial (Trade\ Openness)_{(i,t)}} = \gamma_2 + C_{(i,t)}\gamma_4 \tag{1.2}$$

This equation indicates that the estimated impact on income inequality due to a change in trade openness amounts to the estimated coefficient of trade openness (γ_2) and the product of the coefficient of the interaction between trade openness and conflict risk (γ_4), and the level of conflict risk. If the effects of trade openness on income inequality are conditional to the level of conflicts, the estimated coefficients, γ_2 and γ_4, must be of opposite signs and the threshold level should belong to the interval $(0, 12)$. The same analysis can be done for the marginal effect of conflict risk on income inequality through the following expression:

$$\frac{\partial EHII_{(i,t)}}{\partial (Conflict\ Risk)_{(i,t)}} = \gamma_3 + \gamma_4 TO_{(i,t)} \tag{1.3}$$

1.3.2 Estimation Strategy

In this section, I briefly describe the first estimation method used, namely, the bias-corrected Least Squares Dummy Variable (LSDVC) estimation technique, based on the work by Kiviet (1995), which is extended by Bun and Kiviet (2003) and Bruno (2005). For simplicity, I rewrite the dynamic panel data model expressed in Equation 1.1 as follows:

$EHII_{(i,t)} = \gamma EHII_{(i,t-1)} + X'_{(i,t)}\beta + \eta_i + \epsilon_{(i,t)}$

where $EHII_{(i,t)}$ is the dependent variable, $EHII_{(i,t-1)}$ is the lagged dependent variable, $X_{(i,t)}$ is the vector of explanatory variables, η_i is an unobserved individual effect, and $\epsilon_{(i,t)}$ is

an unobserved white noise disturbance.

The model can equivalently be written as

$EHII = W\delta + D\eta + \epsilon$ with $W = [EHII^{(-1)}|X]$ and $\delta' = (\gamma, \beta')$ and where W is the matrix of explanatory variables and lagged dependent variable, D is the (NTxN) matrix of individual dummies, δ is the (kx1) vector of coefficients, η is the (Nx1) vector of individual effects, and ϵ is the (NTx1) vector of disturbances. The LSDV estimator of δ, which is also often indicated as the fixed effects or the within-group estimator is:

$$\widehat{\delta} = (W'AW)^{-1}W'A(EHII) \tag{1.4}$$

where A is the within transformation matrix that gets rid off the individual effects.

Anderson and Hsiao (1982) show that the Least Squares Dummy Variable (LSDV) estimator is not consistent for finite T and for large number N, even though it has a relatively small variance. In Bun and Kiviet (2003), it is indicated that the bias associated with the LSDV estimator is:

$E(\widehat{\delta} - \delta) = c_1(T^{-1}) + c_2(N^{-1}T^{-1}) + c_3(N^{-1}T^{-2}) + O(N^{-2}T^{-2})$

The bias-corrected LSDV estimator (LSDVC) is obtained by using the two-step procedure suggested by Kiviet (1995), Bun and Kiviet (2003) and Bruno (2005). The first step obtains estimates for the variance and the vector of coefficients. The second step performs bias correction by depuring the LSDV estimator from the bias[6] approximation (B_i), as shown in the following expression:

$LSDVC_i = \widehat{\delta} - B_i$, $i = 1, 2$ and 3.

[6]For more detailed information about the bias approximations, see Bun and Kiviet (2003) and Bruno (2005).

1.3.3 Endogeneity Issues

Under the assumption of exogenous explanatory variables, the bias-corrected LSDV estimator is usually better than GMM and than most of other instrumental-variable estimators (Kiviet, 1995). Since the LSDVC estimator deals with the endogeneity of the lagged dependent variable in the dynamic specification but does not correct for the endogeneity of other explanatory variables, we control for the endogeneity issues that can be driven by some regressors included in the model. It is well known that endogeneity likely arises as a result of measurement error, omitted variables, sample selection errors, and simultaneity problems. In the particular case of this study, the endogeneity is engendered by the relation of reverse causality that may arise between income inequality and conflict risk. This allows to consider conflict risk (internal and external conflicts risks), trade openness, and their interaction terms as endogenous variables. Previous studies on growth and income inequality suggest a reverse causality from income inequality to the GDP per capita variable. Moreover, the measurement error of the dependent variable does not lead to biased estimated coefficients when the error is not correlated with other explanatory variables. However, one can think of the fact that the measurement error in income inequality can be affected by some explanatory variables such as the level of educational attainment in developing countries. In the estimation of the model specified in Equation (1.1), it is likely to experience a combination of measurement error, omitted variables and reverse causality problems. So, the only use of the bias-corrected LSDV estimator could lead to inconsistent estimated coefficients.

Therefore, to address the likely endogeneity issues, I apply the technique of consistent System Generalized Method of Moments (System-GMM) estimator suggested by Blundell and Bond (1998). The use of instruments is required to deal with these endogeneity problems that may arise due to reverse causality between income inequality and conflict risk, because

if current level of inequality can be affected by current and past levels of conflict risk, at the same time, contemporaneous income inequality can also influence current realization of conflict risk. However, it is less likely that current level of income inequality affects past realization of conflict risk. To this end, GMM estimator incorporates, in a single system, the regression equation in both changes and levels, each with its specific set of instruments. Two tests are crucial for the consistency of the GMM estimator in order to show whether the lagged values of explanatory variables are valid instruments. The first test is the Sargan test of overidentifying restrictions and the hypothesis tested is that the instrumental variables are uncorrelated to a set of residuals. If the null hypothesis is not rejected, the lagged variables used as instruments are acceptable and valid. The second test is the Arellano and Bond error autocorrelation test. The test consists of examining the first and second-order serial correlations of the differenced error term (that is, the residual of the regression in differences). By construction, the first-order serial correlation of the disturbance term is expected. The hypothesis of the second-order serial correlation is that the differenced errors are not correlated. If the null hypothesis of the absence of autocorrelation of the error terms is not rejected, then the use of lagged variables as instruments is allowed. As argued by Asiedu and Lien (2011) and Roodman (2007), these two tests can lose power when the number of instruments, i, is higher than the number of countries, n; that is when the ratio $r = \frac{n}{i} < 1$. To solve for this problem, I follow Roodman (2007) who suggests to reduce the instrument count by limiting the number of lags used as instruments.

This GMM estimation technique has been widely used in the literature to solve for endogeneity issues related to reverse causality (Asiedu and Lien, 2011; Spilimbergo, 2009; Rajan and Subramanian, 2008; Djankov et *al.*, 2008; Fajnzylber et *al.*, 2002). For example, Rajan and Subramanian (2008) analyze the effects of aid on growth, and correct for the

possible bias associated with the fact that poorer growth may draw aid contributions to recipient countries. In their analysis, they mention that the exclusion restriction underlying the use of lagged policy leads to the fact that trade reform has an important contemporaneous effect on growth, but absolutely no effect four years later. To assess the relationship between violent crime rates and income inequality, Fajnzylber et *al.* (2002) use GMM technique to correct for the joint endogeneity problem, mentioning that the underlined relationship is often characterized by a two-way causality. Recently, Asiedu and Lien (2011) employ GMM estimator to solve for the possibility of reverse causality between foreign direct investments (FDI) and democracy.

However, Windmeijer (2005) shows that, in small samples, estimated asymptotic standard errors of the two-step system-GMM estimator can be downward biased. As a robustness test, I provide robust standard errors by computing Windmeijer's finite-sample correction.

1.3.4 Results

Table 1.2 reports a series of regressions using the Least Squares Dummy Variable Corrected estimator (LSDVC) technique. Bootstrapped standard errors are obtained after 200 iterations to test for the statistical significance of the estimated coefficients.

Column 1 shows the results of the basic model with the lagged dependent variable, the five control variables, the year and country fixed effects. The results of the model when adding trade openness are shown in Column 2. Columns 3 and 4 display the results obtained by taking into account respectively external conflict risk and its interaction with trade openness. The results displayed in Columns 5 and 6 concern the case of internal conflict risk and its interaction with trade openness.

From all the regressions, the results indicate that the estimated coefficient associated

with the lagged dependent variable is positive and highly statistically significant at 1%. This result is consistent with previous studies, suggesting that past inequality appears to be a good predictor for current inequality (Calderon and Chong, 2001), and this gives support to the use of dynamic specification model of income inequality.

The results of Column 1 suggest that the coefficient related to inflation rate is positive and significant[7]. This denotes that higher inflation rate has a worsening effect on income inequality. The estimates of Column 1 also point out that the coefficients associated with GDP per capita and educational attainment have the expected signs and the coefficient of population structure is positive, even though they do not reach the conventional level of significance.

When the trade openness variable is added in Column 2, its coefficient is negative and statistically significant, meaning that trade openness reduces income inequality. This gives support to the Heckscher-Ohlin prediction, arguing that greater openness exerts a reducing effect on income inequality in developing countries. The results of Column 2 also show that the coefficient estimate of the variable called *military in politics*, which measures the presence of militaries in a political sphere, is negative and statistically significant at 10%. This indicates that countries with a large presence of militaries in the political sphere tend to increase income inequality. According to a theory of military dictatorships carried out by Acemoglu et *al.* (2010), when countries are supported by large militaries, they will find it difficult to consolidate democracy and will end up with military dictatorships, leading to worse economic performance because of conflict that may arise between citizens and soldiers. This large presence of militaries in the politics may then induce an increase in income inequality, since a military regime poses the greatest risk and the system of governance

[7]This variable enters all the regressions with a positive and significant coefficient.

will become corrupt and may create an armed opposition.

In Column 3, external conflict risk is added to the model. It appears, from the additive model, that the coefficient associated with external conflict risk is not significant, the estimate of trade openness remains negative and significant, even though it falls slightly in the absolute term.

The interaction term between external conflict risk and trade openness is introduced in Column 4. The results of the interactive model suggest that the coefficient of the trade openness variable becomes positive and loses its significance. Moreover, the coefficient associated with external conflict risk remains positive and is significant. At the same time, the interaction term variable exhibits a negative coefficient and is statistically significant. This tends to support the hypothesis that the distributive impact of trade openness on income inequality depends on the level of external conflict risk, *that is, trade openness increases income inequality in the countries where the risk of external conflict is very high, but reduces income inequality in countries where the risk is very low.* More precisely, the estimates of Column 4 show that the positive effect of trade openness on income inequality is more pronounced in the countries where the risk of external conflict is higher.

Columns 5 and 6 display the results of the models including, respectively, internal conflict risk and its interaction with trade openness. It appears that the coefficient of interaction term is negative and significant. This suggests, once again, the existence of the *interaction effect* between internal conflict risk and trade openness on income inequality.

These empirical findings can be explained as follows: when the risks of internal and external conflicts are higher, the traditional mechanisms of transmission, by which exported and imported goods and services operate, work for a minority of *well informed and connected people*, most of the time, who are very close to the regime in power. So, having put their

hands on the most *profitable commercial activities*, these people enjoy the situation of rents created by the conflicting environment which profits them, excluding, consequently, the large majority of the *already vulnerable population*. This leads to a reinforcement of income inequality among the populations. These results corroborate the finding of Barro (2000) who argued that the rich groups will be most able to take advantage of the opportunities offered by global commerce, leading to the fact that an increased trade would be most likely to raise inequality in poor countries.

In the next section, I deal with the endogeneity issues related to some of the explanatory variables included in this analysis.

1.3.5 Generalized Method of Moments (GMM) Estimation Approach

The LSDVC results presented in the previous sub-section are based on the assumption that all the explanatory variables, except the lagged dependent variable, are exogenously determined. In this section, I relax this assumption.

The results obtained with the System-GMM dynamic panel data estimation are summarized in Table 1.3. First, it is important to notice that the test of second-order autocorrelation of Arellano and Bond AR(2) does not reject the hypothesis of the absence of autocorrelation of the error terms. Second, the Hansen test of overidentifying restrictions accepts the null hypothesis that all the lagged variables used as instruments are not correlated with the error terms, supporting the use of the lagged explanatory variables as instruments.

Column 1 reports the estimated coefficients for the basic specification where neither the trade openness nor the conflict risks variables are included in the model specification. It is found that the coefficient associated with the lagged dependent variable is higher than that

obtained in the previous results with LSDVC, indicating that the positive effect of past levels of income inequality is more pronounced. The estimated coefficient of inflation rate remains positive and statistically significant. Educational attainment exhibits a negative coefficient but is not statistically different from zero.

The results of the model including trade openness are presented in Column 2. Those of the additive model are displayed in Column 3. It appears that the estimated coefficient of trade openness not only increases in absolute term from its value shown in Column 2 of Table 1.2 and remains negative, but also becomes statistically significant. The results also show that the external conflict risk coefficient increases sharply from its value in Column 3 of Table 1.2 but does not reach the conventional significance level.

The outcomes of the interactive model (Column 4) are now discussed. It is clear that the estimated coefficient of the trade openness variable becomes positive, and emerges even more significant. The coefficient of external conflict risk remains positive and becomes statistically different from zero. Another noteworthy feature is that the coefficient corresponding to the interaction term is negative and significant at 1%. Moreover, the inclusion of the interactive term causes the coefficient associated with the educational attainment variable to be negative and statistically significant, suggesting that an increase in human capital reduces income inequality.

Columns 5 and 6 of Table 1.3 look at the links between income inequality and internal conflict risk and its interaction with trade openness. The estimated coefficient of the multiplicative variable is, once again, negative and statistically significant, even though the direct effects of trade openness and internal conflict risk on income inequality fail to reach the conventional significance level. This can be explained by the fact that, in the case of internal conflict risk, either the interaction effect is important enough that it neutralizes the direct

effects, or as argued earlier, internal conflict risk may have little impact on all the countries' economic activities, since it can be local.

The implication of these findings, which goes along with popular assertion but discords with standard trade theory, is that the worsening effect of trade openness on income inequality is accentuated in countries where the risks of external and internal conflicts are higher. It is important to highlight that the interactive model portrays *conditional relationships*, instead of unconditional relationships suggested, until now, by the literature related to the political economy of trade openness.

Overall, these results indicate that the interaction effect between trade openness, the risks of external and internal conflicts must be accounted for in the analysis of the distributional impacts of trade openness on income inequality. Whether the environment is torn by conflict risks may matter when assessing the relationship between trade openness and income inequality, since the gains from trade may not be equally distributed.

1.3.6 Relationship between Conflict Risk and Income Inequality

Up to this point, I have only tested the linear relationship between conflict risk and income inequality.

In this section, I further investigate a non-linear relationship between conflict risk and income inequality. For this reason, I introduce the squared variables for both external and internal conflict risks. The results are summarized in Table 1.4. Column 1 reports the outcomes of the model, including the squared external conflict risk variable. The estimated coefficients suggest a non-monotonous relationship between external conflict risk and income inequality. The linear coefficient associated with external conflict risk is positive and significant, and the coefficient related to the squared external conflict risk variable is significantly

negative, showing that income inequality increases at first and then decreases for large values of external conflict risk.

Column 2 shows the results when internal conflict risk and its squared term are incorporated into the interactive model. I also find a non-monotonous relationship between internal conflict risk and income inequality. Since a greater value of conflict index corresponds to lower conflict risk, this is an interesting result for policy-makers to know that, after reaching a certain level of conflict index, any effort, in order to reduce a conflict risk, is associated with a decrease in income inequality. The results also indicate that the coefficient estimate associated with the educational attainment variable is negative and statistically significant, suggesting that an increase in human capital tends to reduce income inequality. Moreover, I find that the GDP per capita variable exhibits a positive and significant coefficient. This can be explained by the fact that during early stage of economic development, income inequality increases over time[8].

Overall, this non-monotonous relationship implies that income inequality worsens in countries experiencing higher risk of conflicts, and this result is consistent with Bircan et *al.* (2010) who argued that conflicts may affect, negatively, social spending and limit the government's ability of raising revenues necessary for public investment.

1.4 Robustness Checks: Additional Control variables

The previous section has shown that the effect of the interaction term between trade openness and conflict risk in explaining income inequality is robust to the inclusion of variables such as GDP per capita, the level of inflation rate, the structure of the population, military

[8]For more detailed explanation, see Kuznets (1955) who tested the hypothesis of an inverted-U-shape between income inequality and the stages of economic development.

in politics, educational attainment, and the lagged dependent variable. In this section, I further check the robustness of the results by using other explanatory variables that can affect income inequality.

1.4.1 Institutional Quality

I examine whether the main findings of this study are influenced by the inclusion of some institutional quality variables. Following Chong and Gradstein (2007), I use democracy and corruption to proxy for the institutional quality. The two institutional variables used come from the International Country Risk Guide (ICRG) database. The indices of democracy and corruption range from 0 to 6. The highest rates of democracy and corruption indicate that the country is more democratic and less corrupt, respectively.

The results of the models including the level of democracy and corruption perception are displayed, respectively, in Columns 1 and 2 of Table 1.5 for external conflict risk. The results are robust when controlling for those institutional variables, even though the estimated coefficients linked to democracy and corruption fail to be significant. However, their inclusion allows the coefficient of the lagged dependent variable to be higher, denoting that the persistent characteristic of income inequality is much pronounced when controlling for the level of democracy and corruption. It is also worth mentioning that, with the model including the index of corruption, the coefficient related to educational attainment is negative and statistically significant.

The same exercise is performed for internal conflict risk. The results are reported in Columns 4 and 5. It is observed that the coefficient associated with democracy is negative and significant, suggesting that democratic regimes are more likely to reduce income inequality.

1.4.2 Ethnic Tensions

The literature suggests that fragmented societies are associated with poor policy management (Alesina and La Ferrara, 2005) and that ethnically fragmented economies may find it difficult to agree on public goods and good policies (Easterly and Levine, 1997). As a robustness check, I include into the model the index of ethnic tensions which is an index that ranges from 0 to 6. It is drawn from the ICRG database as a proxy for ethnic diversity.

The results, summarized in Columns 3 (for external conflict risk) and 6 (internal conflict risk) of Table 1.5, also appear to be robust to the inclusion of the ethnic tensions variable. Even more, in Column 6, the coefficient estimate associated with the ethnic tensions variable is negative and statistically significant, suggesting that more *ethnically diverse countries* are likely to experience greater income inequality. This result is in line with Montalvo and Reynal-Querol (2005) when they said:

> "Trade may be restricted to individuals of the same ethnic group; public infrastructure may have an ethnic bias; government expenditure may favor some ethnic groups."

1.4.3 Financial Development

Are the results remaining robust when I control for financial development proxied by liquid liabilities as a percentage of GDP? This question is investigated in Table 1.6. Column 1, reporting the results for external conflict risk, shows that the coefficient related to the interaction term is statistically significant in the presence of liquid liabilities, and the coefficient associated with the financial deepening variable is negative but is not statistically different from zero. The same analysis is performed with internal conflict risk and similar results are

found in Column 2.

1.4.4 Natural Resource Abundance

It is documented that countries that are highly dependent on the exportation of natural resources are likely to experience civil violence (Collier and Hoeffler, 2004). To test for the effect of natural resource, I use a variable called natural resource abundance. It is the sum of ores and metals exports and fuel exports as a percentage of merchandise exports. This variable is drawn from the World Development Indicator database (World Bank, 2006). The results, summarized in Table 1.7, do not change when the natural resource abundance variable is included into the model. I report the results associated with external conflict in Column 1. It can be seen that the coefficients related to trade openness and external conflict are still positive and significant. Moreover, the coefficient linked to the interaction term is statistically negative. I run the same regression for internal conflict and report the results in Column 2. It appears that, not only the interaction term coefficient is still negative and significant, but also the coefficient related to the internal conflict variable is positive and becomes significant. However, the coefficient of the natural resource abundance variable is negative but not significant.

1.4.5 Robustness to Regional Effects

In this section, I check the sensitivity of the results to the inclusion of regional effects. I include into the model regional dummies for African countries, Latin American countries, and for Asian countries. It is found that the results, which I do not report, are robust to the use of regional dummies variables. Interestingly, the statistical significance of the coefficients related to the interaction terms between external/internal conflicts risks and trade openness

has increased even more.

1.4.6 Additional Robustness Test

In this section, since the two-step system-GMM estimator can yield downward biased standard errors in small samples, I run the same regressions displayed in Tables 1.3 and 1.4, and correct for the standard errors by computing the Windmeijer's finite-sample correction. The results with standard errors corrected by the Windmeijer's finite-sample correction method are reported in Tables 1.9 and 1.10. The correction method does not change the estimated coefficients, even though, not always, the statistical significance level decreases slightly.

1.5 Conclusion and Policy Recommendations

The objective of this study is to show the existence of the interaction effect between trade openness and conflict risk on income inequality for a panel of 39 developing countries. The main conclusion which contradicts the HO prediction is that, once the interactive model is accounted for, trade openness increases income inequality, and this positive relationship between trade openness and income inequality is even more exacerbated in states where *the risk of conflict is higher*. After controlling for a wide range of macroeconomic, demographic and institutional variables, this relationship appears to be a clear empirical evidence that explains the differences in income inequalities across countries over time. The results also suggest that past levels of income inequality are good predictors of current inequality.

This study provides empirical analysis of the interaction between trade openness and conflict risk in explaining income inequality, and the evidence that trade openness reduces income inequality in countries with low risk of conflict is encouraging.

The evidence presented suggests that all policies preventing or reducing the risks of internal and external conflicts, and supporting "peace" in developing countries, not only, are more likely to directly decrease income inequality, but also, may help trade openness to be more egalitarian. This evidence sheds light on the recurrent debate about whether or not developing countries must open more their economies to international trade.

Appendix 1:

Tables Of Different Econometric Estimations

Table 1.1: Summary Statistics

Variable	Full Sample		Africa		Latin America		Asia	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*	*Mean*	*Std. Dev.*	*Mean*	*Std. Dev.*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
EHII	46.93	4.24	47.73	5.33	46.44	3.63	46.76	3.55
Trade Openness	61.12	36.61	57.19	19.88	57.49	35.25	71.38	49.76
External Conflict	9.26	2.42	8.98	2.45	9.56	2.31	9.10	2.52
Internal Conflict	7.43	2.59	7.64	2.67	7.38	2.48	7.25	2.67
GDP per capita	2170.45	2478.97	1016.43	1003.76	2881.55	1756.63	2399.45	3827.47
Inflation Rate	105.63	745.56	21.45	32.45	225.93	1140.74	14.99	22.83
Population Aged 65+	4.18	1.92	3.13	0.59	5.35	2.37	3.57	0.86
Military in Politics	3.26	1.60	3.42	1.51	3.29	1.63	3.01	1.65
Educational Attainment	4.35	1.81	3.13	1.49	5.32	1.42	4.23	1.81
Democracy Index	3.41	1.10	3.05	1.13	3.62	0.93	3.50	1.23
Corruption Index	2.95	1.00	3.32	0.87	2.86	0.94	2.66	1.12
Ethnic Tensions Index	3.62	1.59	3.19	1.20	4.68	1.31	2.48	1.33
Liquid Liabilities	41.48	24.51	34.83	16.71	33.73	11.96	61.40	34.07
Natural Resource Abund.	23.97	26.72	29.39	33.14	23.48	23.95	20.73	25.09

Note: For definitions of variables and sources, see Table 1.8.

Table 1.2: LSDVC Dynamic Estimation: Effect of Trade Openness, External and Internal Conflicts Risks on Income Inequality

Variable	[1]	[2]	[3]	[4]	[5]	[6]
Lagged EHII	0.596***	0.588***	0.589***	0.579***	0.584***	0.572***
	(10.77)	(10.67)	(10.73)	(10.75)	(10.73)	(10.46)
Trade Openness		-0.0237**	-0.0227**	0.0138	-0.0246***	-0.0008
		(-2.50)	(-2.38)	(0.58)	(-2.57)	(-0.06)
External Conflict			0.0254	0.292*		
			(0.35)	(1.87)		
Internal Conflict					-0.0685	0.0996
					(-0.96)	(0.90)
*TO*EC*				-0.00425*		
				(-1.75)		
*TO*IC*						-0.00297*
						(-1.79)
Inflation Rate	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***
	(2.72)	(2.75)	(2.74)	(2.82)	(2.75)	(2.90)
Population Structure	0.0972	0.00619	0.0584	-0.528	-0.0556	-0.501
	(0.13)	(0.01)	(0.08)	(-0.66)	(-0.07)	(-0.61)
Military in Politics	-0.224	-0.246*	-0.256*	-0.261*	-0.170	-0.201
	(-1.59)	(-1.75)	(-1.76)	(-1.81)	(-1.08)	(-1.29)
GDP per capita	-0.00020	-0.00023	-0.00023	-0.00006	-0.00019	-0.00002
	(-0.48)	(-0.53)	(-0.54)	(-0.16)	(-0.45)	(-0.06)
Educational Attainment	-0.334	-0.180	-0.189	-0.157	-0.198	-0.144
	(-1.19)	(-0.65)	(-0.69)	(-0.58)	(-0.72)	(-0.52)
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	407	407	407	407	407	407
Number of Countries	39	39	39	39	39	39

Notes: For definitions and sources of data, see Table 1.8.
The estimation method is the Least Squares Dummy Variable Corrected (LSDVC) Dynamic Regression. t-Statistics are below the coefficients.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 1.3: System-GMM Estimation: Effects of Trade Openness, External and Internal Conflicts Risks on Income Inequality

Variable	[1]	[2]	[3]	[4]	[5]	[6]
Lagged EHII	0.8096***	0.7894***	0.5476*	0.7498***	0.6157***	0.5726***
	(5.28)	(5.43)	(1.92)	(5.63)	(5.78)	(5.27)
Trade Openness		-0.0027	-0.0219*	0.0959***	-0.0243*	0.0183
		(-0.26)	(-1.89)	(2.95)	(-2.04)	(1.09)
External Conflict			0.2590	0.8991***		
			(1.40)	(2.96)		
Internal Conflict					-0.0162	0.2067
					(-0.16)	(1.22)
*TO*EC*				-0.0093***		
				(-2.85)		
*TO*IC*						-0.0039*
						(-1.95)
Population Structure	0.0666	0.0153	-0.0330	0.0187	-0.2900	-0.1868
	(0.61)	(0.11)	(-0.13)	(0.11)	(-1.57)	(-0.70)
Military in Politics	-0.0392	-0.0679	0.0663	-0.1412	-0.1235	-0.0881
	(-0.39)	(-0.70)	(0.34)	(-1.34)	(-0.66)	(-0.36)
Inflation Rate	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***
	(6.80)	(6.83)	(3.46)	(5.46)	(6.17)	(5.78)
GDP per capita	-8.97e-06	-0.00003	-0.00006	0.00008	0.0002	0.0002
	(-0.05)	(-0.61)	(-0.14)	(0.70)	(1.23)	(0.55)
Educational Attainment	-0.3675	-0.2403	-0.6062	-0.5960*	-0.1306	-0.2588
	(-1.24)	(-0.86)	(-0.75)	(-1.86)	(-0.40)	(-0.62)
Constant	11.0109	11.8353	23.8853	6.1928	21.7476***	21.6420***
	(1.31)	(1.46)	(1.41)	(0.77)	(3.47)	(3.31)
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Hansen Test of overid.	9.30	8.67	7.53	5.75	3.60	4.48
(p-value)	0.677	0.653	0.821	0.764	0.990	0.973
AR(1)	0.046	0.044	0.059	0.035	0.029	0.025
AR(2)	0.276	0.279	0.351	0.289	0.298	0.288
Observations	407	407	407	407	407	407
Number of Countries	39	39	39	39	39	39
Number of Instruments	33	33	35	33	35	36

Notes: *For definitions and sources of data, see Table 1.8. The estimated method is a two-step System-GMM estimator. t-statistics are below the coefficients.*
AR(1) and AR(2) are respectively Arellano-Bond first and second autocorrelation tests.
Time dummy variables are included in all regressions.
Variables such as trade openness, conflict risks, GDP per capita and education are instrumented, using their own lags in level and differences. Inflation rate, population structure and military in politics are treated as exogenous.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 1.4: System-GMM Estimation: Non-Monotonous Relationship between Conflicts Risks (Internal and External) and Income Inequality

Variable	[1]	[2]
Lagged EHII	0.738***	0.580***
	(8.76)	(5.66)
External Conflict	1.291***	
	(3.13)	
External Conflict Squared	-0.0580***	
	(-2.63)	
TOEC	-0.00624**	
	(-2.48)	
Internal Conflict		1.514***
		(2.92)
Internal Conflict Squared		-0.0863**
		(-2.57)
TOIC		-0.00136
		(-0.50)
Trade Openness	0.0543**	0.00399
	(2.05)	(0.16)
GDP per capita	0.00006	0.00043**
	(0.53)	(1.97)
Population Structure	-0.0759	-0.111
	(-0.43)	(-0.45)
Inflation Rate	0.0004***	0.0005***
	(5.81)	(6.03)
Educational Attainment	-0.283	-0.737**
	(-1.05)	(-2.14)
Military in Politics	-0.0520	-0.272
	(-0.51)	(-1.35)
Constant	7.737	18.60***
	(1.35)	(3.24)
Country Fixed Effect	Yes	Yes
Year Fixed Effect	Yes	Yes
Hansen Test of overid.	5.29	9.09
(p-value)	0.916	0.766
AR(1)	0.037	0.029
AR(2)	0.263	0.258
Observations	407	407
Number of Countries	39	39
Number of Instruments	36	38

Notes: *For definitions and sources of data, see Table 1.8. The estimation method is a two-step System-GMM estimator. t-statistics are below the coefficients.*
AR(1) and AR(2) are respectively Arellano-Bond first and second autocorrelation tests.
Time dummy variables are included in all regressions.
Variables such as trade openness, conflict risks and their squared terms, GDP per capita and education are instrumented, using their own lags in level and differences.
Inflation rate, population structure and military in politics are treated as exogenous.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 1.5: System-GMM Estimation: Robustness of the Results to the Inclusion of Institutional Quality and Ethnic Tensions

Variable	[1]	[2]	[3]	[4]	[5]	[6]
Lagged EHII	0.8235***	0.8326***	0.6985***	0.6266***	0.6249***	0.5533***
	(5.36)	(7.84)	(4.20)	(3.86)	(4.29)	(2.97)
Trade Openness	0.0876*	0.0853**	0.0998***	0.0123	0.0169	0.0162
	(1.84)	(2.25)	(2.93)	(0.85)	(0.91)	(1.07)
External Conflict	0.8114**	0.7509***	0.8565***			
	(2.07)	(2.62)	(2.90)			
Internal Conflict				0.1739	0.2235	0.1460
				(1.16)	(1.00)	(0.93)
*TO*EC*	-0.0083**	-0.0079**	-0.0098***			
	(-2.11)	(-2.25)	(-3.85)			
*TO*IC*				-0.0038**	-0.0036*	-0.0033**
				(-2.17)	(-1.80)	(-1.96)
Population Structure	0.0344	0.06335	0.0802	-0.1169	-0.2091	-0.0980
	(0.45)	(0.36)	(0.19)	(-0.73)	(-0.88)	(-0.51)
Military in Politics	-0.1052	-0.0641	-0.0735	0.0652	-0.0502	0.0006
	(-0.51)	(-0.36)	(-0.51)	(0.23)	(-0.12)	(0.00)
Inflation Rate	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***
	(5.26)	(7.19)	(6.91)	(8.17)	(5.45)	(6.47)
GDP per capita	0.00007	0.00002	0.00008	0.00001	0.0001	0.00008
	(0.41)	(0.21)	(0.46)	(0.03)	(0.29)	(0.15)
Educational Attainment	-0.2403	-0.5260*	-0.4916	-0.1317	-0.1432	-0.2353
	(-0.84)	(-1.88)	(-1.22)	(-0.36)	(-0.33)	(-0.47)
Democracy Level	-0.1295			-0.3132*		
	(-0.43)			(-1.92)		
Corruption Index		-0.0574			-0.0894	
		(-0.19)			(-0.25)	
Ethnic Tensions			-0.2472*			-0.1556
			(-1.90)			(-0.73)
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Hansen Test of overid.	11.68	5.82	4.84	4.25	5.40	4.59
(p-value)	0.554	0.758	0.963	0.994	0.979	0.970
AR(1)	0.041	0.038	0.047	0.036	0.027	0.039
AR(2)	0.296	0.280	0.293	0.295	0.287	0.296
Observations	407	407	407	407	407	407
Number of Countries	39	39	39	39	39	39
Number of Instruments	38	34	37	39	39	37

Notes: *For definitions and sources of data, see Table 1.8. The estimation method is a two-step System-GMM estimator. t-statistics are below the coefficients.*
AR(1) and AR(2) are respectively Arellano-Bond first and second autocorrelation tests.
Time dummy variables are included in all regressions. Variables such as trade openness, conflict risks, GDP per capita and education are instrumented, using their own lags in level and differences.
Inflation rate, population structure and military in politics are treated as exogenous.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 1.6: System-GMM Estimation: Robustness of the Results to the Inclusion of Financial Development

Variable	[1]	[2]
EHII	0.719***	0.536*
	(4.59)	(1.88)
External Conflict	0.863***	
	(2.57)	
*TO*EC*	-0.00929**	
	(-2.50)	
Trade Openness	0.0977**	0.0211
	(2.20)	(0.99)
GDP per capita	0.00015	0.00014
	(0.82)	(0.37)
Population Structure	-0.0403	-0.0213
	(-0.24)	(-0.09)
Inflation Rate	0.0004***	0.0004***
	(6.23)	(4.39)
Educational Attainment	-0.554*	-0.628
	(-1.77)	(-1.03)
Military in Politics	-0.168	-0.167
	(-1.01)	(-0.49)
Liquid Liabilities	-0.0125	-0.00556
	(-0.89)	(-0.24)
Internal Conflict		0.333
		(1.30)
*TO*IC*		-0.0037**
		(-2.15)
Country Fixed Effect	Yes	Yes
Year Fixed Effect	Yes	Yes
Hansen Test of overid.	5.17	7.68
(p-value)	0.819	0.809
AR(1)	0.034	0.032
AR(2)	0.281	0.275
Observations	407	407
Number of Countries	39	39
Number of Instruments	34	37

Notes: *For definitions and sources of data, see Table 1.8. The estimation method is a two-step System-GMM. t-statistics are below the coefficients.*
AR(1) and AR(2) are respectively Arellano-Bond first and second autocorrelation tests. Time dummy variables are included in all regressions.
Variables such as trade openness, conflict risks, GDP per capita and education are instrumented, using their own lags in level and differences. Inflation rate, population structure and military in politics are treated as exogenous.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 1.7: System-GMM Estimation: Robustness of the Results to Natural Resource Abundance

Variable	[1]	[2]
EHII	0.8020***	0.7447***
	(11.55)	(6.05)
External Conflict	0.8693***	
	(2.79)	
*TO*EC*	-0.0086***	
	(-2.72)	
Trade Openness	0.0846***	0.0195
	(2.57)	(1.34)
GDP per capita	0.00005	0.00005
	(0.32)	(0.54)
Population Structure	-0.0979	-0.0402
	(-0.45)	(-0.22)
Inflation Rate	0.0004***	0.0004***
	(6.69)	(6.68)
Educational Attainment	-0.3843*	-0.4630*
	(-1.69)	(-1.90)
Military in Politics	-0.1035	-0.2830*
	(-0.71)	(-1.73)
Natural Resource Abundance	-0.0211	-0.0247
	(-0.75)	(-1.28)
Internal Conflict		0.4364***
		(2.91)
*TO*IC*		-0.0031*
		(-1.84)
Country Fixed Effect	Yes	Yes
Year Fixed Effect	Yes	Yes
Hansen Test of overid.	4.23	5.34
(p-value)	0.937	0.868
AR(1)	0.007	0.023
AR(2)	0.936	0.963
Observations	348	348
Number of Countries	39	39
Number of Instruments	34	37

Notes: *For definitions and sources of data, see Table 1.8. The estimation method is a two-step System-GMM. t-statistics are below the coefficients.*
AR(1) and AR(2) are respectively Arellano-Bond first and second autocorrelation tests. Time dummy variables are included in all regressions.
Variables such as trade openness, conflict risks, GDP per capita and education are instrumented, using their own lags in level and differences. Inflation rate, population structure and military in politics are treated as exogenous.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 1.8: Definitions of Variables and Sources of Data

Variable	Definitions and Sources
EHII	Estimated Household Income Inequality. It ranges from 0 to 100, with 0 corresponding to complete equality and 100 corresponding to complete inequality; provided by the Wage University of Texas Income Project (WUTIP)
Trade Openness, TO	Sum of exports and imports as a % of GDP, provided by World Development Indicators (WDI), World Bank (2006)
Internal Conflict, IC	Absence of internal conflict (civil war/coup threat, terrorism/political violence, civil disorder); ranges 0 to 12, with a higher score meaning very low risk; provided by Political Risk Services/International Country Risk Guide (PRS/ICRG).
External Conflict, EC	Absence of external conflict (war, cross-border conflicts and foreign pressures); ranges from 0 to 12, with a higher score meaning very low risk; provided by PRS/ICRG.
TOEC	Interaction term between external conflict risk and trade openness
TOIC	Interaction term between internal conflict risk and trade openness
Educational Attainment, EA	Educational Attainment of the Total Population Aged 25 and Over, from Barro and Lee (2000)
GDP per capita	GDP per capita (constant 2000 US); provided by WDI, World Bank (2006)
Inflation Rate, Infl	Inflation rate, consumer prices (annual %); provided by WDI, World Bank (2006)
Population, POP	Population ages 65 and above (% of total); provided by WDI, World Bank (2006)
Military in Politics, MP	Index of Military in Politics ranges from 0 to 6, with 0 corresponding to high presence of military in politics and 6 to its absence; provided by PRS/ICRG
Democracy, Dem	Index of democracy level ranges from 0 to 6, with 0 corresponding to autarchies and 6 to alternating democracies; provided by PRS/ICRG
Corruption, Cor	Index of corruption level ranges from 0 to 6, with 0 corresponding to highly corrupt countries; provided by PRS/ICRG
Ethnic Tensions, ET	Index of ethnic tensions also ranges from 0 to 6, with 0 corresponding to more ethnically diverse countries and 6 to less ethnically diverse countries; provided by PRS/ICRG
Liquid Liabilities, LL	Sum of currency and deposits in the central bank (M0), and deposits and interests of non-central bank intermediaries (M1 and M2) as % of GDP; provided by WDI, World Bank (2006)
Natural Resource Abundance, NRA	Sum of ores, metal and fuel exports as % of merchandise exports; provided by WDI, World Bank (2006)

List of Countries Included in the Analysis: Algeria, Botswana, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Senegal, South Africa, Tunisia, Uganda, Zimbabwe, Kuwait, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Panama, Peru, Uruguay, Bangladesh, India, Indonesia, Jordan, Malaysia, Pakistan, Philippines, Thailand, Turkey.

Table 1.9: System-GMM Estimation with Windmeijer Finite Sample Correction: Trade Openness, External and Internal Conflicts Risks, and Income Inequality

Variable	[1]	[2]	[3]	[4]	[5]	[6]
Lagged EHII	0.8096***	0.789441***	0.5493*	0.7498***	0.6157***	0.5726***
	(2.92)	(3.04)	(1.82)	(4.26)	(4.89)	(3.28)
Trade Openness		-0.0027	-0.0181*	0.0959***	-0.0243*	0.0183
		(-0.17)	(-1.83)	(3.01)	(-1.81)	(1.09)
External Conflict			0.2145*	0.8991***		
			(1.75)	(3.04)		
Internal Conflict					-0.0162	0.2067
					(-0.13)	(0.97)
*TO*EC*				-0.0093***		
				(-3.04)		
*TO*IC*						-0.0039*
						(-1.86)
Population Structure	0.0666	0.0153	0.0635	0.0187	-0.2900	-0.1868
	(0.43)	(0.07)	(0.30)	(0.10)	(-1.49)	(-0.77)
Military in Politics	-0.0392	-0.0679	0.1391	-0.1412	-0.1235	-0.0881
	(-0.25)	(-0.45)	(0.83)	(-1.13)	(-0.55)	(-0.23)
Inflation Rate	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***
	(5.80)	(6.89)	(3.75)	(5.40)	(6.42)	(6.50)
GDP per capita	-8.97e-06	-0.00003	-0.0002	0.00008	0.0002	0.0002
	(-0.05)	(-0.20)	(-0.88)	(0.64)	(0.79)	(0.31)
Educational Attainment	-0.3675	-0.2403	-0.6842	-0.5960	-0.1306	-0.2588
	(-0.80)	(-0.84)	(-0.91)	(-1.52)	(-0.38)	(-0.51)
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Hansen Test of overid.	9.30	8.67	5.16	5.75	3.60	4.48
(p-value)	0.677	0.653	0.923	0.764	0.990	0.973
AR(1)	0.064	0.059	0.059	0.039	0.031	0.033
AR(2)	0.283	0.285	0.332	0.290	0.299	0.292
Observations	422	407	407	407	407	407
Number of Countries	39	39	39	39	39	39
Number of Instruments	33	33	34	33	35	36

Notes: *For definitions and sources of data, see Table 1.8. The estimation method is a two-step System-GMM estimator with Windmeijer finite sample correction. t-statistics are below the coefficients. AR(1) and AR(2) are respectively Arellano-Bond first and second autocorrelation tests. Time dummy variables are included in all regressions. Variables such as trade openness, conflict risks, GDP per capita and education are instrumented, using their own lags in level and differences. Inflation rate, population structure and military in politics are treated as exogenous.*

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 1.10: System-GMM Estimation with Windmeijer Finite Sample Correction: Non-Monotonous Relationship between Conflicts Risks (Internal and External) and Income Inequality

Variable	[1]	[2]
Lagged EHII	0.738***	0.580**
	(6.31)	(2.56)
External Conflict	1.291***	
	(2.88)	
External Conflict squared	-0.0580**	
	(-2.30)	
TOEC	-0.00624**	
	(-2.32)	
Internal Conflict		1.514**
		(2.19)
Internal Conflict squared		-0.0863**
		(-1.99)
TOIC		-0.00136
		(-0.35)
Trade Openness	0.0543*	0.00399
	(1.86)	(0.11)
GDP per capita	0.00006	0.00043
	(0.55)	(1.44)
Population Structure	-0.0759	-0.111
	(-0.39)	(-0.34)
Inflation Rate	0.0004***	0.0005***
	(5.07)	(5.33)
Educational Attainment	-0.283	-0.737
	(-0.92)	(-1.25)
Military in Politics	-0.0520	-0.272
	(-0.40)	(-0.95)
Country Fixed Effect	Yes	Yes
Year Fixed Effect	Yes	Yes
Hansen Test of overid.	5.29	9.09
(p-value)	0.916	0.766
AR(1)	0.039	0.047
AR(2)	0.264	0.268
Observations	407	407
Number of Countries	39	39
Number of Instruments	36	38

Notes: *For definitions and sources of data, see Table 1.8. The estimation method is a two-step System-GMM estimator with Windmeijer finite sample correction. AR(1) and AR(2) are respectively Arellano-Bond first and second autocorrelation tests. Time dummy variables are included in all regressions. Variables such as trade openness, conflict risks, GDP per capita and education are instrumented, using their own lags in level and differences. Inflation rate, population structure and military in politics are treated as exogenous. t-statistics are below the coefficients.*
* significant at 10%; ** significant at 5%; *** significant at 1%.

Chapter 2

State Capacity and the Enforcement of Property Rights in the Natural Resource Sector

2.1 Introduction

The management of natural resources requires the establishment of use rights and rules of exclusion. In doing so, property rights are being created and must be enforced. Now in most settings, enforcement calls for *joint* efforts by both the local resource manager and the state.[1] The object of this chapter[2] is to analyze the implications of this requirement of a joint effort when states have differing abilities to provide enforcement support. We do so in

[1]The fact that the successful management of common property natural resource requires the simultaneous participation of both the local communities and the state is a subject that pervades the work of Elinor Ostrom, where issues of exclusion are fundamental (Ostrom, 1990, 2000). Of course, it also pervades the literature on the economics of property rights.

[2]This chapter is based on a working paper coauthored with Louis Hotte. We both contributed equally.

the context of a small open economy with two sectors – manufacturing and natural resource – and in which property rights in the natural resource sector are costly to enforce.

We begin with the fact that property rights require costly enforcement of exclusion by the *resource manager*. Note that the analysis applies equally well to private and common property resources. The resource manager is simply an agent who decides on the use of the resource and its enforcement. She may be the actual owner of the resource or be hired by the local community. Either way, the problem of enforcement is present, though it may be more or less severe, depending on the local circumstances. Analogously, unauthorized users may invariably be called trespassers, cheaters, rule-breakers or poachers.

We then posit that the *effectiveness* of those private enforcement efforts depends on the extent to which the state supports them. This *de facto* public support is also costly and is paid for with a tax. Broadly speaking, they constitute a form of public protection services provided by the justice system. The state must therefore decide on how much public protection to supply while anticipating its impact on the decentralized decisions of resource managers. In doing so, a key issue will be to compare states with differing capacities to provide public protection.

We begin by describing why, for a given supply of public protection, private enforcement tends to be inefficiently high. The negative externality is explained by the fact that higher private enforcement allows a manager to better manage the resource through a reduction in the number of resource workers. As labor is being released into the economy, the wage rate drops. Since the wage rate is a determinant of the opportunity cost of unauthorized users, other resource managers see the cost of their enforcement increase. This is a technological effect because the wage rate affects the efficiency of enforcement efforts.

We then run three sets of simulations which respectively characterize three states that

differ *exogenously* by their capacities to provide public protection services. We refer to those as *low*, *intermediate*, and *high* capacity states. Note that the amount of public protection services – equivalently the size of the justice system – uses up real economic resources as it is determined by the number of public officers hired. However, for an equal amount of public officers, a high-capacity state provides more effective enforcement support than a low-capacity state. In this respect, we wish to underscore the importance of differentiating between the *size* of the justice system and the *effective* supply of protection services.

For a high-capacity state, we obtain a non-monotonous relationship between real national income and the *size* of the justice system, i.e. national income initially rises before declining. With a large justice system, the decline in national income is not surprising as the contribution of an additional public officer becomes quite small. But more interesting is the mechanism through which national income initially rises. Firstly, we obtain that an increase in the size of the justice system induces resource managers to shed private enforcement labor. *Thus, with a high-capacity state, public and private enforcement are effective substitutes.* Secondly, in a setting where exclusion is costly, a better enforced exclusion allows the resource manager to reduce the number of resource workers to a more efficient level. Now when the justice system is still small, this combined reduction of resource labor and private enforcement labor exceeds the increase in the number of public officers, which leads to a net addition to the manufacturing labor force. The resulting increase in national income has therefore two sources: one is the net addition to the directly productive workforce; the other is the movement of workers from the resource sector to the manufacturing sector where the marginal product is higher. In the same vein, we obtain that the total size of the non-directly productive labor, i.e. the sum of public and private enforcers, varies non-monotonically with the quantity of public officers: it begins by decreasing before increasing. Finally, we show

that even though public enforcement is entirely financed by a tax on resource rents, resource managers demand more public enforcement than would be efficient.

In the case of an intermediate-capacity state, a remarkable difference is the fact that national income initially decreases with the size of the justice system. This outcome is explained by the fact that at low levels of public enforcement, increases in its level induce resource managers to also increase private enforcement. *Thus, with an intermediate-capacity state, public and private enforcement are initially effective complements.* This results in a net draw of labor away from directly productive activities and thus reduces national income. This effect disappears when the justice system reaches a certain size, after which public officers act as substitutes to private enforcers and national income begins to increase. A maximum level of the national income is eventually reached after which decreasing returns to enforcement weigh in. In comparison to a high-capacity state, the efficient size of the justice system in an intermediate-capacity state requires the use of more non-directly productive labor, a result reminiscent of the development trap curse.

In the case of the low-capacity state, the national income invariably decreases with an increase in public protection. Indeed, we obtain that *with a low-capacity state, public and private enforcement are effective complements throughout.* This means that enforcement labor tends to siphon off an excessive amount of productive labor. Consequently, open access to the resource is here preferable to exclusive access at any level of public protection. It should be noted that this inefficiency result holds despite the fact that public enforcement does contribute to raise resource rents. There is therefore a private demand for public enforcement by resource managers even though it contributes to lower the national income level.

In reference to the existing literature, our over-enforcement result links two separate

strands of the literature. One is the crime literature, in which it has been shown that (observable) private protection has the negative effect of diverting criminals towards other victims who then react by increasing their protection effort (see Shavell, 1991 and Hotte and van Ypersele, 2008). The other is the property rights literature, in which it is argued that the privatization of one resource site diverts some workers towards other open-access resource sites where labor's marginal productivity is lower than the wage rate (see de Meza and Gould, 1992). In our analysis, both effects are present, even though resources are all exploited under exclusive ownership and deterrence is complete.

The basic features of our general equilibrium analysis builds on the work of Weitzman (1974) and Samuelson (1974), who study the resdistributive effects of privatisation and show that the private gain may exceed the social gain. de Meza and Gould (1992) assume a fixed cost of enforcement and show that private enforcement decisions are interdependent and generally inefficient. Based on Hotte (2005), we extend those analysis with the consideration of endogenous private enforcement costs. In the natural-resource literature, the fact that private enforcement also requires public support is an issue that has been mentioned in Karp (2005), which we now tackle directly. Helsley and Strange (2005) introduce a formal analysis where public and private enforcement supplement each other, but apply it to the specific case of protection against crime. Finally, as far as we know, the introduction of the role played by state capacity in the context of public and private enforcement is novel to our analysis.

General equilibrium models that incorporate costly public and private enforcement decisions are few. Helsley and Strange (2005) is a notable exception applied to the problem of crime. Karp (2005) considers the role of the judicial system and is a main inspiration here. A crucial difference with our work is that in Karp (2005), the efficiency of the judicial

system varies exogenously and thus, one cannot differentiate between size and capacity. In this respect, our analysis extends that work to a new set of insightful results regarding the problem of state capacity, a problem which is gaining renewed interest (see, for instance, Besley and Persson (2009, 2010), Besley and Ghatak (2010) and Verdier (2010)).

The literature on the importance of state capacity is evolving quite rapidly. As discussed in the short survey of section 2.2, it forms a part of the larger literature on institutions and governance. This survey sets the stage for our stylised representation of state capacity.

In Section 2.3, we introduce the problem of exclusion in the resource sector and define a role for the state. The rest of the economy is then introduced in Section 2.4 in order to lay out the general equilibrium conditions. In Section 2.5, we show that private decisions to enforce property rights are inefficient. We then perform simulations in Section 2.6 in order to analyze the effect of increasing the size of the justice system for low, intermediate and high capacity states. We conclude our study in Section 2.7.

2.2 A Short Survey on the Concept of State Capacity

The most popularly used definition of institutions in literature is from North (1991) who voices that:

> "Institutions are the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights)."

In line with North (1991), Kaufmann et *al.* (2009) also define institutions as part of governance by which authority in a country is exercised. According to institutional theories,

some historical determinants are usually mentioned to explain differences in property rights protection.

"The Law and finance view", carried out by La Porta et *al.* (1998), predicts that legal origins ascertain protection of property rights. Using a data set embodying 49 countries and surveying legal rules concerning the rights of investors and the quality of enforcement of these rules, La Porta et *al.* (1998) elucidate that countries with the British Common Law tradition have the strongest legal protection of investors than countries with the French Civil law tradition that have the weakest protection.

Acemoglu et *al.* (2001) adopt the *"endowment view"* to explain differences in property rights protection. Arguing that geography and disease environment shape the institutional environment, they find out that in colonies such as United States, Australia and New Zealand, Europeans establish institutions that enforced rule of law and encouraged investments. However, Acemoglu et *al.* (2001) point out that the possibility of resource extraction in some colonies like Congo, Gold Coast and Latin America gives some incentives to Europeans to build on *extractive states* with little protection of property rights. They also use the disease environment to explain that the settlement of Europeans in countries closer to equator characterized by more tropical and inhospitable climate brings on to extraction institutions, which are less conducive of property rights.

Ethnic diversity view has also been employed by political theorists to explain the perceptions of property rights across countries (Easterly and Levine, 1997; Alesina et *al.*, 2003). For example, Alesina et *al.* (2003) provide new measures for ethnic, linguistic and religious fractionalization for about 190 countries and come to the conclusion that ethnic and linguistic fractionalization are key determinants of economic success, policy quality and the quality of institutions. They notice that countries with greater ethnic fractionalization are less likely

to protect property rights.

While the literature on the enforcement of property rights in connection with resources exploitation yields many interesting results, it does not, however, take into account the ability of states to provide *protection services*, which we refer to as state capacity. Besley and Persson (2010) explain that state capacity is the wider range of competencies that the state acquires in the development process, which includes the power to enforce contracts and support markets through regulation. In this respect, state capacity can be viewed as the ability to coherently and efficiently implement policies. If Besley and Ghatak (2010) consider effective states as those supporting institutions that allowing households and firms to enjoy secure property rights, Kohli (2010) points out that effective states are countries with a higher capacity. Considering the growing interest concerning state capacity in the literature, it is important to ask the following question: what are the determinants of state capacity? Some recent papers have attempted to deal with this question.

Dividing state capacity into legal and fiscal capacities where regulation of market supporting measures and tax rates are endogenous policy choices, Besley and Persson (2009) show that investments in legal and fiscal capacity are often complements. They use historical incidence of external war as proxy for public goods in a dataset covering 103 countries and find that the key determinants of state capacity are interest public goods, political stability and political institutions. Rauch and Evans (2000) explain cross-national variation in state bureaucracy and argue that bureaucratic performance is important to carry out policies that are conducive to economic growth. To capture bureaucratic performance, they use variables such as corruption in government and bureaucracy quality from International Country Risk Guide (ICRG), bureaucratic delays from Business and Environmental Risk Intelligence (BERI), bureaucracy and red tape and index of corruption from Business International (BI).

After controlling for country income, level of education and ethnolinguistic diversity, they find that meritocratic recruitment is a statistically significant determinant of bureaucratic performance in 35 less developed countries. Treisman (2000), in a cross-national study of the causes of corruption, found that countries experiencing protestant traditions, histories of British rule and a high level of economic development are less corrupt.

There is a number of papers which investigate the relationship between property rights and economic growth. Schleifer and Vishny (1993) argue that if central government is weak, private agents may have to pay independent bribes imposed by governmental agencies and bureaucracies, and therefore, the resulting corruption can be costly to economic development. Knack and Keefer (1995) look at the impacts of institutions on economic performance and show that institutions that protect property rights are crucial to economic growth and to investments. Alternatively, Mauro (1995) uses some indices of bureaucratic honesty and efficiency such as indices of corruption, the amount of red tape and the judicial system, and show that corruption is negatively and significantly correlated to economic growth.

2.3 A Resource Sector with Costly Exclusion

The economy is composed of two sectors: manufacturing and (natural) resource. We assume that there are no property right issues in the manufacturing sector i.e. property rights are perfectly and costlessly delineated and enforced.

In the resource sector, on the other hand, the control of access requires costly enforcement measures, necessitating the joint participation of the resource manager and the state. We begin by looking at the problem of a resource manager, assuming a fixed public enforcement effort, and then describe a role for the state in section 2.3.2.

2.3.1 The Resource Sector

The resource sector is composed of n identical resource sites. The total output of resource goods on site i is given by $y_{ri} = f_{ri}(L_{ri})$, where subscript r refers to the resource sector.[3] There are two types of resource users, "authorized" and "unauthorized", whose total exploitation effort levels are respectively denoted L_{ai} and L_{ui}. The total amount of labor exploiting site i is therefore given by $L_{ri} = L_{ai} + L_{ui}$.

We consider a sequential game where the resource manager first chooses the amount of authorized labor (L_{ai}) and the quantity of enforcement labor (L_{ei}) hired to exclude unauthorized users.

Authorized and unauthorized users are equally productive. For clarity of exposition, we denote the average product of a resource worker on site i as:

$$\phi(L_{ri}) \equiv \frac{f_{ri}(L_{ri})}{L_{ri}}. \tag{2.1}$$

Since unauthorized users choose last, we begin by solving for their equilibrium choices.

The Unauthorized Users

For concreteness, we refer to unauthorized users as *trespassers*. A trespasser can also hold a legitimate job. Each trespasser/worker inelastically supplies a total of one unit of labor, which must be allocated between legitimate and illegitimate activities. In the legitimate sector, a trespasser/worker receives the wage w as any other legitimate worker. The unit return from trespassing is equal to the average product of a legitimate resource worker, that

[3]The model of this section is based on Hotte (2005).

is $p\phi(L_{ri})$, where p is the unit price of the resource.

A trespasser has a probability γ_i of being caught and punished. Once caught, his gain from trespassing is confiscated and destroyed. No other penalty is exacted. Before deciding on the amount of trespassing on site i, each trespasser knows probability γ_i and observes the amount of legitimate labor hired by the site manager, L_{ai}. Taking L_{ai} as given, a trespasser must decide on how to allocate his time between trespassing and legitimate work. Moreover, since the returns to trespassing also depend on the decisions of other trespassers, a trespasser must anticipate the others' decisions. Assuming that all potential trespassers decide simultaneously and non-cooperatively, we adopt the Nash equilibrium concept in order to characterize the trespass equilibrium effort levels.

Suppose there are m such trespassers, considering site i. Trespasser j must choose the fraction (u_{ij}) of his time spent trespassing, which provides unit return $p\phi(L_{ri})$ only when he is not caught, i.e. with probability $1-\gamma_i$. The rest of j's time, $(1-u_{ij})$, yields a unit return w with certainty. The individual problem is thus expressed as follows:

$$\max_{u_{ij}} v_j = (1-\gamma_i)[(1-u_{ij})w + u_{ij}p\phi(L_{ri})] + \gamma_i(1-u_{ij})w \tag{2.2}$$

$$\text{where } L_{ri} = L_{ai} + \sum_{k=1}^{m} u_{ik} \text{ and } u_{ij} \in [0,1]. \tag{2.3}$$

Assuming an interior solution, the first-order condition to this problem is:

$$(1-\gamma_i)[p\phi(L_{ri}) + u_{ij}p\phi'(L_{ri})] = w. \tag{2.4}$$

This condition says that when considering a marginal increase in trespassing effort, a

trespasser/worker will compare its revenue gain, $p\phi(L_{ri})$, with its two types of costs: one is the fall in average product of resource labor $u_{ij}\phi'(L_{ri}) < 0$; the other is the opportunity cost in terms of legitimate work w. Note that the trespassers' problem is analogous to the standard free-access problem, adjusted for the fact that a trespasser can be caught and punished, which simply raises the expected opportunity cost of effort to $w/(1-\gamma_i)$.[4]

Assuming a symmetrical Nash equilibrium, we have $u^e_{i1} = u^e_{i2} = ... = u^e_{im} \equiv u^e_i$, such that the total amount of trespassing efforts on site i is $L^e_{ui} = mu^e_i$. Inserting this into condition (2.4) gives

$$(1-\gamma_i)[p\phi(L_{ri}) + \frac{L^e_{ui}}{m}p\phi'(L_{ri})] = w. \tag{2.5}$$

This condition characterizes the equilibrium amount of trespass for given enforcement level γ_i and authorized use L_{ai}. Given the non-negativity constraint on trespassing, it is straightforward to verify that $L^e_{ui} = 0$ if the following condition holds:

$$(1-\gamma_i)p\phi(L_{ai}) \leq w. \tag{2.6}$$

This inequality says that trespassing can be entirely deterred if the enforcement level γ_i and/or the level of authorized use L_{ai} are sufficiently large.

In order to simplify the analysis, we shall approximate a situation with a large number of potential trespassers by considering the limit where $m \to \infty$. For the interior solution,

[4]See, for instance, Cheung (1970) and Dasgupta and Heal (1979).

this yields:

$$p\phi(L_{ai} + L_{ui}^{e}) = \frac{w}{1-\gamma_i}, \tag{2.7}$$

This condition is simply the trespassing counterpart of the open-access equilibrium (Gordon 1954). Indeed, with an arbitrarily large number of non-cooperating trespassers, the *expected* rent from trespassing is zero. Note that as far as the resource manager is concerned, this does not imply that rents on the resource site are being dissipated, as will be seen next.

The Resource Manager

The resource manager on site i must decide on the number of authorized users L_{ai} and the private enforcement effort L_{ei} in order to exclude illegal users.

Enforcement labor affects the probability of catching a trespasser γ_i through the following technology:

$$\gamma_i = \gamma(L_{ei}; \Upsilon),\ \gamma \in [0,1],\ \frac{\partial \gamma}{\partial L_{ei}} \geq 0,\ \frac{\partial^2 \gamma}{(\partial L_{ei})^2} \leq 0, \tag{2.8}$$

where Υ denotes the state's presence, which will be discussed in detail in section 2.3.2. For now, it is treated as a fixed parameter by the resource manager. It should be noted that function $\gamma(L_{ei}; \Upsilon)$ summarizes the technology that transforms labor inputs into property right enforcement in terms of trespasser exclusion. The opportunity cost of that labor corresponds to a transaction cost linked to the existence of a property right. An important

aspect of our analysis consists in untangling the general equilibrium implications of the resource managers' enforcement choices.

The profit maximizing problem of the resource manager is thus given by

$$\max_{L_{ai},L_{ei}} \pi_i = p\phi(L_{ai} + L_{ui})L_{ai} - w(L_{ai} + L_{ei}), \tag{2.9}$$

$$\text{where } [1 - \gamma(L_{ei}; \Upsilon)]p\phi(L_{ai} + L_{ui}) \leq w, \tag{2.10}$$

where the strict inequality in (2.10) holds with $L_{ui} = 0$ as discussed in the unauthorized users' section. Recall also that p is the price of the resource good and w is the wage rate for labor, all expressed in units of manufactures.

The solution to problem (2.9) requires that L_{ri} and L_{ei} be chosen in such a way that $L_{ui} = 0$ and constraint (2.10) holds with equality. This result is formally derived in a partial equilibrium setting in Hotte (2005). In the following, we proceed with some intuitive arguments. Assume that γ_i is fixed for the moment. In an interior solution where $L_{ui} > 0$, constraint (2.10) implies that the average product of labor is constant and equal to $w/(1-\gamma_i)$; this is because each additional unit of authorized labor drives off one unit of unauthorized work in order to respect the equality. With $w/(1-\gamma_i) > w$, it always pays for the manager to increase L_{ai}, that is, until all trespassers are driven off. Beyond that point, further increases in L_{ai} will reduce labor's average product and inequality (2.10) becomes strict with $L_{ui} = 0$. This is where an adjustment in γ_i becomes necessary. Holding (2.10) with strict inequality implies that enforcement labor can be reduced without any effect on trespassing; since this labor is costly, L_{ei} must be chosen in such a way that the constraint is respected with equality

while $L_{ui} = 0$, i.e.

$$[1 - \gamma(L_{ei}; \Upsilon)]p\phi(L_{ai}) = w \tag{2.11}$$

We shall refer to expression (2.11) as the *exclusion constraint*. It implies that γ_i and L_{ai} are uniquely linked so that the problem of the manager can be reduced to choosing γ_i only. Moreover, since the wage is taken as given, cost minimization implies that the total cost of achieving a given enforcement level can be summarized by cost function $c(\gamma_i; w, \Upsilon)$, which is increasing and convex in γ_i. The problem of the resource manager can thus be expressed as follows:

$$\max_{\gamma_i} \pi_i = p\phi(L_{ai})L_{ai} - wL_{ai} - c(\gamma_i; w, \Upsilon) \tag{2.12}$$

$$\text{s.t. } (1 - \gamma_i)p\phi(L_{ai}) = w. \tag{2.13}$$

Using the fact that $p\phi(L_{ai}) = w/(1-\gamma_i)$, the first-order condition for an interior solution is:

$$\frac{\partial \pi_i}{\partial \gamma_i} = \left(\frac{w}{1-\gamma_i} - w\right)\frac{\partial L_{ri}}{\partial \gamma_i} + \frac{w}{(1-\gamma_i)^2}L_{ri} - c_\gamma(\gamma_i; w, \Upsilon) = 0 \tag{2.14}$$

$$\text{where } \frac{\partial L_{ri}}{\partial \gamma_i} = \frac{\phi(L_{ri})}{(1-\gamma_i)\phi'(L_{ri})} < 0 \text{ as per (2.11)} \tag{2.15}$$

The first term in (2.14) denotes the decrease in revenues stemming from the fact that less labor can be hired after an increase in γ_i, i.e. there is less of a need to over-exploit the resource in order to deter unauthorized users. The second term is the increase in revenues

caused by the larger average product once the owner sheds off some workers. The last term is just the direct cost of hiring extra enforcement agents needed to increase γ_i. One should keep in mind that even though trespassing is completely deterred, the threat of trespass remains present. In equilibrium, the resource manager achieves deterrence with two instruments: *directly* by hiring enforcers L_{ei} and *indirectly* through intentional resource overuse aimed at reducing the returns from trespassing.

2.3.2 The Function of the State

The state has the function of providing protection services. This takes the form of *public support* in the enforcement of exclusion by resource managers. For simplicity, we consider that protection assistance is only needed in the resource sector. From an economic standpoint, the state intervenes because of scale economies in the production of protection services. Let Υ denote the level of protection services provided by the state. We assume that they affect *all* property owners equally. We have:

$$\gamma_i = \gamma(L_{ei}, \Upsilon),\ \gamma_1, \gamma_2 \geq 0,\ \gamma_{11}, \gamma_{22} \leq 0,\ \gamma_{12} \geq 0 \tag{2.16}$$

The provision of public protection services requires labor inputs, denoted L_g. They comprise judges, attorneys, police officers, prison guards, etc, and we shall refer to them as *state officers* or simply *officers*. We have:

$$\Upsilon = \Upsilon(L_g; \kappa),\ \Upsilon_1 \geq 0,\ \Upsilon_{11} \leq 0. \tag{2.17}$$

κ is a parameter that subsumes the state's capacity to provide protection services effectively.

State officers receive the same wage rate as other workers in the economy. The total cost

of running the state is thus equal to wL_g. This cost must be covered by taxation. Let I_g denote the total taxes levied by the government. A balanced government budget requires the following condition to be respected:

$$I_g = wL_g \tag{2.18}$$

We assume that the state raises income by taxing profits in the resource sector only at *ad valorem* rate t:[5]

$$I_g = t\pi_r \tag{2.19}$$

2.4 The General Equilibrium

Labor is the only mobile input between sectors. The total endowment is denoted $\bar{L}$.

2.4.1 The Manufacturing Sector

Let $y_m = f_m(L_m)$ denote the total output in the manufacturing sector, increasing and concave. Property rights in the manufacturing sector are assumed perfectly and costlessly defined and enforced. The manufacturing labor demand is thus given by

$$f'_m(L_m) = w \tag{2.20}$$

[5]Note that this does not affect the profit maximizing condition.

2.4.2 The Demand

Let z denote the national nominal income level. Assuming that consumers have homothetic preferences, the aggregate demands for each good are linear in income and thus can be represented as follows:

$$d_r = c_r(p)z, \tag{2.21}$$

$$d_m = c_m(p)z. \tag{2.22}$$

2.4.3 The Economic General Equilibrium

The total product is given by

$$z = p\sum_{i=1}^{n} y_{ri} + y_m \tag{2.23}$$

The labor market clearing condition is given by

$$\sum_{i=1}^{n}(L_{ri} + L_{ei}) + L_m + L_g = \bar{L}. \tag{2.24}$$

With trade, the small open economy assumption fixes the price to the world price and we assume balanced trade, respectively as follows:

$$p = p^* \tag{2.25}$$

$$p(\sum_{i=1}^{n} y_{ri} - d_r) + (y_m - d_m) = 0 \tag{2.26}$$

The economy is summarized in Appendix 2-A.

2.5 The Efficiency of Private Enforcement Decisions

In order to analyze the efficiency of private decisions to enforce exclusion, we shall compare the private gain of increasing L_{ei} with the social gain. In a decentralized economy, the private gains affecting the decision to exclude are given by the effect of L_{ei} on the profit of resource site i. Without loss of generality, let us consider the case of site 1. Given exclusion constraint (2.11), the marginal effect of enforcement labor on site 1's profit is expressed as follows:

$$\frac{\partial \pi_1}{\partial L_{e1}} = pf'(L_{r1})\frac{\partial L_{r1}}{\partial L_{e1}} - w\left[\frac{\partial L_{r1}}{\partial L_{e1}} + 1\right], \tag{2.27}$$

$$\text{where } \frac{\partial L_{r1}}{\partial L_{e1}} = \frac{\gamma'(L_{e1})\phi(L_{r1})}{(1-\gamma)\phi'(L_{r1})} < 0 \text{ per exclusion constraint (2.11).} \tag{2.28}$$

The gain from an increase in L_{e1} is given by the first of the two terms between square brackets on the right-hand side of (2.27); it corresponds to the lower wage bill in terms of the labor that can be shed off the resource once it is better guarded. The counterparts are that output revenues drop by the first term on the right-hand side of (2.27) and L_{e1} has a unit cost of w. Note that it makes sense to reduce the output level because the exclusion constraint forces the marginal product to be below the wage rate. But this can only be achieved after an increase in the enforcement level. It should also be clear from (2.27) that in order for $\partial \pi_1/\partial L_{e1}$ to be non-negative, it must be the case that $-(\partial L_{r1}/\partial \gamma)\gamma'(L_{e1}) > 1$: In order to be profitable, a unit increase in enforcement labor must lead to a larger than unit drop in resource labor on the site.

Turning now to the social gains, since prices are fixed under the assumption of a small open economy, we can simply look at the effect of L_{e1} on the national income level z. Note that we are considering a *second-best* effect since we take as given the fact that property

rights are not freely respected by individuals. This means that exclusion must be enforced so that the constraint (2.11) always binds.

In the decentralized economy, the choice of private exclusion level L_{e1} takes as given the level of effective state protection support Υ, i.e. L_g is fixed. So a meaningful comparison of the private and social benefits of an increase in L_e must assume that L_g is fixed in the social case also. For any choice of L_{ei}, $i \in \{1, ..., n\}$, the national income level z is fully determined by the following system:

$$z = p\sum_i f_r(L_{ri}) + f_m(L_m) \tag{2.29}$$

$$\text{s.t.} \quad (1-\gamma(L_{ei}))p\phi(L_{ri}) = w, i \in \{1, ..., n\} \tag{2.30}$$

$$f'_m(L_m) = w, \tag{2.31}$$

$$\sum_i^n (L_{ri} + L_{ei}) + L_m = \bar{L} - L_g. \tag{2.32}$$

We have:

$$\frac{\partial z}{\partial L_{e1}} = \sum_{i=1}^{n} \left[pf'_r(L_{ri}) - f'_m(L_m)\right] \frac{\partial L_{ri}}{\partial L_{e1}} - f'_m(L_m). \tag{2.33}$$

In Appendix 2-B, it is shown, for the case where $n = 2$, that we have $\partial L_{r2}/\partial L_{e1} > 0$ if $f''_m(L_m) < 0$ and $\partial L_{r1}/\partial L_{e1} < -1$. The first condition is satisfied by assumption while the second is respected in equilibrium, i.e. when $\partial \pi_1/\partial L_{e1} = 0$. Given that due to the exclusion constraint, we have $pf'_r(L_{ri}) < f'_m(L_m)$, this implies that $\partial z/\partial L_{e1} < \partial \pi_1/\partial L_{e1}$: the private gain from an increase in enforcement labor exceeds the social gain.

Proposition 1 *For a given provision of state protection services, the private enforcement level exceeds the socially optimal level.*

This result is due to the presence of a negative externality in exclusion activities which is similar to the diversion effect of private protection noted in the crime literature (See Shavell, 1991 and Hotte and van Ypersele, 2008). Since a unit increase in L_{e1} allows the resource manager to shed more than one resource worker, there is a downward pressure on the wage rate as the size of the manufacturing labor force expands. But this drop in wage makes the other resource sites provide a better return to potential trespassers. If we first assume that the resource managers do not vary their enforcement effort, they will react by increasing the hired resource labor in order to respect the exclusion constraint. This reduces the national income because resource workers have a lower marginal product than manufacturing workers in equilibrium.

Note that a necessary condition for proposition one is that manufacturing labor exhibits *strictly* diminishing returns. This causes the wage rate to decrease with enforcement labor. With $f''_m = 0$, the private and social products coincide; this corresponds to an infinite elasticity of resource labor supply and a constant wage rate.[6]

2.6 State Capacity and the Size of the Justice System

We perform simulations in order to analyze the effect of variations in the size of the justice system, which we define as the number of public officers (L_g) hired by the state. To this end, we begin with a low value of L_g and then increase it by small increments. We are interested in knowing how this affects variables such as national income, resource rents, labor wages, labor allocations and the tax rate.

Assuming $n = 1$, the simulations are performed using the following functional forms for

[6]de Meza and Gould (1992) similarly obtain that a finitely elastic supply of labor is a necessary condition for the private gain from enforcement to exceed the social one.

production and enforcement technologies as well as individual utility from consumption[7].

$$f_r(L_r) = L_r^{\delta} \tag{2.34}$$

$$f_m(L_m) = L_m^{\alpha} \tag{2.35}$$

$$\gamma(L_e, \Upsilon) = \Upsilon L_e^{\rho} \tag{2.36}$$

$$\Upsilon(L_g; \kappa) = \kappa L_g^{\theta} \tag{2.37}$$

$$u(c_r, c_m) = c_r^{\beta} c_m^{1-\beta} \tag{2.38}$$

The form of the individual utility function implies the following aggregate demands:

$$d_r = \frac{\beta}{p} z \tag{2.39}$$

$$d_m = (1 - \beta) z \tag{2.40}$$

Moreover, the indirect utility function for an individual nominal income z_i is as follows:

$$v = \frac{B}{p^{\beta}} z_i, \tag{2.41}$$

where $B = \beta^{\beta}(1-\beta)^{1-\beta}$. We define real national income by the indirect utility function:

$$z_R = \frac{B}{p^{\beta}} z. \tag{2.42}$$

[7]These functional forms have been used in the literature on property rights enforcement (Hotte et *al.*, 2000; Karp, 2005).

The form of the private enforcement technology implies the following total cost of exclusion level γ with its associated marginal cost:

$$c(\gamma; w, \Upsilon) = w\left(\frac{\gamma}{\Upsilon}\right)^{\frac{1}{\rho}} \tag{2.43}$$

$$c_\gamma = \frac{c(\gamma; w, \Upsilon)}{\rho\gamma} \tag{2.44}$$

The following technology and utility parameter values are used:

$$\alpha = \delta = \theta = \rho = \beta = 0.5, \bar{L} = 35, p^* = 1$$

As for the state's capacity to provide enforcement assistance, we consider three levels: $\kappa = 0.75$, $\kappa = 0.3$ and $\kappa = 0.1$, which we refer to as high-, intermediate- and low-capacity states, for reasons that will become clear below. We begin by looking at the high-capacity state case.

2.6.1 High State Capacity ($\kappa = 0.75$)

Figure 2.1 in the Appendix 2-C reports the simulation results for values of state officers numbers that vary from 0.05 to 2.5 by increments of 0.05. We report values on profits, wages, GDP, tax rates, labor allocations and exports.

For comparison purposes, Figure 2.1 includes values pertaining to the familiar open-access and classical regimes, respectively labeled OA and CL. They also appear in Table 2.1. Since they will be used as benchmarks, we begin by commenting on the properties of those two equilibria while commenting on some implications for enforcement.

Variables	Classical Regime	Open Access Regime
Resource Labor L_{ri}	17.5	28
Manufacture Labor L_m	17.5	7
Wage Rate w	0.12	0.19
Resource Labor Marginal Product	0.12	.09
Resource Labor Average Product	0.24	0.19
GDP	8.37	7.94
Resource Profit π_r	2.09	0
Resource Exports X_r	0	1.32

Table 2.1: Classical and Open-Access General Equilibria

By definition of an open-access regime, the value of the average product of labor is equal to the wage rate (point $w(OA)$ in panel b- of Figure 2.1) and the profit is nil (point OA in panel a-. This equilibrium is deemed inefficient because the wage rate exceeds the marginal product of labor and thus, output value could be raised by transferring some labor to the manufacturing sector. This is indeed what happens with the classical equilibrium, under which labor's marginal product equals the wage rate (point $w(CL)$ in panel b-). For this reason, the classical equilibrium, usually referred to as the private ownership regime, is deemed efficient. (Gordon, 1954; Cheung, 1970; Dasgupta and Heal, 1979)

A move from an open-access regime to a classical regime of perfect and costless exclusion has two noteworthy income effects. One is that it causes the wage rate to fall. The other is that the rents generated by the resource ($\pi_r = 2.09$ in Table 2.1) exceed the GDP gain $\Delta GDP = 0.43$ (Samuelson, 1974 and Weitzman, 1974).

Now the classical equilibrium posits that no enforcement effort is required in order to achieve the exclusion of "unwanted" users from the resource. This, even though the average product exceeds the wage rate. In panel d-, the absence of enforcement effort is illustrated by the fact that $L_e + L_g = 0$ and thus $L_r + L_m = \bar{L}$. In the classical equilibrium all inputs

are therefore *directly productive* in the sense that each unit contributes directly to increase the output of either of the two goods.[8] Moreover, the allocation of labor between the two sectors is considered efficient since the marginal products are equalized.

Enforcement efforts are similarly absent in the open access equilibrium. But the similarity ends there. This is because exclusion is also absent; hence the complete rent exhaustion on the resource and the absence of a need to exclude. In panel d-, we therefore also have that all inputs are directly productive as $L_r + L_m = \bar{L}$. But the allocation of labor is different from that of the classical equilibrium in that the number of workers is larger in the resource sector. Here, the allocation is inefficient because workers in the manufacturing sector have a strictly higher marginal product value. The prescription is thus to transfer workers from the resource sector to the manufacturing sector. In doing so, however, the average product of workers in the resource sector exceeds the wage rate. The prescription therefore assumes that exclusion can be performed at no cost in the resource sector, as per the classical equilibrium. This assumption does not hold in our economy.

In our economy, the enforcement of property rights in the resource sector implies that resource managers need labor to enforce exclusion. But as we saw in the model of section 2.3, exclusion is then achieved with a combination of resource over-use and enforcement effort. A crucial factor for the resource manager is thus the effectiveness of the private enforcement labor: The more effective it is, the lower the private cost of achieving a certain level of enforcement and thus the lower the need to over-exploit the resource in order to exclude.

As we have argued, the state's role is precisely to increase the effectiveness of private enforcement efforts through an increase in the number of public officers L_g, a role which

[8] Or, equivalently, there are no transaction costs.

is well illustrated by Figure 2.1. Panel d- indicates indeed that as the number of officers increases, workers, whose marginal productivity is below the wage rate, are being shed from the resource sector. At low L_g values, there is a corresponding increase in the number of manufacturing workers (L_m) and a decrease in the total number of enforcement labor ($L_e + L_g$). Now given that the marginal product in the manufacturing sector exceeds that of the resource sector, the increase in L_g is clearly efficient; this is attested by the fact that the gross domestic product increases with the number of state officers for $L_g < 0.6$ (see panel c-).

One concludes from panel c- that the enforcement of property rights can improve on the open-access regime even though exclusion is costly. But of course, it can never be as efficient as with the classical case, which is why the GDP remains lower. It is interesting to note however that for values of L_g below 0.6, increases in L_g lead to a corresponding decrease in the total amount of enforcement labor $L_g + L_e$. This signifies that with $\kappa = 0.75$, the state's capacity is sufficiently high that by increasing the size of the justice system, private enforcement labor can be freed to perform directly productive activities.

Panel c- shows however that beyond $L_g = 0.6$, further increases in the number of public officers cause GDP to decrease. This implies that the gains in terms of a better management of the resource – as indicated in panel b- by labor's marginal product which gets closer to the wage rate – and the decrease in private enforcement labor L_e shown in panel d-, are not important enough to compensate for the additional labor that the state removes from the private sector. In our synthetic economy, we therefore conclude that with a state capacity level of $\kappa = 0.75$, the optimal size of the justice system is $L_g = 0.6$, which corresponds to a mere 1.7% of the total labor force. And in terms of non-directly-productive activities, $L_g + L_{ei}$ uses up 3.7% of the economy's total labor force.

Another noteworthy feature of the equilibrium is that resource managers' demands for public protection services exceed the efficient level. This is true, even though they bear the full direct cost of those public services through taxation. The after-tax profit on the resource is maximized at $L_g = 0.75$ with a tax rate of 4.8%, while GDP is maximized at $L_g = 0.6$ with a tax rate of 3.9%. This suggests that the private gain from public protection exceeds the social gain, as noted by de Meza and Gould (1992).

Labor wages vary non-monotonically with the number of state officers: They decrease at first and then increase for large values of L_g. Now as noted in Samuelson (1974) and Weitzman (1974), the enforcement of property rights tends to lower the wage rate because with the possibility of exclusion, resource managers choose to reduce the number of workers directly exploiting the resource. This puts a downward pressure on wages once these workers join the manufacturing sector's workforce. The difference with Samuelson (1974) and Weitzman (1974) is that with increased public enforcement activities, resource managers also choose to shed private enforcement labor. We therefore have that for $L_g \in (0.05, 1.15)$, a given increase in L_g is associated with a larger decrease in $L_r + L_e$, with the result that the extra labor force joins the manufacturing labor force which causes the wage rate to drop.

When the justice system's size exceeds $L_g = 1.15$, however, enforcement is already so effective that additional public efforts do not bring much benefit. Those diminishing returns from public enforcement services are due to the fact that the private enforcement effort becomes negligible and so is the gap between the wage rate and the marginal product of resource labor. Hence, there is little scope for additional private benefits coming from more public enforcement support.[9] Above $L_g = 1.15$, therefore, a given increase in L_g is matched with a lower decrease in $L_r + L_e$, which means that the state must now take labor away from

[9]Note that we obtain the same qualitative results by assuming constant marginal product for function $\Upsilon(L_g; \kappa)$.

the manufacturing sector as well, thus leading to an increase in wages.

2.6.2 Intermediate State Capacity ($\kappa = 0.3$)

Figure 2.2 in the Appendix 2-C reports results for the same "decentralized" economy, but for which the state has a lower capacity to provide property enforcement support. In our economy, this is represented by parameter κ in equation (2.37), which is now equal to 0.3 instead of 0.75 in the previous section.

Qualitatively, many of the observations from the previous section carry over to this economy as well. We let the reader see for himself or herself by comparing Figures 2.2 and 2.1. We highlight the most interesting differences.

The first thing to note is that at low numbers of state officers, the enforcement of property rights in the resource sector actually causes national income to fall (panel c-). This phenomenon is best understood by a look at labor panel d-, where it is seen that an increase in L_g causes L_e to increase also: A rise in the productivity of private enforcement induces resource managers to enforce further. In this case, public and private enforcement activities complement each other. Now though this contributes to raise resource net rents, it lowers the national income. The provision of enforcement is thus locally inefficient as it draws a significant amount of labor away from directly productive activities.

But as the size of the justice system reaches a certain size, the national income begins to increase along with resource rents. This reversal (almost) corresponds with the fact that public and private enforcements begin to substitute each other. And as in the case of the high-capacity state, further increases in public enforcement eventually reduce the national income.

It is noteworthy that property rights are socially desirable only within a strictly positive

range of the supply of public enforcement. This means that there can be either too much or too little public enforcement. This also points to the difficulty of setting up a justice system in the initial stages of development: A gradual increase may be difficult to sustain as it can lead to a drop in national income.

Another notable difference with the high-capacity state is the fact that in order to maximize national income, a lower state capacity requires the hiring of more public enforcement officers.

2.6.3 Low-Capacity State ($\kappa = 0.1$)

Figure 2.3 in the Appendix 2-C reports the case of a low-capacity state. The first thing to note is that public enforcement is unable to raise the national income. This is despite the fact that it leads to an *apparent* better resource management, as it reduces the gap between the wage rate and the marginal product of labor (see panel b-). Note further that the fact that net resource rents increase is also a misleading indicator of the efficiency of property enforcement.

In this case of low-capacity state, the resource is better left as open access.

2.7 Conclusion

The purpose of this paper has been to analyze the effect of public and private enforcement efforts on the management of natural resources. We have set up a general equilibrium model where the de facto public support takes a form of public protection services. The model lays down a basis for a comparison of states that differ according to their capacities of providing public protection services. We first show that, for a given supply of public protection, private

enforcement tends to be inefficiently high. This inefficient level of private enforcement occurs because of the negative externality caused by the fact that a resource manager can better manage the resource by releasing resource workers, leading to a drop in the wage rate.

As the simulations results have shown, we find for high-capacity state that there is a non monotonous relationship between real national income and the size of the justice system, that is national income first increases, and declines thereafter. It is also obtained that the total size of public and private enforcers varies non-monotonically with the quantity of public support. For an intermediate-capacity state, we obtain that national income initially decreases because public and private enforcements act as effective complements at low size of the justice system. However, in the case of low-capacity state, we find that an increase in public protection is unable to raise national income. Our results show clear mechanisms through which an increase in public protection services affects the national income.

Appendix 2-A: The Economy Summarized

$$y_r = f_r(L_{ri}) \text{ [resource output]} \tag{2.45}$$

$$y_m = f_m(L_m) \text{ [manufacturing output]} \tag{2.46}$$

$$\pi_r = pf_r(L_{ri}) - w(L_{ri} + L_{ei}) \text{ [resource profit]} \tag{2.47}$$

$$\left(\frac{w}{1-\gamma} - w\right)\frac{\partial L_{ri}}{\partial \gamma} + \frac{w}{(1-\gamma)^2}L_{ri} - c_\gamma(\gamma; w, \Upsilon) = 0 \text{ [resource foc]} \tag{2.48}$$

$$(1-\gamma)p\phi(L_{ri}) = w \text{ [resource exclusion constraint]} \tag{2.49}$$

$$\gamma_i = \gamma(L_{ei}; \Upsilon) \text{ [exclusion enforcement function]} \tag{2.50}$$

$$\Upsilon = \Upsilon(L_g; \kappa) \text{ [state property rights support function]} \tag{2.51}$$

$$f'_m(L_m) = w \text{ [manufacturing foc]} \tag{2.52}$$

$$d_r = c_r(p)z \text{ [resource aggregate demand]} \tag{2.53}$$

$$d_m = c_m(p)z \text{ [manufacturing aggregate demand]} \tag{2.54}$$

$$I_g = wL_g \text{ [government budget balance]} \tag{2.55}$$

$$I_g = t\pi_r \text{ [government income]} \tag{2.56}$$

$$z = p\sum_{i=1}^{n} y_{ri} + y_m \text{ [GDP]} \tag{2.57}$$

$$L_{ri} + L_{ei} + L_m + L_g = \bar{L} \text{ [labor constraint]} \tag{2.58}$$

Trade Small Open Economy Conditions

$$p = p^* \text{ [world price of resource good]} \tag{2.59}$$

$$p(y_r - d_r) + (y_m - d_m) = 0 \text{ [trade balance condition]} \tag{2.60}$$

Autarky Conditions

$$d_r = y_r \text{ [autarky resource goods clearing condition]} \tag{2.61}$$

$$d_m = y_m \text{ [autarky manufactures clearing condition]} \tag{2.62}$$

There are 16 equations and 15 endogenous variables for given L_g:

$$L_{ri}, L_m, L_{ei}, t, I_g, \pi_r, \gamma, \Upsilon, z, d_r, d_m, y_r, y_m, p, w$$

By Walras' Law, one of the goods demand condition is redundant. The system is thus well defined.

Appendix 2-B: The Social Benefit of Private Enforcement

For illustrative purposes, we assume that there are only two resource sites, i.e. $n = 2$. However, when choosing L_{ei}, the manager of site i still takes the wage as given. Hence, first-order condition (2.14) continues to hold. We have

$$z = pf_r(L_{r1}) + pf_r(L_{r2}) + f_m(\bar{L} - L_{r1} - L_{e1} - L_{r2} - L_{e2}) \tag{2.63}$$

$$\Psi^1 \equiv (1 - \gamma(L_{e1}))p\phi(L_{r1}) - f'_m(\bar{L} - L_{r1} - L_{e1} - L_{r2} - L_{e2}) = 0 \tag{2.64}$$

$$\Psi^2 \equiv (1 - \gamma(L_{e2}))p\phi(L_{r2}) - f'_m(\bar{L} - L_{r1} - L_{e1} - L_{r2} - L_{e2}) = 0 \tag{2.65}$$

For fixed L_{e2}, the effect of a marginal increase in L_{e1} on z is

$$\frac{\partial z}{\partial L_{e1}} = pf'_r(L_{r1})\frac{\partial L_{r1}}{\partial L_{e1}} + pf'_r(L_{r2})\frac{\partial L_{r2}}{\partial L_{e1}} - f'_m(L_m)\left(\frac{\partial L_{r1}}{\partial L_{e1}} + 1 + \frac{\partial L_{r2}}{\partial L_{e1}}\right) \tag{2.66}$$

In order to find the full effect of L_{e1} on L_{r1} and L_{r2}, we must simultaneously account for exclusion constraints (2.64) and (2.65). Through implicit differentiation, we have

$$\frac{\partial L_{r1}}{\partial L_{e1}} = -\frac{\frac{\partial \Psi^1}{\partial L_{e1}}\frac{\partial \Psi^2}{\partial L_{r2}} - \frac{\partial \Psi^2}{\partial L_{e1}}\frac{\partial \Psi^1}{\partial L_{r2}}}{|J|} \tag{2.67}$$

$$\frac{\partial L_{r2}}{\partial L_{e1}} = -\frac{\frac{\partial \Psi^1}{\partial L_{r1}}\frac{\partial \Psi^2}{\partial L_{e1}} - \frac{\partial \Psi^2}{\partial L_{r1}}\frac{\partial \Psi^1}{\partial L_{e1}}}{|J|} \tag{2.68}$$

where

$$
\begin{aligned}
|J| &= \frac{\partial \Psi^1}{\partial L_{r1}} \frac{\partial \Psi^2}{\partial L_{r2}} - \frac{\partial \Psi^2}{\partial L_{r1}} \frac{\partial \Psi^1}{\partial L_{r2}} && (2.69)\\
&= (1-\gamma(L_{e1}))p\phi'(L_{r1})(1-\gamma(L_{e2}))p\phi'(L_{r2}) \\
&+ f_m''(L_m)[(1-\gamma(L_{e1}))p\phi'(L_{r1}) + (1-\gamma(L_{e2}))p\phi'(L_{r2})] > 0 && (2.70)
\end{aligned}
$$

$$
\frac{\partial \Psi^1}{\partial L_{r1}} = (1-\gamma(L_{e1}))p\phi'(L_{r1}) + f_m''(L_m) \quad (2.71)
$$

$$
\frac{\partial \Psi^1}{\partial L_{r2}} = \frac{\partial \Psi^2}{\partial L_{r1}} = \frac{\partial \Psi^2}{\partial L_{e1}} = f_m''(L_m) \quad (2.72)
$$

$$
\frac{\partial \Psi^2}{\partial L_{r2}} = (1-\gamma(L_{e2}))p\phi'(L_{r2}) + f_m''(L_m) \quad (2.73)
$$

$$
\frac{\partial \Psi^1}{\partial L_{e1}} = -p\phi(L_{r1})\gamma'(L_{e1}) + f_m''(L_m) \quad (2.74)
$$

If $f_m''(L_m) = 0$, this yields $\partial L_{r2}/\partial L_{e1} = 0$. If $f_m''(L_m) < 0$, this yields

$$
\begin{aligned}
\frac{\partial L_{r2}}{\partial L_{e1}} &= \frac{-pf_m''(L_m)[(1-\gamma(L_{e1}))\phi'(L_{r1}) + \gamma'(L_{e1})\phi(L_{r1})]}{|J|} && (2.75)\\
&> 0 \text{ iff } -\frac{\phi(L_{r1})\gamma'(L_{e1})}{(1-\gamma(L_{e1}))p\phi'(L_{r1})} > 1 && (2.76)
\end{aligned}
$$

One can verify from the resource manager's first-order condition (2.14) that

$$
\frac{\partial \pi_1}{\partial L_{e1}} \geq 0 \text{ only if } -\frac{\phi(L_{r1})\gamma'(L_{e1})}{(1-\gamma(L_{e1}))p\phi'(L_{r1})} > 1 \text{ (necessary condition)} \quad (2.77)
$$

This implies that an increase in L_{e1} forces site 2's manager to increase L_{r2}. This tends to depress GDP because the marginal productivity of resource labor is lower than the wage

rate. We also have

$$\frac{\partial L_{r1}}{\partial L_{e1}} = \frac{p\phi(L_{r1})(\gamma'(L_{e1}))p(1-\gamma(L_{e2}))\phi'(L_{r2}) - pf''_m(L_m)[(1-\gamma(L_{e2}))\phi'(L_{r2}) - \gamma'(L_{e1})\phi(L_{r1})]}{|J|} < 0 \tag{2.78}$$

Hence, the total effect of L_{e1} on GDP is

$$\begin{aligned} \frac{\partial z}{\partial L_{e1}} &= pf'_r(L_{r1})\frac{\partial L_{r1}}{\partial L_{e1}} + (pf'_r(L_{r2}) - f'_m(L_m))\left(\frac{\partial L_{r2}}{\partial L_{e1}}\right) && (2.79) \\ &- f'_m(L_m)\left(\frac{\partial L_{r1}}{\partial L_{e1}} + 1\right) && (2.80) \end{aligned}$$

Appendix 2-C: Figures of High, Intermediate and Low State Capacity

Figure 2.1: High State Capacity ($\kappa = 0.75$)

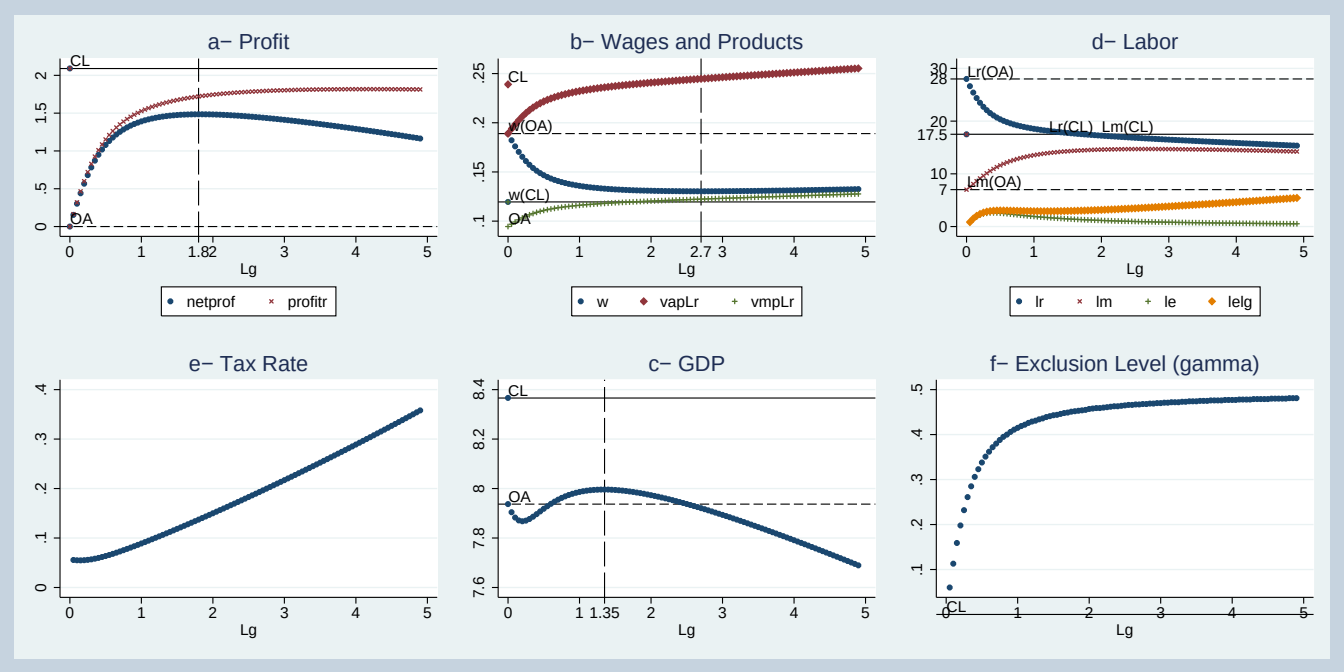

Figure 2.2: Intermediate State Capacity ($\kappa = 0.3$)

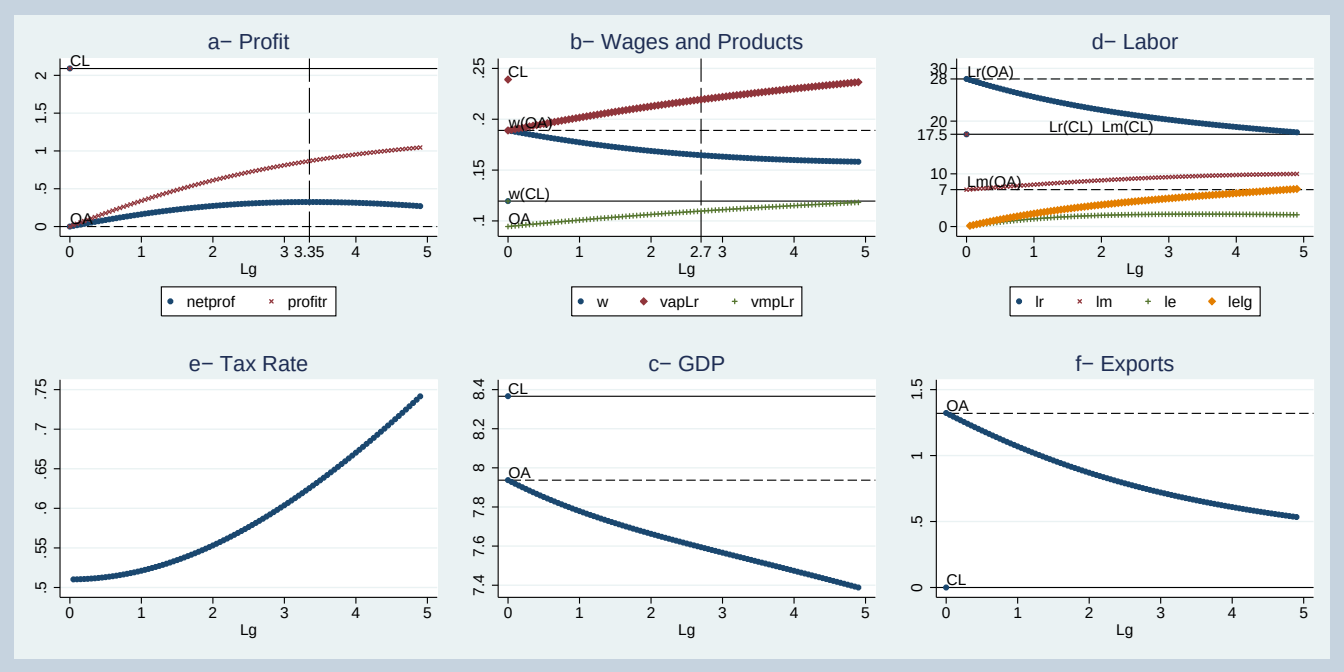

Figure 2.3: Low State Capacity ($\kappa = 0.1$)

Chapter 3

Sharing Citizens: Economic Gains from Dual Citizenship Institution

3.1 Introduction

Dual citizenship is a status in which a person is legally recognized as a citizen of more than one country. Legislation on dual citizenship varies widely across countries and time. Certain countries at some point have had policies that prohibit dual citizenship, with their citizens automatically losing their citizenship if they voluntarily acquire a foreign nationality. On the opposite end, other countries permit it and in fact view it as a way of allowing their citizens to connect with the rest of the world. The number of countries allowing dual citizenship has substantially increased since the 1930s. While almost all countries prohibited dual citizenship in 1930, over 24% of developed countries and 26% of developing countries now allow it (see Figures 3-a and 3-b). Debate on dual citizenship has revolved around its implications for the patriotism, cultural assimilation, and political participation of dual

citizens in their new countries (Staton et *al.*, 2007; Renshon, 2004, Blatter et *al.*, 2009, Iheduru, 2011). Some scholars argue that individuals who obtain a second citizenship without giving up the benefits of their first citizenship may have dual loyalty, or may find it difficult to adopt the values of their second country, thus degrading national identity and cohesiveness (Guarnizo et *al.*, 2003). While dual citizenship is primarily viewed by lawyers and political scientists as a political institution (Staton et *al.*, 2007), in this study, we argue that dual citizenship is also likely to have important social and economic impacts. We assemble new panel data on dual citizenship legislation to investigate some of these economic impacts for developed and developing countries. In particular, we focus on the role of dual citizenship in connecting diasporas with origin countries, as well as its implications for the development of transnational solidarity and business networks, and the associated benefits for households and national economies. Furthermore, we examine how dual citizenship legislation differs from other economic and political institutions in terms of its economic impact.

Individuals living outside of their country of origin most often become citizens of their host country because of the practical advantages that citizenship offers (Ruget and Usmanalieva, 2010). Such advantages include unrestricted residency, legal employment, property ownership, retirement funds, and eligibility for social programs including welfare, healthcare, and public education. Denying dual citizenship rights to individuals who emigrate inevitably increases the cost of maintaining ties with family, friends, and communities in the homeland as, for instance, a visa is now required to travel to the origin country. In addition, most countries have restrictive policies on investment and property ownership by foreigners. Finally, members of the diaspora who have become citizens of their host country lose all rights and public benefits in their origin country if the latter prohibits dual citizenship; this, in turn, diminishes their incentive to invest in an origin country's economic or political prosperity.

Prohibiting dual citizenship therefore disconnects the diaspora from its homeland socially, economically and politically.

Allowing dual citizenship, on the contrary, is likely to produce the opposite effects. Socially, recognition of dual citizenship is likely to increase connections between members of a country's diaspora and their families, friends, and communities in the origin country, developing transnational trust, cooperation, and solidarity, and therefore raising the potential for mutual assistance when needed. From the perspective of economic development, dual citizenship recognition is likely to facilitate the transfer of new ideas and technologies to the homeland by diasporic scientists, encouraging "brain circulation" (Nyarko, 2011), and increasing the documented positive effects of brain drain - or, conversely, mitigating its negative impacts (Beine et *al.*, 2008; Easterly and Nyarko, 2008, Bertoli and Brücker, 2011). Dual citizenship may also foster investment by diasporic entrepreneurs by allowing them to invest, monitor their investments, and hold domestic business partners accountable in case of a legal dispute, without facing differential treatment due to foreign status. Politically, dual citizenship is likely to encourage the diaspora to participate in homeland politics, encouraging political accountability and therefore affecting the allocation of public goods.

In order to test these hypotheses regarding the likely impacts of dual citizenship, we consider three sets of outcome variables. The first set comprises the volume of remittances received by a country, and a country's child mortality rate. Variables in this set measure the extent to which the diaspora is connected with the homeland, and the implications of this connection for household welfare. The second set comprises several macroeconomic indicators including gross capital formation, foreign direct investment net inflows, GDP, household consumption expenditures, the volume of trade and the emigration rates of low and high skilled workers. The third set comprises government-controlled factors such as

public spending on education and health. Any impact of dual citizenship on variables in this latter set would suggest that the diaspora affects the allocation of government funds to social programs. We estimate these effects separately for developed and developing countries.[1]

In this chapter[2], we first examine the relationship between dual citizenship recognition and remittances. In theory, this relationship is not easily predictable. As argued earlier, dual citizenship recognition by a country is likely to increase remittance inflows as it fosters the development of transnational solidarity and business networks. At the same time, it encourages members of the diaspora to acquire the nationality of their host countries, making it easier for them to sponsor close family members (e.g., parents, spouse, children, etc.) to become citizens as well. Once the latter individuals leave their origin country for their new country, there are no more incentives to remit, thus decreasing foreign remittances towards the origin country. However, since under most legislation, only close family members can be sponsored, dual citizenship recognition by a country is likely to decrease remittance inflows only if the predominant family structure in that country is "nuclear", as opposed to "extended". In collectivistic cultures or countries where the extended family prevails, dual citizenship recognition is likely to foster remittance inflows. We therefore expect the effect of dual citizenship on remittances to vary across countries. In particular, we expect the effect to be positive for developing countries, and negative for developed countries.

A descriptive analysis of the relationship between dual citizenship and remittances is presented in Figure 3.2. It shows that countries allowing dual citizenship receive more remittances from their diasporic communities than those that do not. This is true both for developed and developing countries. In multivariate analysis, we exploit cross-country and

[1]We use the World Bank classification of developing countries as low and middle-income economies, and developed countries as high income economies (OECD and non-OECD countries).

[2]This chapter is based on a working paper coauthored with Roland Pongou. We both contributed equally.

cross-time variation in the introduction of dual citizenship rights to econometrically identify the causal effect of the latter variable on remittances. We confirm the results of the descriptive analysis for developing countries only. On average, the volume of remittances received by a developing country is about US$1.2 billion larger when it allows dual citizenship than when it does not. However, in a developed country that allows dual citizenship, remittance inflows decrease by US$1.4 billion. These results are consistent with the fact that the extended family is more prevalent in developing countries while the nuclear family is the norm in developed countries.

The estimated impacts of dual citizenship on remittances are robust to the control of a wide range of variables including average GDP and population of destination countries, the size of the diaspora, and the fraction of the diaspora living in dual citizenship-granting countries. Interestingly, the latter variable has a positive effect on remittances, and partly absorbs the effect of dual citizenship itself, which shows that dual citizenship recognition by a country produces more effect among its dual citizens living abroad.

We also examine the impact of dual citizenship recognition on child survival. This latter variable is unanimously considered as an important indicator of household welfare in both developed and developing countries, since it responds promptly to better nutrition and improved health care (Boone, 1996; Ross, 2006). We find a positive effect of dual citizenship recognition on this outcome. Moreover, this effect is entirely mediated by remittances, suggesting that dual citizenship-induced funds are primarily used for consumption purposes, which is consistent with the literature on the allocation of remittances (Gupta et *al.*, 2009; Osili, 2007; Clemens, 2011).

Next, we turn to the second set of variables, which are macroeconomic indicators comprising GDP, household consumption expenditures, the net inflows of foreign direct investment

(FDI), gross capital formation, trade volume, and emigration rates of low and high-skilled workers. Importantly, estimating the effect of dual citizenship recognition on investment (measured by gross capital formation and FDI net inflows) in addition to remittances is motivated by the fact that the latter may not totally account for all funds directed to investment, especially in developed countries. When the banking system in the origin country is reliable, diasporic entrepreneurs may transfer important funds directly to their bank accounts. Therefore, dual citizenship recognition is likely to have a distinct effect on investment. Our analysis indeed supports this assertion, especially in developed countries, where dual citizenship increases gross capital formation by US$12 trillion and FDI net inflows by US$828 billion. It also fosters trade. In developing countries, dual citizenship recognition raises GDP. In both developed and developing countries, dual citizenship recognition increases household consumption expenditures, provides incentives for low and high-skilled workers to move to other countries, indicating that it may be used as an instrument to receive remittances from abroad, given the positive impacts of immigrants' productive inputs (see, e.g., Borjas (1995) for the US). The fraction of the diaspora living in dual citizenship-granting countries has a significant effect on most of these outcomes (e.g., trade, household consumption, GDP, and gross capital formation), showing that they constitute an engine of economic growth for their homelands.

The estimate of the effects of dual citizenship on public spending on health and education shows no significant impact, which implies that the diasporic populations have little say in homeland politics. Importantly, diasporas do not seem to influence political outcomes in origin countries, which is consistent with the notion that dual citizenship legislation itself is exogenous to external pressure, although it may be used by a country as an instrument to attract investments from the same diasporas.

Finally, we compare the effectiveness of dual citizenship and other institutional variables including government stability and the absence of internal and external conflicts in improving child survival. We find that dual citizenship is more effective in general, although its effect is less pronounced in developed countries.

The remainder of this paper is organized as follows. In Section 3.2, we situate our study in the extant literature. In Section 3.3, we present our econometric strategy, and show our results in Sections 3.4 and 3.5. We discuss and conclude our study in Section 3.6.

3.2 Related Literature

To our knowledge, the economic impacts of dual citizenship legislation have not been widely studied. Ebeke (2011) and Leblang (2011) show that dual citizenship recognition by a country positively affects remittance inflows. In addition, Leblang (2011) finds, based on household data from Germany and Spain, that the propensity to send remittances is greater for those individuals whose origin countries allow dual citizenship. Our analysis only partly confirms their results, as we also find that dual citizenship recognition by a developed country decreases remittance inflows. In addition, we have important methodological differences. Ebeke (2011) uses a cross-sectional approach and limits his analysis to developing countries observed over the period 2000-2008. Leblang (2011) uses panel data spanning the period 1972-2009, but as Ebeke (2011), focuses on developing countries only. By contrast, our analysis is based on data collected from both developed and developing countries and observed over a much longer period of time (1960-2010), which allows us to exploit variation across countries and time in dual citizenship policies. Further, we significantly differ in our scope and results, as we study the effect of dual citizenship legislation on several other important

variables (GDP, gross capital formation, volume of trade, net inflows of foreign direct investment, household consumption expenditures, public spending on education, public health expenditures, child survival, and emigration rates of low and high skilled workers). We also conduct the analysis for developing countries and developed countries separately, and compare the effectiveness of dual citizenship with other economic and institutional variables such as government stability, and the absence of internal and external conflicts in improving welfare. For the first time, we also highlight the importance of remittance inflows to developed countries and their effects on economic outcomes, finding that foreign remittance inflows decrease the unemployment rate and increase child mortality. These results are consistent with findings that positive economic shocks lead to adverse health outcomes in developed countries such as the U.S (Ruhm, 2000). In doing so, we deliver findings that are entirely new.

Given the political nature of dual citizenship legislation, we also view our study as contributing to the literature on the economic impacts of institutions (Shleifer and Vishny, 1993; Mauro, 1995; Knack and Keefer, 1995; Acemoglu and Johnson, 2005; Svensson, 2005). Acemoglu and Johnson (2005) show that improvement in property rights positively affects GDP per capita. Besley (1995) finds that institutions that improve land rights induce investment incentives in Ghana. Knack and Keefer (1995) also find that institutions that protect property rights are important determinants of economic growth and investment. Mauro (1995) shows that corruption lowers investment and growth. Osili and Paulson (2008) find that immigrants in the US coming from countries with good institutions have a greater propensity to own stock. Our findings on the impacts of dual citizenship suggest that dual citizenship is primarily an institution that protects the rights of members of the diaspora in their homeland. However, as we show, the different mechanisms through which dual citizenship

operates differ from those discussed in the extant literature on the economic impacts of institutions.

Other studies have investigated the effects of institutions on a range of human capital variables. Democracy has been found to improve infant mortality, life expectancy, literacy, and access to water and sanitation (Moon and Dixon, 1985; Besley and Kudamatsu, 2006; Tavares and Waczing, 2001; Zweifel and Navia, 2000; Stasavage, 2005; Ross, 2006). Lazarova and Mosca (2008) find that good governance increases life expectancy. Gupta et *al.* (2000) document the negative effects of corruption on health care and education, and Dawson (2010) finds that the rule of law reduces child mortality. Our study is related in that it documents, for the first time, the effect of dual citizenship, viewed as an institution, on child survival. Additionally, our study is novel in that it compares the effect of dual citizenship with that of other institutional variables such as government stability and the absence of internal and external conflicts, and finds that the former has a larger effect in both low and high income economies.

3.3 Econometric Strategy

3.3.1 Data

We combine a newly assembled dataset on dual citizenship with data from a variety of sources to estimate the economic effects of dual citizenship. We provide more details on our data sources as we describe our variables.

Dual Citizenship

We obtain information on dual citizenship legislation from the Citizenship Laws of the World (2001) database assembled by the United States Office of Personnel Management (USOPM). This database provides detailed information on dual citizenship legislation for 206 countries, classifying countries into those which accept dual citizenship and those which do not.

The Citizenship Laws of the World (2001) database however has two limitations. First, information on dual citizenship only covers the period prior to 2001. Second, it does not provide information on when dual citizenship was introduced for those countries that allowed it. We update this database, and further complete it with information on the year of the introduction of dual citizenship. We obtain this information from the online sites of various governments.

Figure 3-a shows the proportion of countries having introduced dual citizenship rights at some point during the period 1929-2009. As evidenced in this figure, dual citizenship recognition by developed countries is well spread over this time interval, but most developing countries introduced dual citizenship rights only after 1950. This difference in the temporal patterns of dual citizenship recognition might stem from the fact that most developing countries gained their political independence only after 1950. In particular, dual citizenship recognition accelerated during the 1990s in these countries. Figure 3-b shows that till the early 1990s, developed countries were slightly more likely to recognize dual citizenship rights than developing countries, but this pattern has reversed ever since. In 2009, 26% of developing countries allowed dual citizenship, against 24% for developed countries.

Interestingly, the fact that the pattern of dual citizenship recognition does not differ much for developed and developing countries after 1950 suggests that dual citizenship policies are not determined by the level of economic development or by such institutional factors as

democracy. Among countries with similar characteristics, some recognize dual citizenship rights, but others do not. For instance, the US, Canada, France and Togo allow dual citizenship, but Germany, Japan, Austria and Cameroon do not. This fact makes it hard to think of dual citizenship as being endogenous to unobservable factors likely to affect our outcome variables, which is essential for the econometric identification of the effect of dual citizenship legislation.

Dependent Variables

We estimate the effects of dual citizenship on three sets of variables. The first set comprises workers' remittances, and the under-five mortality rate. Remittances represent current transfers by migrants who are employed or intend to remain employed for more than a year in a foreign country in which they are considered residents. Data on remittances are available only for the period 1970-2010. The under-five mortality rate is the probability that a child dies before his fifth birthday. These variables reflect social connections between members of a country's diaspora and their families, friends, and communities in their homeland.

The second set comprises gross domestic product (GDP), gross capital formation, the volume of trade, foreign direct investment, household final consumption expenditures, unemployment rate, and emigration rates of low, medium and high-skilled workers. These variables provide a global picture of a country's economy. GDP is the sum of gross value added plus product taxes minus subsidies. Gross capital formation (also called gross domestic investment) is composed of an economy's fixed assets and the net changes in the amount of inventories. The volume of trade is the sum of merchandise exports and imports. Foreign direct investment (net inflows) is new investment inflows less disinvestment and is composed of equity capital, reinvestment of earnings, long and short-term capital. Household final

consumption expenditures are the market value of goods and services purchased by households. Unemployment rate is calculated as the percentage of unemployed individuals in the labor force. Domestic credit to the private sector is measured as the total financial resources provided to the private sector. It measures the level of financial development. Most of the variables in this set are drawn from the World Development Indicators (WDI, 2011) of the World Bank. Information on emigration rates of low, medium and high-skilled workers is provided by Docquier and Marfouk (2005), and has been used in Beine et *al.* (2008).

The third set comprises government-controlled factors such as public spending on education and health. These variables measure the allocation of government funds to social programs. Public health spending is calculated as total health expenditures from governmental budgets, external loans, grants, and social health insurance funds. Public spending on education is expressed as the total spending of the government on education. These variables are obtained from the World Development Indicators (WDI, 2011).

Table 3.1 provides summary statistics for all these variables. Columns 1 and 2 report mean values and standard deviation for the full sample. Columns 3 and 4 report mean values and standard deviations for the subsample of developing countries, while Columns 5 and 6 show mean values and standard deviations for the subsample of developed countries. In Table 3.8, we summarize information on the definition and sources of variables used in the analysis. Our sample is composed of 141 developing countries and 37 developed countries.

Organizing the Analysis

We analyze the impacts of dual citizenship legislation in three main parts. First, we consider the sets of variables reflecting the economy and allocation of government funds to social programs. In the second part, we consider remittances and child mortality. We pay special

attention to the latter variable since child mortality, unlike other human capital outcome variables, responds quickly to better nutrition and improved access to health care, and is therefore more sensitive to exogenous increases in income. It has been used as an important measure of poverty in developing countries (Ross, 2006), and as an indicator of child well-being in developed countries (Case et *al.*, 2002; Almond et *al.*, 2006; Condliffe and Link, 2008).

In the third part, we compare the effectiveness of dual citizenship and remittances in lowering child mortality. We also compare dual citizenship with other institutional variables including government stability and the absence of internal and external conflicts in terms of their effects on child mortality. These institutional variables are obtained from the Political Risk Services/International Country Risk Guide (PRS/ICRG) database.

3.3.2 Model Specification

We use a panel of ten average five-year periods from 1960-2010 for our analysis. We estimate the following econometric model:

$$y_{c,t} = \alpha_0 + \alpha_1 Citizen_{(c,t)} + X_{c,t}^{'}\alpha_2 + \eta_c + \vartheta_t + \varepsilon_{c,t} \tag{3.1}$$

where $y_{c,t}$ represents an outcome of interest measured for country c in period t; $citizen_{c,t}$ measures dual citizenship for country c in period t; it takes on value 1 if the country permits dual citizenship for its citizens in period t, and 0 if not. Note that as we use a panel of ten periods of five years each for our estimations, the dual citizenship variable takes on value 1 in period t if the year in which dual citizenship was introduced belongs to that period.

Also, we do not have an instance in which dual citizenship recognition has been reversed after being introduced, which implies that if the dual citizenship variable takes on value 1 in period t, it takes the same value in subsequent periods. All other variables are averaged over each period. $X_{c,t}$ is a vector of control variables. η_c is a country dummy variable, ϑ_t is a period dummy variable. The variable $\varepsilon_{c,t}$ is an error term. The coefficient α_1 is the main parameter of interest, and α_2 is a vector of coefficients capturing the effects of the control variables in $X_{c,t}$.

A number of studies have used a similar model to analyze the impact of new policies on a range of outcomes (e.g., Osili and Paulson, 2008). Policies are usually viewed as exogenous (e.g., Osili and Paulson, 2008; Besley and Persson, 2009). In our analysis, as argued earlier, the fact that countries with similar characteristics have different legislation on dual citizenship makes it hard to think of dual citizenship as being endogenous to unobservable factors that might also affect our outcomes. The legislative and constitutional nature of dual citizenship also enhances the exogeneity of dual citizenship decisions vis-à-vis external factors (e.g., foreign investors or aliens), as these decisions involve many decision-makers with possibly conflicting views, unlike policy decisions made by the executive branch of a government.

Nevertheless, we control for a range of variables that might be possible sources of endogeneity for dual citizenship. First, by estimating time and country fixed effect regressions, we control for time trends, possible sources of endogeneity that are identical for all countries for each period, but vary over time, and sources of endogeneity that are time-invariant for each country, including historical factors. One could also think of dual citizenship as being endogenous to pressure exerted by members of the diaspora on the origin country's government. To account for this, we control for the size of the diaspora in most of our analyses. We

also control for the fraction of a country's diaspora populations living in dual citizenship-granting countries. Any external pressure is likely to come from these populations, as they are the ones who gain most from dual citizenship rights, given that these rights are also recognized by their countries of residence. We also control for average GDP and population of destination countries, under the assumption that members of the diaspora living in richer countries are more likely to influence homeland politics.[3] We note that the fraction of a country's diaspora populations living in dual citizenship-granting countries and average GDP of destination countries are strongly correlated (the coefficient of correlation is 0.60), and so, we do not control for both simultaneously. Further, we control for a range of other institutional variables related to political stability. We believe that all these controls address possible though unlikely endogeneity issues associated with dual citizenship. Also working in our favor is the fact that dual citizenship has no impact on the allocation of public funding to education and health, indirectly suggesting that the diaspora has little say on homeland politics.

3.4 Empirical Results

3.4.1 The Macroeconomic Impacts of Dual Citizenship Legislation

In this section, we estimate the impact of dual citizenship legislation on macroeconomic indicators and on the allocation of government funds to education and health. The results for developing countries are presented in Table 3.2, and those associated with developed

[3]These averages are weighted by the fraction of a country's emigrants living in each of the other countries in each period. For instance, if there are 5 countries $C_1, ..., C_5$, and the fraction of country $C_1's$ emigrants in country C_i in period t is P_{it} ($P_{1t} = 0$), and if Z_{it} is the value of a variable Z (e.g., dual citizenship rights, GDP, population) in country C_i in period t, then the average of Z in the destination countries of country $C_1's$ emigrants in period t is $0Z_{1t} + P_{2t}Z_{2t} + P_{3t}Z_{3t} + P_{4t}Z_{4t} + P_{5t}Z_{5t}$.

countries are presented in Table 3.3. For each outcome variable, we first estimate the effect of dual citizenship without any controls, and then we control for country and period fixed effects, the fraction of the diaspora's population living in dual citizenship-granting countries, and the average population of destination countries. We additionally control for the population size of each country when estimating the impact of dual citizenship on GDP and household consumption, and for population size and GDP when estimating the effect of dual citizenship on public spending on health and education.

We find that in developing countries, dual citizenship recognition raises GDP and household consumption expenditures. The effect of dual citizenship on GDP is mediated by the fraction of the diaspora populations living in dual citizenship-granting countries, as this effect loses statistical significance only after we control for this latter variable in fixed effect regressions. The effects of dual citizenship on the net inflows of FDI, and trade are positive, but are not statistically significant once we control for time and country fixed effects.

In developed countries, dual citizenship recognition raises the net inflows of FDI by over US$877.57 billion, gross capital formation by US$11.7 trillion, and trade volume by US$12.8 trillion. It also has a positive and statistically significant effect on household consumption.

We also find that dual citizenship recognition by a country provides incentives for its low- and high-skilled workers to move to other countries without facing the risk of losing their origin citizenship, showing that dual citizenship recognition as a political institution improves a country's ability to stimulate international labor mobility, which temporally solves the problem of unemployment.

We do not find any effect of dual citizenship recognition on public spending on health and education, which suggests that the diaspora plays little role in homeland politics. Importantly, diasporas do not seem to influence political outcomes in origin countries, which

is consistent with the notion that dual citizenship legislation itself is exogenous to external pressure, although it may be used by a country as an instrument to attract investments from the same diasporas.

It is also worth noting that members of the diaspora living in dual citizenship-granting countries have important and statistically significant impacts on several outcomes including GDP and household consumption for both developed and developing countries, and trade, domestic credit to the private sector, and gross capital formation for developed countries. These effects show that these diasporic populations have a greater incentive to invest in their origin country, therefore constituting an engine of economic growth.

3.4.2 Dual Citizenship Legislation and Workers' Remittances

In this section, we estimate the impact of dual citizenship legislation on workers' remittances. The results are presented in Table 3.4. We report the results both for developing countries (Columns 1-4) and developed countries (Columns 5-8). In results not shown, we test a similar specification of the model, but replace the continuous variables by their logarithmic transformation, and our conclusions regarding the effect of dual citizenship do not change. In Columns 1 and 5, dual citizenship is the only predictor. We find that it positively affects remittances, but the effect is statistically significant only for developed countries. In Columns 2 and 6, we control for period and country fixed effects, country population size, the size of the diaspora (measured by the stock of emigrants), the inflation rate, and financial development (measured by domestic credit to the private sector). We find that recognition of dual citizenship raises remittance inflows by US$1.190 billion in developing countries. The findings show that a mere cross-sectional regression grossly underestimates the effect of dual citizenship, as the fixed-effect coefficient is about 3.25 times larger than

the coefficient obtained from the cross-sectional analysis. For developed countries, however, the coefficient associated with dual citizenship becomes negative and statistically significant. As argued in the introduction, a plausible reason for this negative effect is that emigrants from developed countries who become citizens of their host countries remit less once they reunite their close family members with them in their new countries. This behavior is in contrast with that adopted by emigrants from collectivistic cultures, which are predominant in developing countries.

The fact that the effect of dual citizenship on remittances is greater for developing countries also suggests that the additional funds generated by dual citizenship are aimed at poverty alleviation in the origin country. It also indicates, as Pongou (2010) has shown theoretically, that developing countries have more skilled emigrants than more developed countries, and so receive more remittances.

In Columns 3 and 7, we additionally control for the average GDP and population of destination (or remittances-sending) countries, our proxy for the diaspora's financial power. This decreases the effect of dual citizenship, which shows that this effect is partially driven by emigrants living in richer countries. In Columns 4 and 8, we replace the average GDP of destination countries by the fraction of the diaspora populations living in dual citizenship-granting countries, which does not significantly change the coefficient on dual citizenship obtained from the previous estimation. Interestingly, consistent with the notion that developing countries are more collectivistic and developed countries more individualistic (Todaro and Smith, 2012), the fraction of the diaspora's population living in dual citizenship granting-countries positively affects remittance inflows in the former countries, whereas it has an opposite effect in the latter. Indeed, emigrants from developed countries who become citizens of their host countries remit less once they reunite their close or nuclear family mem-

bers with them in their new countries, whereas those from developing countries continue to remit to their extended families and communities.

3.4.3 Dual Citizenship Legislation and Child Mortality

In this section, we investigate the role of dual citizenship in alleviating household poverty, measured by the under-five child mortality rate. We also investigate the channel through which it operates. As we shall see, remittances mediate mostly the effects of dual citizenship, suggesting that dual citizenship and remittances parallel foreign aid in lifting the poor. Following the literature (Ross, 2006), we analyze the logarithmic transformation of the child mortality rate, therefore also considering the logarithmic transformation of all the predictors that are continuous. This allows us to interpret the coefficients as elasticities.

The results of the estimation of the effect of dual citizenship on child mortality are presented in Table 3.5. Results for developing countries are presented in Columns 1-5. In Column 1, only dual citizenship is included, and in Column 2, we additionally control for country and period fixed effects, country population size, the size of the diasporic populations, inflation rate, and financial development. In both estimations, the coefficient associated with the dual citizenship variable is negative and statistically significant. To investigate the channel through which this effect operates, we control for the average GDP and population of destination countries remittances in Column 3, for the fraction of the diaspora living in dual citizenship-granting countries in Column 4, and for remittances in Column 5. We find that while the fraction of the diaspora living in dual citizenship-granting countries reduces child mortality, its inclusion does not affect the size of the effect of dual citizenship. Including remittances however decreases the effect of dual citizenship which becomes statistically insignificant, clearly showing that dual citizenship recognition improves child survival through

stimulating remittances.

In Columns 6-10, we replicate the analysis in Columns 1-5 for developed countries. Dual citizenship reduces mortality (Column 6), but this effect disappears after we control for country and period fixed effects, country population size, the size of the diasporic populations, inflation rate, and the level of financial development (Column 7). We note that the latter variable improves child survival, and its effect is persistent across estimations (Columns 8-10). The fraction of the diaspora living in dual citizenship-granting countries and remittances worsen child mortality (Columns 9-10), a surprising fact which we explain below.

The effects of remittances on child survival differ for developing and developed countries. A possible explanation is that in developing countries, poor households most often must rely on remittances sent from abroad in order to afford basic nutritional needs and better health services for their children. This finding is consistent with studies showing that remittances have poverty-alleviating and consumption-smoothing effects on recipient households (Chami et *al.*, 2009). It is also similar to Barajas et *al.* (2009) who argue that remittances, often used as social insurance, help receiving families to primarily afford basic necessities such as food, clothing, medicine and shelter. In developed countries, however, remittances are invested into activities that improve the economy. In fact, we find that remittances decrease the unemployment rate in developed countries, but have no such effect in developing countries (see Appendix Table 3.9). As the economy improves, that increases the price of labor, causing parents to invest more time in income-generating activities than in children. Our findings are consistent with studies showing that mortality rates are strongly procyclical in developed countries (see, e.g., Ruhm (2000) for the U.S.). The adverse effect of the fraction of the diaspora in dual citizenship-granting countries on child survival in developed countries could also be explained by the fact that this variable positively affects the economy of these

countries (see Section 4.1), producing an impact similar to that of foreign remittances.

3.5 Comparing Dual Citizenship with other Institutional Variables

In this section, we compare the effects of dual citizenship and other institutional variables on child mortality. This comparison is motivated by the fact that dual citizenship is primarily viewed as an institution by political scientists, as it is frequently mentioned in the literature on the comparative effects of institutions on political and economic outcomes (North, 1991; Sokoloff and Engerman, 2000; Acemoglu et *al.*, 2002; Ross, 2006). The other institutional variables we use are government stability, and the absence of internal conflict and external conflict.[4]

The results for developing and developed countries are presented in Tables 3.6 and 3.7, respectively. We control for a range of variables. While two of the other institutional variables (government stability and absence of internal conflicts) improve child survival in developing countries, their effects are smaller than that of dual citizenship. In developed countries, dual citizenship recognition reduces mortality, but its effect is not statistically significant. The absence of internal conflicts, however, increases mortality. In results not shown, we also find that in the absence of internal conflicts, less public funding is allocated to public health, which suggests that internal conflicts may put pressure on the government to dedicate more funding to social programs, improving child welfare and survival. We also note that while internal conflicts are usually armed conflicts in developing countries, in developed countries,

[4]Information on these variables is available only for the period 1984-2007. To avoid losing data in our analysis, for each variable, we set all missing values to zero, and we control for a dummy indicator for missing information.

they take the form of civil disorder and strikes, and are organized to induce more social justice, which benefits lower-income households and improve welfare in general. The effect of internal conflicts for developed countries is therefore less surprising when the rationale behind those conflicts is taken into account.

Overall, it follows from our analysis that dual citizenship has a greater effect on child survival than other institutional variables both in developing and developed countries.

3.6 Conclusion

We have analyzed the economic impacts of dual citizenship legislation for both developing and developed countries. A country that permits dual citizenship allows members of its diaspora to retain several benefits in their homeland, including unrestricted entry and residency, easy access to investment and other economic opportunities, property ownership, and entitlement to social programs and other public goods. We argue that dual citizenship recognition therefore provides multiple incentives for members of the diaspora to keep ties with family, friends and communities in the origin country. These private international relations mobilize transfers of resources from the destination country to the origin country, improving household living conditions and the national economy.

Using a newly assembled dataset on dual citizenship legislation, we have found that dual citizenship recognition in developing countries increases remittance inflows, raises GDP and household consumption, and improves child survival. Also, dual citizenship recognition is more effective in improving child survival than other institutional variables such as government stability and the absence of internal and external conflicts. In developed countries, dual citizenship recognition increases gross capital formation and FDI net inflows, raises house-

hold consumption expenditures, fosters trade, and stimulates international labor mobility. We have found no effect of dual citizenship on public spending on health and education, suggesting that the diaspora plays little role in homeland politics, and lending credence to the notion that dual citizenship recognition itself is mostly exogenous to external pressure. Importantly, however, we have controlled for several variables capturing external pressure, delivering finding that are interesting in their own rights.

Dual citizenship is a hotly debated topic among political scientists, lawyers, and in the policy circle. Its recognition leads to countries sharing citizens and their potentials, as it fosters the free flow of people, money, and goods across national borders. In this paper, we have shown that dual citizenship recognition generates huge economic gains for countries and improves household welfare.

Appendix 3:

Figures and Tables Of Different Econometric Estimations

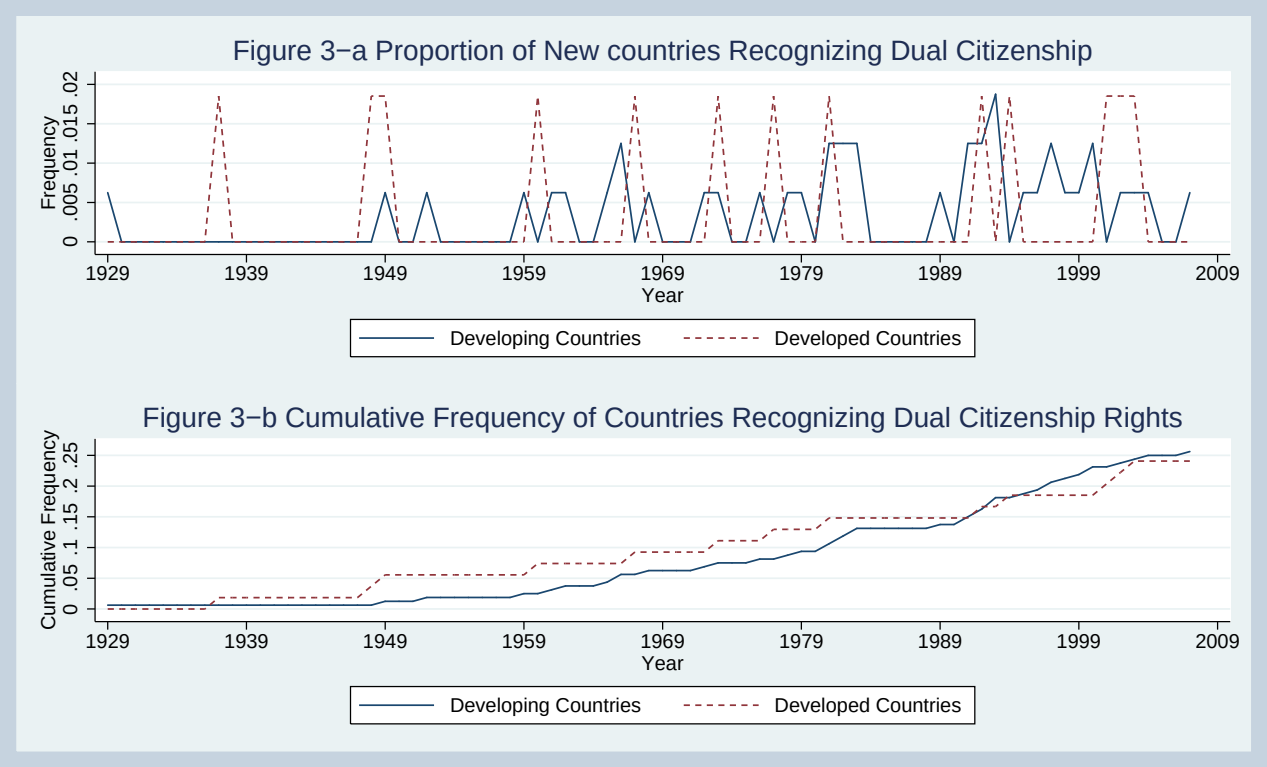

Figure 3.1: Proportion of Countries Recognizing Dual Citizenship, 1929-2009

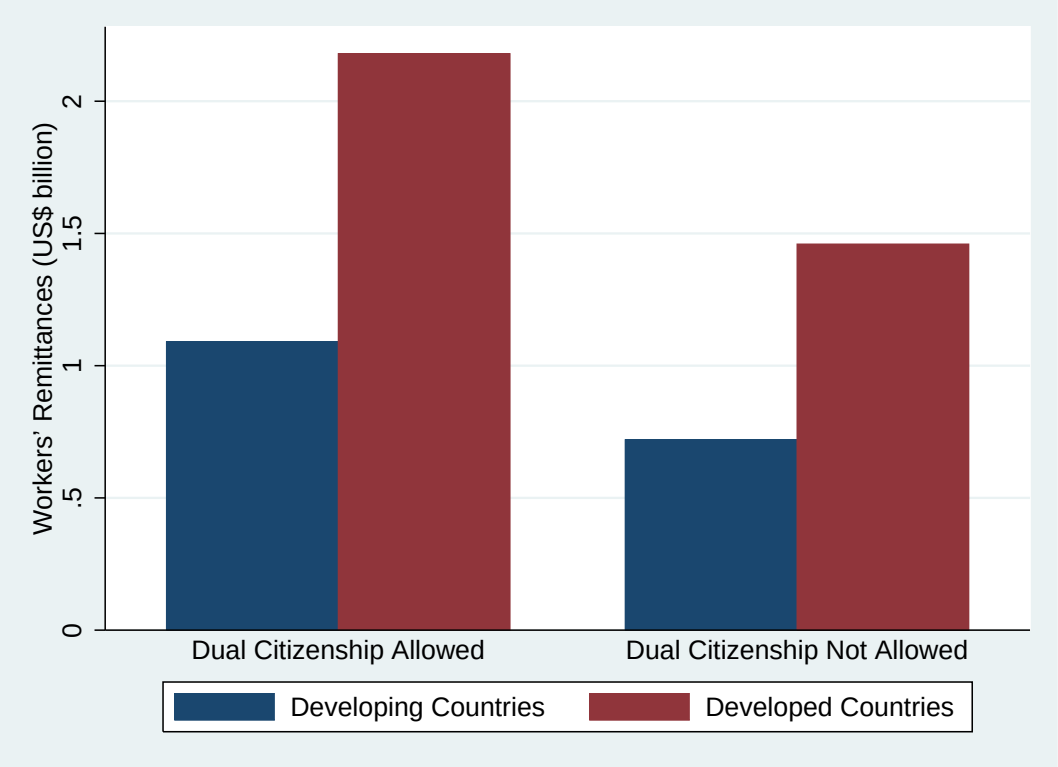

Figure 3.2: Dual Citizenship Legislation and Workers' Remittances

Table 3.1: Summary Statistics

Variable	Full Sample		Developing Countries		Developed Countries	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*	*Mean*	*Std. Dev.*
	1	*2*	*3*	*4*	*5*	*6*
Dual Citizenship Legislation	0.186	0.389	0.178	0.382	0.213	0.410
Child Mortality Rate (per thousand)	85.612	79.607	103.329	79.794	18.438	22.855
Workers' Remittances[b]	0.977	2.811	0.803	2.910	1.649	2.284
Gross Domestic Product[a]	0.119	0.643	0.036	0.170	0.363	1.211
Foreign Direct Investments[a]	0.303	1.389	0.116	0.664	0.929	2.536
Volume of Trade[a]	4.998	18.673	1.862	9.121	15.674	33.271
Household Consumption Expenditures[a]	0.083	0.455	0.023	0.083	0.288	0.915
Population[b]	0.023	0.095	0.025	0.108	0.016	0.039
Gross Capital Formation[a]	3.079	14.515	1.063	6.841	10.250	27.004
Domestic Credit to Private Sector[a]	16.297	120.548	2.129	17.602	64.834	245.656
Inflation Rate	42.678	426.107	54.729	490.741	6.123	13.586
Unemployment Rate	9.076	6.937	10.228	7.736	6.681	3.837
Public Health Spending[a]	1.137	5.993	0.163	0.583	4.924	12.521
Public Spending on Education[a]	0.782	4.159	0.175	0.576	2.548	7.917
Government Stability	7.505	2.070	7.213	2.140	8.366	1.559
Absence of Internal Conflict	8.570	2.629	7.953	2.533	10.404	1.976
Absence of External Conflict	9.497	2.248	9.154	2.240	10.517	1.947
Stock of Emigrants	0.673	2.270	0.439	1.160	1.340	3.911
Emigration Rate of Low-skilled Workers	0.044	0.072	0.042	0.077	0.047	0.051
Emigration Rate of Medium-skilled Workers	0.086	0.144	0.094	0.159	0.058	0.064
Emigration Rate of High-skilled Workers	0.208	0.230	0.234	0.248	0.118	0.114
Average GDP in Destination Countries[a]	1.05	1.68	0.933	1.60	1.42	1.86
Average Population in Destination Countries[b]	0.085	0.100	0.082	0.106	0.096	0.079
% of Diaspora in Dual Citizenship-Granting Countries	0.255	0.285	0.248	0.286	0.269	0.278

Detailed information about the variables is provided in Table 3.8.
Variables indexed with "a" and "b" are in US$ trillion and US$ billion, respectively.

Table 3.2: Effects of Dual Citizenship Legislation on Macroeconomic Outcomes (Developing Countries)

Panel A	Public Spending On Education		Public Health Spending		Volume of Trade	
Variable	[OLS]	[FE]	[OLS]	[FE]	[OLS]	[FE]
Dual Citizenship	-0.013	-0.014	0.020	-0.002	0.466	0.049
	(-1.00)	(-0.43)	(1.25)	(-0.12)	(0.82)	(0.09)
% Diaspora in dual		0.041		-0.047*		1.093
citizenship-granting countries		(0.73)		(-1.82)		(1.29)
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Period Fixed Effect	No	Yes	No	Yes	No	Yes
Panel B	GDP		Household Consumption Expenditures		Gross Capital Formation	
Dual Citizenship	0.026***	0.012	0.017***	0.011***	-0.151	-0.233
	(3.01)	(1.63)	(2.94)	(2.61)	(-0.42)	(-0.57)
% Diaspora in dual		0.035***		0.021***		-0.240
citizenship-granting countries		(3.17)		(3.30)		(-0.41)
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Period Fixed Effect	No	Yes	No	Yes	No	Yes
Panel C	FDI Net Inflows		Low Skilled Emigrant Workers		Medium/High Skilled Emigrant Workers	
			1990	2000	1990	2000
Dual Citizenship	0.017	0.039	0.053***	0.212**	0.036***	0.151**
	(0.40)	(0.88)	(3.82)	(2.55)	(2.82)	(2.34)
% Diaspora in dual		0.095	n/a	n/a	n/a	n/a
citizenship-granting countries		(1.44)				
Country Fixed Effect	No	Yes	n/a	n/a	n/a	n/a
Period Fixed Effect	No	Yes	n/a	n/a	n/a	n/a

Detailed information on the variables is provided in Table 3.8. We control for the percentage of the diaspora living in dual citizenship granting countries and the average population of destination countries in all regressions except when estimating the effect of dual citizenship on low-skilled and medium/high-skilled immigrant workers. In addition to these controls, we control for population size when estimating the effects of dual citizenship on household consumption expenditures, GDP and domestic credit to private sector. We additionally control for GDP in estimating the effect of dual citizenship on public spending on education and on public health spending. In the regressions of low-skilled and medium/high-skilled immigrant workers, we control for population size.
****, **, * denote statistical significance at the threshold of 1%, 5% and 10% respectively.*
t-statistics are in parentheses.

Table 3.3: Effects of Dual Citizenship Legislation on Macroeconomic Outcomes (Developed Countries)

Panel A	Public Spending On Education		Public Health Spending		Volume of Trade	
Variable	[OLS]	[FE]	[OLS]	[FE]	[OLS]	[FE]
Dual Citizenship	0.338*	0.275	0.211	-0.139	18.897***	13.967***
	(1.74)	(1.21)	(0.97)	(-0.40)	(3.14)	(3.32)
% Diaspora in dual citizenship-granting countries		-0.635		-0.227		17.709**
		(-1.27)		(-0.38)		(2.03)
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Period Fixed Effect	No	Yes	No	Yes	No	Yes
Panel B	GDP		Household Consumption Expenditures		Gross Capital Formation	
Dual Citizenship	0.363***	0.112	0.272***	0.094*	12.037**	12.164***
	(3.70)	(1.44)	(3.85)	(1.79)	(2.37)	(3.03)
% Diaspora in dual citizenship-granting countries		0.555***		0.333***		19.726**
		(3.91)		(3.03)		(2.28)
Country Fixed Effect	No	Yes	No	Yes	No	Yes
Period Fixed Effect	No	Yes	No	Yes	No	Yes
Panel C	FDI Net Inflows		Low Skilled Emigrant Workers		Medium/High Skilled Emigrant Workers	
			1990	2000	1990	2000
Dual Citizenship	1.326***	0.828**	0.062***	0.129**	0.030**	0.087*
	(2.83)	(1.98)	(3.16)	(2.24)	(2.07)	(1.74)
% Diaspora in dual citizenship-granting countries		-0.800	n/a	n/a	n/a	n/a
		(-0.91)				
Country Fixed Effect	No	Yes	n/a	n/a	n/a	n/a
Period Fixed Effect	No	Yes	n/a	n/a	n/a	n/a

Detailed information on the variables is provided in Table 3.8. We control for the percentage of the diaspora living in dual citizenship granting countries and the average population of destination countries in all regressions except when estimating the effect of dual citizenship on low-skilled and medium/high-skilled immigrant workers. In addition to these controls, we control for population size when estimating the effects of dual citizenship on household consumption expenditures, GDP and domestic credit to private sector. We additionally control for GDP in estimating the effect of dual citizenship on public spending on education and on public health spending. In the regressions of low-skilled and medium/high-skilled immigrant workers, we control for population size.
****, **, * denote statistical significance at the threshold of 1%, 5% and 10% respectively.*
t-statistics are in parentheses.

Table 3.4: Effects of Dual Citizenship Legislation on Workers' Remittances

Variable	Developing Countries				Developed Countries			
	[OLS]	[FE]	[FE]	[FE]	[OLS]	[FE]	[FE]	[FE]
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Dual Citizenship	0.366	1.190***	0.514***	0.598***	0.718*	-1.44***	-0.969***	-0.907***
	(1.49)	(3.92)	(2.85)	(3.19)	(1.86)	(-3.43)	(-2.92)	(-2.76)
Population		55.671***	35.196***	34.062***		255.382***	309.691***	283.824***
		(15.19)	(14.03)	(12.95)		(3.16)	(4.05)	(3.89)
Stock of Emigrants		0.092	0.439**	0.305		-0.299	-0.509**	-0.457**
		(0.31)	(2.23)	(1.49)		(-1.52)	(-2.51)	(-2.49)
Inflation Rate		28.9e+04	18.7e+03	14.3e+04		34.3e+05	21.4e+05	22.4e+05
		(0.85)	(0.10)	(0.71)		(0.48)	(0.42)	(0.44)
Domestic Credit		0.072***	0.052***	0.053***		-0.0027*	-0.0029**	-0.0025*
		(17.22)	(8.18)	(8.08)		(-1.79)	(-2.26)	(-1.89)
Average GDP in Destination Countries			0.335***				-0.289	
			(6.11)				(-1.28)	
Average Population in			-4.004*	3.463			21.922**	17.496**
Destination Countries			(-1.65)	(1.63)			(2.56)	(2.36)
% of Diaspora in Dual Citizenship				0.646**				-1.56*
granting Countries				(2.06)				(-1.75)
Controls:								
Period Fixed Effect	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Country Fixed Effect	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Number of Countries	125	122	117	117	28	28	28	28
Number of Observations	719	636	523	523	194	189	162	162
R-squared	0.0029	0.7131	0.6429	0.6130	0.0213	0.5140	0.5645	0.5695

Detailed information on the variables is provided in Table 3.8. t-statistics are in parentheses.
****, **, * denote statistical significance at the threshold of 1%, 5% and 10% respectively.*

Table 3.5: Effects of Dual Citizenship on Child Mortality (The dependent variable is the log of child mortality)

Variable	Developing Countries					Developed Countries				
	[OLS]	[FE]	[FE]	[FE]	[FE]	[OLS]	[FE]	[FE]	[FE]	[FE]
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Dual Citizenship	-0.621***	-0.076**	-0.062*	-0.067**	-0.031	-0.516***	-0.024	-0.031	-0.027	-0.062
	(-10.01)	(-2.35)	(-1.93)	(-2.04)	(-0.93)	(-7.06)	(-0.64)	(-0.78)	(-0.71)	(-1.45)
Log(Population)		0.441***	0.396***	0.428***	0.417***		-0.155**	-0.309***	-0.222**	0.359*
		(5.94)	(4.70)	(5.02)	(4.22)		(-2.24)	(-3.20)	(-2.40)	(1.70)
Log(Stock of		-0.052***	-0.054***	-0.054***	0.017		-0.136**	-0.124***	-0.115***	-0.003
Emigrants)		(-3.05)	(-3.11)	(-3.10)	(0.75)		(-4.04)	(-3.36)	(-3.21)	(-0.08)
Log(Inflation)		0.024***	0.017*	0.014	0.016		0.019	-0.001	0.003	0.038
		(2.64)	(1.82)	(1.55)	(1.61)		(0.86)	(-0.07)	(0.15)	(1.37)
Log(Domestic		-0.010**	-0.007*	-0.009*	-0.009*		-0.116***	-0.095***	-0.110***	-0.064*
Credit)		(-2.07)	(-1.68)	(-1.93)	(-1.77)		(-4.51)	(-3.42)	(-4.21)	(-1.72)
Log(AGDC)			0.130***	0.007	0.058			-0.103**	0.034	-0.059
			(4.50)	(0.29)	(1.58)			(-2.26)	(0.91)	(-0.75)
Log(APDC)			-0.128***					0.142**		
			(-3.38)					(2.22)		
Log(% of DCGC)				-0.190***	0.008				0.517***	0.300*
				(-2.61)	(0.11)				(4.31)	(1.95)
Log(Workers'					-0.019**					0.047**
Remittances)					(-2.14)					(2.31)
Controls:										
Period Fixed Effect	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Country Fixed Effect	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Number of Countries	123	123	118	118	116	37	34	34	34	27
Number of Observations	1230	817	696	696	514	344	279	245	245	158
R-squared	0.075	0.818	0.821	0.816	0.792	0.082	0.937	0.937	0.941	0.940

Detailed information on the variables is provided in Table 3.8. t-statistics are in parentheses.
****, **, * denote statistical significance at the threshold of 1%, 5% and 10%, respectively.*
AGDC and APDC represent Average GDP and Average Population of Destination Countries, respectively.
DCGC represents a percentage of Diaspora in Dual Citizenship-Granting Countries.

Table 3.6: Effects of Dual Citizenship and Other Institutional Variables on Child Mortality (Developing Countries).

Variable	[1]	[2]	[3]	[4]
Dual Citizenship	-0.057*	-0.052*	-0.050*	-0.050*
	(-1.85)	(-1.70)	(-1.66)	(-1.65)
Absence of Internal Conflict	-0.009*			-0.002
	(-1.76)			(-0.34)
Absence of External Conflict		-0.002		0.005
		(-0.41)		(0.84)
Government Stability			-0.029***	-0.029***
			(-4.05)	(-3.57)
Log(GDP)	-0.238***	-0.242***	-0.233***	-0.231***
	(-9.53)	(-9.69)	(-9.70)	(-9.42)
Log(Population)	0.321***	0.299***	0.338***	0.343
	(3.95)	(3.72)	(4.25)	(4.29)
Log(Inflation Rate)	-0.002	0.0005	-0.000	-0.000
	(-0.24)	(0.06)	(-0.66)	(-0.72)
Log(Domestic Credit)	-0.0009	-0.001	0.0002	0.0003
	(-0.20)	(-0.31)	(0.06)	(0.08)
Log(% of diaspora in Dual Citizenship granting Countries)	-0.108	-0.124*	-0.137**	-0.144**
	(-1.52)	(-1.75)	(-1.98)	(-2.03)
Log(Average Population in Destination Countries)	-0.007	-0.005	-0.015	-0.013
	(-0.31)	(-0.23)	(-0.68)	(-0.58)
Number of Countries	118	118	118	118
Number of Observations	696	696	703	703
R-squared	0.8414	0.8406	0.8407	0.8409

Detailed information on the variables is provided in Table 3.8. t-statistics are in parentheses.
****, **, * denote statistical significance at the threshold of 1%, 5% and 10% respectively.*

Table 3.7: Effects of Dual Citizenship and Other Institutional Variables on Child Mortality (Developed Countries).

Variable	[1]	[2]	[3]	[4]
Dual Citizenship	-0.017	-0.024	-0.025	-0.021
	(-0.47)	(-0.64)	(-0.65)	(-0.55)
Absence of Internal Conflict	0.017*			0.032**
	(1.92)			(2.27)
Absence of External Conflict		0.004		-0.019
		(0.50)		(-1.46)
Government Stability			0.008	-0.0002
			(0.76)	(-0.02)
Log(GDP)	-0.201***	-0.203***	-0.210***	-0.192***
	(-4.01)	(-4.00)	(-4.08)	(-3.71)
Log(Population)	-0.290***	-0.300***	-0.321***	-0.299***
	(-3.25)	(-3.33)	(-3.50)	(-3.19)
Inflation Rate	-0.003	-0.0009	-0.0003	-0.0005
	(-0.18)	(-0.04)	(-0.41)	(-0.68)
Log(Domestic Credit)	-0.010	-0.009	-0.007	-0.024
	(-0.30)	(-0.25)	(-0.20)	(-0.66)
Log(% of diaspora in Dual Citizenship granting Countries)	0.565***	0.578***	0.582***	0.554***
	(4.86)	(4.94)	(4.97)	(4.75)
Log(Average Population in Destination Countries)	0.055	0.045	0.047	0.053
	(1.46)	(1.19)	(1.26)	(1.43)
Number of Countries	34	34	34	34
Number of Observations	245	245	245	245
R-squared	0.9452	0.9443	0.9444	0.9459

Detailed information on the variables is provided in Table 3.8. t-statistics are in parentheses.
****, **, * denote statistical significance at the threshold of 1%, 5% and 10% respectively.*

Table 3.8: Definitions of Variables and Sources of Data

Variable	Definitions and Sources
Institutional Variables:	
Dual Citizenship	Dual Citizenship is a binary variable that takes on value 1 if a country allows dual citizenship and 0 otherwise. Part of our data comes from the Citizenship Laws of the World (2001) database, Office of the Personnel Management of the US Government.
Absence of Internal Conflict	Absence of internal conflict (civil war/coup threat, terrorism/political violence, civil disorder); ranges 0 to 12, with a higher score meaning very low risk; provided by Political Risk Services/International Country Risk Guide (PRS/ICRG).
Absence of External Conflict	Absence of external conflict (war, cross-border conflicts and foreign pressures); *Conflict* ranges from 0 to 12, with a higher score meaning very low risk; provided by PRS/ICRG.
Government Stability	Composite index of government stability based on government unity, legislative strength and popular support; ranges from 0 to 12, with a higher score meaning very higher stability, provided by PRS/ICRG.
Connectedness Between Diasporas and Origin Countries:	
Workers' Remittances[a]	Funds sent from abroad, defined as workers' remittances and compensation of employees, received (current US$); provided by WDI database, World Bank (2011).
Child Mortality Rate (per thousand)	Risk of dying before the fifth birthday; measured in per 1000; provided by World Development Indicators (WDI), World Bank (2011).
Macroeconomic Indicators:	
GDP[a]	Gross Domestic Product (GDP) (current US$); provided by WDI, World Bank (2011).
Inflation Rate	Consumer prices (annual %); provided by WDI, World Bank (2011).
Domestic Credit to private sector[a]	Domestic credit to private sector is defined as financial resources provided to the private sector; provided by WDI, World Bank (2011).
Unemployment Rate	Percentage of unemployed individuals in the labor force; provided by WDI, World Bank (2011).
Gross Capital Formation[a]	Gross capital formation (current US$); provided by WDI, World Bank (2011).
Stock of Emigrants[a]	International migration stock; provided by WDI, World Bank (2011).
Volume of Trade[a]	Merchandise trade (sum of exports and imports); provided by WDI, World Bank (2011).
FDI Net Inflows[a]	Foreign Direct Investments Net Inflows; provided by WDI, World Bank (2011).
Household Expenditures[a]	Household final consumption expenditures (current US$); provided by WDI, World Bank (2011).
Population (in billion)	Total population, values are midyear estimates; provided by WDI, World Bank (2011).
Emigration Rates	Emigration rates of low, medium and skilled workers; provided by Docquier and Marfouk (2005).
Av. GDP in Dest. Countries[a]	Authors' estimations based on Ozden et al. (2011)
Av. Pop. in Dest. Countries	Authors' estimations based on Ozden et al. (2011)
% of diaspora	Authors' estimations based on Ozden et al. (2011)
Variables Related to Public Spending on Social Programs	
Health Public Spending[a]	Total volume of public health expenditures (current US$); provided by WDI, World Bank (2011).
Public Spending Education[a]	Total volume of public spending on education (current US$); provided by WDI, World Bank (2011).

All the variables indexed with "a" and "b" are in US$ trillion and US$ billion, respectively.

Table 3.9: Effect of Workers' Remittances on Unemployment Rate.

Variable	Developing Countries		Developed Countries	
	[OLS]	[FE]	[OLS]	[FE]
Workers' Remittances	-0.008	-0.009	0.313***	-0.257**
	(-0.91)	(-0.90)	(3.54)	(-2.10)
Controls:				
Period Fixed Effect	No	Yes	No	Yes
Country Fixed Effect	No	Yes	No	Yes
Number of Countries	124	124	31	31
Number of Observations	436	436	162	162
R-Squared	0.0331	0.0658	0.0481	0.2099

Detailed information on the variables is provided in Table 3.8.
t-statistics are in parentheses.
****, **, * denote statistical significance at the threshold of 1%, 5% and 10% respectively.*
We control for population size in both the OLS and the fixed effect regressions.

Table 3.10: List of Countries Included in the Analysis.

Low and Middle Income Countries					High Income Countries	
Albania	Congo, Rep,	Indonesia	Mozambique	St, Kitts and Nevis	Andorra	Singapore
Algeria	Costa Rica	Iran, Islamic Rep,	Myanmar	St, Lucia	Australia	Slovenia
Angola	Cote d'Ivoire	Iraq	Namibia	St, Vincent and the Grenadines	Austria	Spain
Antigua and Barbuda	Croatia	Jamaica	Nepal	Sudan	Bahamas, The	Sweden
Argentina	Czech Republic	Jordan	Nicaragua	Suriname	Bahrain	Switzerland
Armenia	Djibouti	Kazakhstan	Niger	Swaziland	Belgium	United Arab Emirates
Azerbaijan	Dominica	Kenya	Nigeria	Syrian Arab Republic	Brunei Darussalam	United Kingdom
Bangladesh	Dominican Republic	Kiribati	Oman	Tajikistan	Canada	United States
Barbados	Ecuador	Kyrgyz Republic	Pakistan	Tanzania	Cyprus	
Belarus	Egypt, Arab Rep,	Lao PDR	Panama	Thailand	Denmark	
Belize	El Salvador	Latvia	Papua New Guinea	Togo	Finland	
Benin	Equatorial Guinea	Lebanon	Paraguay	Tonga	France	
Bhutan	Eritrea	Lesotho	Peru	Trinidad and Tobago	Germany	
Bolivia	Estonia	Liberia	Philippines	Tunisia	Greece	
Bosnia and Herzegovina	Ethiopia	Libya	Poland	Turkey	Iceland	
Botswana	Fiji	Lithuania	Romania	Turkmenistan	Ireland	
Brazil	Gabon	Macedonia, FYR	Russian Federation	Uganda	Israel	
Bulgaria	Gambia, The	Madagascar	Rwanda	Ukraine	Italy	
Burkina Faso	Georgia	Malawi	Samoa	Uruguay	Japan	
Burundi	Ghana	Malaysia	Sao Tome and Principe	Vanuatu	Korea, Rep,	
Cambodia	Grenada	Maldives	Senegal	Venezuela, RB	Kuwait	
Cameroon	Guatemala	Mali	Serbia	Vietnam	Luxembourg	
Cape Verde	Guinea	Malta	Seychelles	Yemen, Rep,	Monaco	
Central	Guinea-Bissau	Mauritania	Sierra Leone	Zambia	Netherlands	
African R.	Guinea-Bissau	Mauritania	Sierra Leone	Zambia	Netherlands	
Chad	Guyana	Mauritius	Slovak Republic	Zimbabwe	New Zealand	
Chile	Haiti	Mexico	Solomon Islands		Norway	
China	Honduras	Moldova	Somalia		Portugal	
Colombia	Hungary	Mongolia	South Africa		Qatar	
Comoros	India	Morocco	Sri Lanka		Saudi Arabia	

We use the World Bank classification of developing countries as low and middle-income economies, and developed countries as high income economies (OECD and non-OECD countries).

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