THÈSE

En vue de l'obtention du

DOCTORAT DE L'UNIVERSITE DE TOULOUSE

Délivré par l'Université Toulouse Capitole

École doctorale : **Sciences Economiques-Toulouse School of Economics**

Présentée et soutenue par

GALEZ-DAVIS Claire

le 28/06/2019

Essais en Economie du Développement

Discipline : **Sciences Economiques**

Unité de recherche : **TSE-R (UMR CNRS 5314 – INRA 1415)**

Directeur de thèse : M. Jean-Paul AZAM, Professeur, TSE, Université Toulouse 1 Capitole

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Rapporteurs Mme Catherine ARAUJO BONJEAN, CR CNRS, CERDI, UCA
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Université Toulouse Capitole

Doctoral Thesis

Essays in Development Economics

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Abstract

This thesis studies economic and political interactions between developed and developing countries, and investigates if and how they can foster global development. The first chapter provides a summary and introduction to the thesis. The three other chapters investigate Foreign Direct Investment (FDI), Official Development Assistance (ODA), global value chains and Corporate Social Responsibility in the cocoa value chain. Chapter two and three are co-authored with Jean-Paul Azam.

Starting from the observation that in recent years both FDI and ODA have soared in Sub-Saharan Africa, the second chapter aims to to evaluate their impacts on the recipient economies' growth. To do so, a two-stage least square analysis is carried out on an unbalanced panel of 41 Sub-Saharan African countries observed from 1980 to 2012. The instrumental strategy is drawn from the political and economic relationships between donors and recipients. The identifying hypothesis is that certain characteristics of a country's main ODA donors, such as GDP per capita, can only affect growth in that country through ODA and FDI. FDI is found to have a positive and significant effect on GDP per capita growth, whereas ODA has no impact.

The title of the third chapter is based on a parallel between the structure of trade in the Mercantilist era and today's trade structure in certain sectors. In both cases, commodities are produced in the South by many fragmented smallholders and transported for consumption in the North by a small number of intermediaries. The chapter provides a theoretical framework of analysis for this trade structure, at the value chain level. To be specific, we develop a two-sided model of oligopoly and oligopsony *à la* Cournot. We then use the model and its comparative statics to compare the situation of producers, intermediaries and consumers in different situations, and confront the model to case studies. Specifically, we look at the value chains for cocoa, coffee and cocaine.

The fourth and last chapter studies and compares the sustainability program of the major firms and independent certification schemes in the cocoa/chocolate industry. Specifically, it aims to understand the emergence of in-house sustainability labels, i.e. sustainability labels created by firms as opposed to independent organizations. I answer this question using the theoretical framework developed in the previous chapter. Overall, I find that riskiness is key in explaining firms' choices of sustainable sourcing. Indeed, these sustainability programs aim to increase the productivity of farmers, but this increase has an uncertain effects on profits for firms dealing with large quantities of cocoa. As a consequence, they are keen to control their sustainable sourcing by creating their own sustainability label. In any case, the impact of these initiatives on cocoa farmers remains ambiguous.

Résumé

Cette thèse s'intéresse aux interactions politiques et économiques entre les pays développés et les pays en développement. Elle explore comment ces interactions peuvent favoriser un développement économique mondial. Le premier chapitre résume et introduit la thèse. Les trois autres chapitres portent sur l'investissement étranger direct (IED), l'aide publique au développement (APD), les chaînes de valeur globales et la responsabilité sociale des entreprises dans la chaîne de valeur du cacao. Les chapitres deux et trois sont co-rédigés avec Jean-Paul Azam.

Partant de l'observation que, ces dernières années, l'IED et l'APD ont explosé en Afrique subsaharienne, le deuxième chapitre vise à évaluer leur impact sur la croissance des économies bénéficiaires. Pour ce faire, une estimation avec la technique des doubles moindres carrés est effectuée sur un panel non équilibré de 41 pays d'Afrique subsaharienne observés de 1980 à 2012. La stratégie instrumentale est tirée des relations politiques et économiques entre les donateurs et les bénéficiaires. L'hypothèse d'identification repose sur le fait que certaines caractéristiques des principaux donateurs d'APD d'un pays, comme le PIB par habitant, ne peuvent affecter la croissance de ce pays que par l'APD et l'IED. On trouve que l'IED a un effet positif et significatif sur la croissance du PIB par habitant, tandis que l'APD n'a aucun impact.

Le titre du troisième chapitre est basé sur un parallèle entre la structure du commerce dans l'ère mercantiliste et la structure commerciale actuelle dans certains secteurs. Dans les deux cas, les produits de base sont produits dans le Sud par de nombreux petits exploitants fragmentés et transportés pour être consommés dans le Nord par un petit nombre d'intermédiaires. Le chapitre fournit un cadre théorique d'analyse pour cette structure commerciale, au niveau de la chaîne de valeur. Plus précisément, nous développons un modèle à deux faces d'oligopole et d'oligopsone à la Cournot. Nous utilisons ensuite le modèle et sa statique comparative pour comparer la situation des producteurs, des intermédiaires et des consommateurs dans différentes situations. Nous confrontons nos résultats à des études de cas, en nous concentrant sur les chaînes de valeur du cacao, du café et de la cocaïne.

Le quatrième et dernier chapitre étudie les programmes de durabilité des grandes entreprises de l'industrie du cacao et du chocolat, et les compare avec les systèmes de certification indépendants. Plus précisément, il vise à comprendre l'émergence de labels de durabilité internes, c'est-à-dire des labels de durabilité créés par les entreprises elles-mêmes, par opposition à ceux créés par des organisations indépendantes. Je réponds à cette question en utilisant le cadre théorique développé dans le chapitre précédent. Dans l'ensemble, je trouve que la notion de risque joue un rôle majeur pour expliquer les choix des entreprises en terme d'approvisionnement durable. En effet, ces programmes de durabilité visent à augmentater la productivité des agriculteurs. Toutefois, cette augmentation a un effet incertain sur les profits des entreprises traitant de grandes quantités de cacao, les rendant désireuses de contrôler leur approvisionnement en créant leur propre label de durabilité. En revanche, l'impact de ces initiatives sur les producteurs de cacao reste ambigü.

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First and foremost, I am grateful to my PhD adviser, Jean-Paul Azam, with whom I have been working with since my Master's thesis. His advice, his availability and his rugby-style coaching throughout the years were always deeply appreciated. He has taught me a lot, and has most definitely shaped my approach to Economics and research.

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Nevertheless, not all of my thesis was written in Toulouse: I spent six weeks in the LICOS laboratory in KU Leuven (Belgium) in the Spring of 2017, and five months in the IREGE laboratory in Annecy-Le-Vieux (France) in 2017 and 2018. I deeply value the time I spent there, what I learned, and the friendships I made. I am particularly grateful to Jo Swinnen from LICOS and Mareva Sabatier from IREGE for welcoming me into their teams.

Last but not least, very special thanks are due to my family. They came many times to visit (including my grandparents and cousins), forcing me to get off my books and discover the beautiful Occitanie region. I am particularly grateful to my sister and brother, who are infinite sources of laughter and comfort, and to my parents, who have always supported me and encouraged me in every ways. Finally, I would like to thank my husband, who shared with me the daily joys and challenges of studying at TSE. His love, patience and humor proved invaluable.

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Chapter 1

Introduction

For a long time, foreign aid was the main way that developed countries envisaged contributing to the development of poorer countries. Countless academic studies have assessed the effects of foreign aid on growth and on a variety of other economic outcomes, including the second chapter of this thesis. Influential contributions include Boone (1996), Burnside and Dollar (2000), Rajan and Subramanian (2008) and C. Arndt, S. Jones, and Tarp (2015), to name a few. However, the aid literature is also famous for not reaching a consensus on the effect of aid on development, as I explain in the second chapter in more details. Hence, is aid the best way that developed countries can contribute to global economic development? Is it the only way? The following three chapters examine other ways, other interactions between developing and developed countries, that can be taken advantage off to foster global economic development.

The second chapter, co-authored with Jean-Paul Azam, investigates and compares the impact of Official Development Assistance (ODA) and Foreign Direct Investment (FDI) on GDP growth in a panel of Sub-Saharan African countries. FDI is found to have a positive and significant effect on GDP per capita growth, whereas ODA has no impact.

The third chapter, also co-authored with Jean-Paul Azam, looks at a certain kind of global value chains, namely those with industrial concentration in the intermediary stages. We call them 'hourglass' value chains, to exemplify this concentration. These hourglass chains are particularly widespread in primary commodities' markets, notably cocoa and coffee, hence their important place in the economic landscape of developing countries. In this chapter, we propose a two-sided, Cournot competition model of oligopoly and oligopsony, which can be applied to case studies and used to investigate value chain-level dynamics. We provide examples in the cocoa, coffee and cocaine value chain.

The fourth and final chapter is essentially a detailed, individual case study of the above model. It focuses on corporate sustainability initiatives in the cocoa value chains. Indeed, as will be explained in more details in the chapter, the cocoa sector is threatened by various factors, all of them somehow coming back to the low income of cocoa farmers. In response, multinational firms have created their own sustainability programs, which can take various forms. Some firms lean on existing sustainability certification schemes, while others create their own labels. It is this strategic choice which is investigated in this final chapter, using the theoretical framework developed previously.

The remainder of this introductory chapter presents in more details each of the three chapters summarized above.

1.1 Chapter 2

Foreign financial flows to Sub-Saharan Africa have soared in the past decade, and this is also true of Foreign Direct Investment (FDI) and Official Development Assistance (ODA). The question of their impact on the recipient's economies comes naturally. However, why compare ODA, which has a specific development goal, to FDI, which responds to private incentives? FDI could have an important developmental effect: job creation, enhancement of capital accumulation, technology transfers, etc. In practice, such positive effects are not automatic. For instance, if FDI occurs mainly in extractive industries, it is unclear how much jobs could be created and what kind of useful technology could be transferred. In addition, FDI could have detrimental effect on the local economic fabric, notably by driving local, less competitive firms out of business.

Hence, the aim of this second chapter is to evaluate the impacts of FDI and ODA on the economic growth of Sub-Saharan African countries. Its contribution to the literature is threefold. First, very few papers include aid as well as FDI in their empirical analysis, suggesting a potential omitted variable bias. Second, few articles focus on Africa specifically. Third and last, we provide a new empirical methodology, relying on the two-stage least squares estimation method.

To be specific, we first derive a growth equation, based on the Solow growth model. The main issue with our growth equation is the probable endogeneity of many of its variables. We examine them one by one, studying whether endogeneity might be an issue in the African context. Three variables are deemed problematic: ODA, FDI and conflict. We therefore choose the two-stage least squares estimation technique, and draw our instrumental strategy from the political and economic relationships between donors and recipients. This strategy is not new: Rajan and Subramanian (2008) already used donor information to estimate the effect of aid on growth. The novelty of our strategy comes in the way these donor-side variables are incorporated into the model. Indeed, we cannot use Rajan and Subramanian's strategy, for a lack of equivalent FDI data. Instead, we build a weighted average of a country's top five donors' information, where the weights are the relative foreign aid presence of each donor in the recipient country. The donor-side information that we choose are GDP per capita; ethnic fractionalization; taxes on income and profits; oil, coal and mineral rents; energy depletion; and arms exports. Justification for each one of these variables is provided in the chapter. The identifying hypothesis is that these donor-country characteristics can only affect growth in the recipient countries through ODA and FDI. We then estimate our model on an unbalanced panel of 41 Sub-Saharan African countries, observed from 1980 to 2012.

Using this estimation strategy, FDI is found to have a positive and significant effect on GDP per capita growth, whereas ODA has no impact. The validity of these results is tested in different ways. First, the main specification passes most of the regression diagnosis tests, except perhaps the weak identification test. To investigate this further, we also estimate our growth equation using limited information maximum likelihood regression techniques, which are more robust to under-identification. The results are similar. The exogeneity and strength of the instruments is also tested in various ways, and exogeneity is never rejected. The Hausman test is performed and passed, providing some confidence as to the relevance of our instrumental strategy, compared to simple ordinary least squares. Robust estimations based on the Newey-West kernel are performed as well, as serial correlation may be an issue, but the results are mostly unchanged. We also estimate our growth equation with generalized method of moments estimation techniques, and find once again similar results.

Finally, we also test the robustness of our results by altering the specification, the instruments, and the weights used in the computation of the instruments. Overall, the results hold.

In sum, several conclusions can be drawn from our results. The first and the most evident one is the necessity to take FDI into account in any growth regression, particularly one involving Sub-Saharan Africa. This chapter also demonstrates the need to take into account donor-side variables, when investigating bilateral flows. But the most important conclusion is probably that aid is indeed not the only way that developed countries can act to contribute to developing countries' development, at least in Sub-Saharan Africa. FDI has a role to play. The investigation of which role exactly is left to future research.

1.2 Chapter 3

This third chapter is also co-authored with Jean-Paul Azam. Its title ('The New Mercantilism') is based on a parallel between the structure of trade in the Mercantilist era and today's trade structure in certain sectors. In both cases, commodities are produced in the South by many fragmented smallholders and transported for consumption in the North by a small number of intermediaries. We compare this structure to an hourglass: many producers on one end, many consumers at the other end, and a bottleneck in-between, enjoying a dual position of oligopoly and oligopsony. Such buyer concentration and multiplicity of suppliers are notably found in the supply chains for cocoa, coffee, tea, sugar, cotton, bananas and various legumes and grains (De Schutter, 2010 and Asfaha, 2008, cited in Podhorsky, 2015). Hence, these 'hourglass' value chains are nowadays a key element in the economic fabric of developing countries. For instance, cocoa farming contributes to the livelihoods of forty to fifty million people, according to a 2012 World Cocoa Foundation report.[1] It follows that these 'hourglass' value chains are good candidates to be studied as a way through which developed countries can contribute to global development. The purpose and contribution of this chapter is therefore to develop a unified and flexible theoretical framework to study these value chains. We focus on the 'meso-level' interactions between Southern producers, intermediary firms and Northern consumers, and leave aside the 'micro' and country-specific aspects of value chains. Nevertheless, our framework is general and flexible enough that adjustments can be made to fit more specific contexts.

We start by detailing three specific examples of hourglass value chains: cocoa, coffee and cocaine. We describe them, and show how their structure fits into the hourglass model. We then get into the model, which is a two-sided Cournot competition model of oligopoly and oligopsony. There are three types of players, all identical within their group: Southern suppliers of a given commodity, intermediary firms which process the commodity into a final good, and Northern consumers who purchase the final good. Intermediary firms maximize their profits, taking into account the fact that the quantities they purchase in the South and sell in the North affect prices. They also incur an iceberg transport cost, for transporting the raw commodity from South to North. We call the first order condition from the maximization problem the 'price pass-through', as it provides the optimal price of the final good for any given price of the raw commodity.

The equilibrium is then studied in a four way diagram. Unsurprisingly, an oligopsony/oligopoly puts farmers at a disadvantage compared to perfect competition, since they

[1] Available from http://www.worldcocoafoundation.org/wp-content/uploads/Cocoa-Market-Update-as-of-3.20.2012.pdf, and last accessed on June 3, 2017.

sell less of their produce, and at a lower price. The equilibrium quantity of the final product also diminishes, and is sold at a higher price. Hence, both producers and consumers are worse off under this two-sided market power. The hourglass structure introduces a wedge between them. Parts of these losses are captured by the intermediaries, who obviously benefit from this situation. In terms of world welfare, two-sided market power results in (i) a dead-weight loss and (ii) a transfer from the South to the North, as long as the losses in the South are larger than the dead-weight loss in the North, and assuming that intermediaries are from the North - which they often are.

The next step in the chapter is to provide examples of applications of the model to the case studies presented earlier (cocoa, coffee and cocaine). The method we propose is close to the analytic narrative approach, developed by R. H. Bates et al. (1998). It combines analytical tools drawn from economic theory and political science with the narrative form, more frequent in history (R. H. Bates et al., 1998). We start by studying one example of comparative statics, and find that the model implies that cocaine trafficking intermediaries may have benefited from the War on Drugs, through the increase in competition it caused. We then demonstrate another use for our framework, by studying the introduction of a minimum price for the raw commodity in the South. We show how in some cases a minimum price can lead to excess supply, like for the 2016/2017 cocoa season in Côte d'Ivoire, and explained how ICO agreements between the 1960s and 1980s allowed to avoid that and to guarantee relatively high and stable prices for producers (drawing extensively on R. H. Bates, 1998). In sum, the model evidences how actors in different countries are linked along value chains, and provides a framework of analysis for studying their interaction. This chapter echoes the previous one, by providing another example of North-South interactions that can be instrumental in global development. I now turn to the fourth and last paper of my thesis.

1.3 Chapter 4

When investigating the cocoa sector, one cannot escape the fact that it is threatened by various factors, including the falling productivity of cocoa farms and the low attractivity of the sector to younger generations. While this is a threat for the future supply of chocolate, immediate consequences can also be dramatic. In particular, low productivity means low income for farmers, and in some contexts, child labour. The largest firms of the cocoa/chocolate sector are fully aware of these major issues, and have stepped up. All of them now have their own sustainability program in place, including Cargill and Barry Callebaut on the side of grinders and Mars, Nestlé and Mondelēz on the side of manufacturers.[2]

The first question that comes to mind is what these programs entail exactly. Among other similarities, I find that they all have in common some kind of farmer support as well as wider cocoa community support. Evidently, this involves fighting against child labor. These sustainability programs also differ on important points, notably in their relationship with independent certification schemes: some firms rely mainly on independent certification like Fairtrade, but still have sustainability programs on the grounds to help provide infrastructure to communities (Mars, Cargill). Others also use independent certification schemes, but have their own sustainability label, with which their products can be stamped. This chapter therefore studies and compares the sustainability programs of the major firms and of independent certification schemes in the cocoa/chocolate industry. Specifically, it aims to understand the emergence of in-house sustainability labels, i.e. labels created by

[2]Grinders are the firms in charge of processing cocoa beans into chocolate couverture, an intermediate chocolate product.

firms as opposed to independent organizations, and to investigate the differences in firms' sustainability strategies. The goal is ultimately to understand what the consequences are for farmers.

To this end, I first discuss why firms might decide to create their own sustainability programs, on top of working with certification schemes. I confront hypotheses with facts, and conclude that in-house quality labels are likely to be a strategic decision. It may be strategic with respect to farmers, since on-the-ground operations allow firms to bypass an intermediary and perhaps secure a sustainable cocoa supply. Firms' decision may also be strategic with respect to consumers, to whom they can advertise the good they do in cocoa producing countries while controlling their costs. To examine this last possibility, I use a particular exercise of comparative statics from the model developed in the previous chapter. Specifically, I vary the productivity parameter of the Southern farmers' supply curve, since these sustainability programs are meant to boost their productivity. Of course, this choice assumes that firms are actually successful and do manage to improve farmers' productivity. While there is no rigorous empirical evaluation of this fact, the key performance indicators provided by firms seem to point this way.

In the end, the model shows that sustainable sourcing entails uncertain profits for firms dealing with large quantities of cocoa and chocolate. Using in-house quality labels might allow such firms to better control what they provide to farmers. Hence, in the end, the choice of sustainability strategy is likely to depend on the total quantity of cocoa traded. This doesn't prevent firms from hedging their bets within their cocoa/chocolate range, i.e. using certification for some products and in-house programs for others. For farmers, the effect of sustainability programs is uncertain. On the one hand, in-house programs might allow more coverage, since they are preferred by firms dealing with the largest amount of cocoa. On the other hand, these same firms might have an incentive to limit the increase in cocoa farmer productivity (σ) to ensure that they make a positive profit.

In sum, my thesis is bringing together four ways in which North and South countries interact: FDI, ODA, global value chains and CSR within value chains. All can be instrumental in promoting global development, as long as their dynamics are understood. With these three chapters, my aim was to contribute to a better grasp of these North-South interactions, and how they can promote global development.

Chapter 2

The Political Economy of Foreign Direct Investment and Foreign Aid in Sub-Saharan Africa: An Empirical Approach

CO-AUTHORED WITH JEAN-PAUL AZAM

2.1 Introduction and motivation

Over the past decade, foreign financial flows into Sub-Saharan Africa have soared, particularly Official Development Assistance (ODA) and Foreign Direct Investment (FDI). As shown by figure 2.1, both are now reaching thousands of billions of U.S. dollars. The surge of aid was in all likelihood spurred by the War on Terror initiated by George Bush in the aftermath of 9/11 (Azam and Thelen, 2010), while investment is probably responding to the impressive economic performance of many African countries since the mid-1990s. In any case, the question of the impact of such large financial flows on the recipients' economic growth comes quite naturally.

Comparing ODA and FDI may seem odd. Beyond the fact that they are both financial flows, they have very different purposes and respond to different factors. ODA is meant to help foster development in poorer countries, whereas FDI responds purely to the economic incentives of firms in more developed countries. Nonetheless, this does not mean that FDI cannot have a beneficial impact on the recipients' economy and society, or that ODA is successful in its aim. The aid effectiveness literature, although very large, does not provide an answer to the latter point (more on this in section 2). In fact, the policy and literature focus has been recently shifting away from ODA towards other ways in which developed economies can contribute to the development of other countries. This is exemplified by the Center for Global Development's (CGD) 'Beyond Aid' initiative, which aims to promote other development policies available to developed countries. In particular, the view that more private funds should be invested in developing countries is more and more advocated, not only by the CGD but also at the 2002 Monterrey conference and in the framework of the New Partnership for Africa's Development initiative (Chauvet and Mesplé-Somps, 2006). In practice, the European Union is already involved in promoting growth in Africa using other means than ODA, by negotiating economic partnership agreements (EPA) with

regional blocs.[1] These agreements guarantee African goods duty-free and quota-free access to European markets. Bilateral business relationships were also discussed in the 2014 E.U.-Africa summit. Similar initiatives are being taken in the United States of America, notably with President Obama's 2013 Trade Africa initiative, which aimed to expand trade and investment between the U.S. and Africa.[2]

But is such a shift in focus justified? Is investment a better way to contribute to economic development? The literature on FDI in developing countries is not as voluminous as the equivalent aid literature, and conclusions are not unanimous. Overall the consensus seems to be that FDI is positively related to growth (Gohou and Soumaré, 2012). Nonetheless, very few papers include aid as well as FDI in their analysis, suggesting a potential omitted variable bias. Fewer still focus on Africa specifically. The main contribution of this paper is therefore to provide further evidence as to the relative effectiveness of both aid *and* FDI in Sub-Saharan Africa.

First, an overview of the literature on aid and FDI flows is provided. We outline how they might affect recipient economies and summarize a few empirical contributions. In section 2.3, the empirical specification is built, drawing on the Solow growth model. Since ODA and FDI are likely to be endogenous, an original instrumental variables strategy is devised. Specifically, it is derived from the political and economic relationships between donors and recipients. The identifying hypothesis is that certain characteristics of the main ODA donors, such as GDP per capita or energy needs, can affect growth in recipient countries *only* through ODA and FDI. Third, the results are presented and confronted to a series of robustness checks. Overall, FDI is found to affect growth positively and significantly, whereas ODA has no impact. The final section concludes.

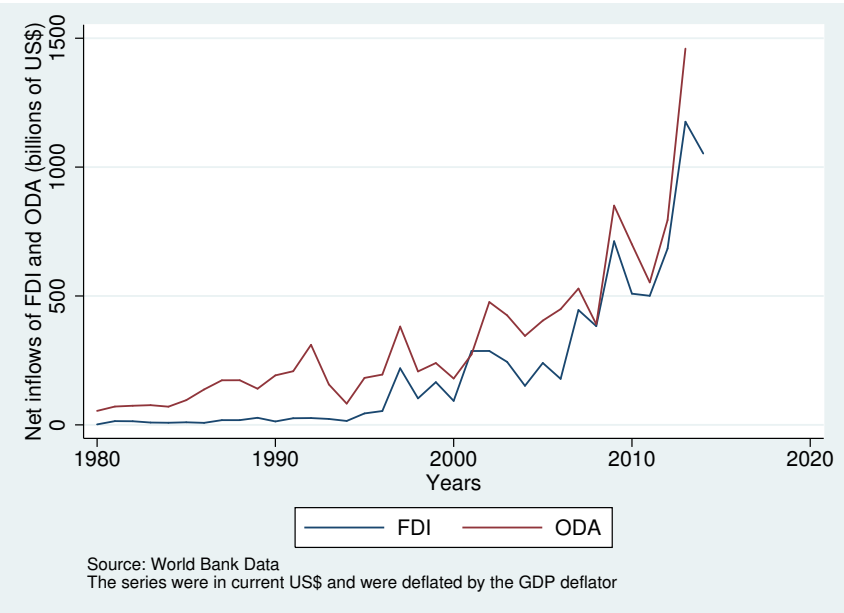


Figure 2.1: Evolution of net ODA received and net inflows of FDI in Sub-Saharan Africa

[1]See http://www.ey.com/ZA/en/Issues/Business-environment/EY-africa-attractiveness-survey-2015, last accessed on April 19, 2019.

[2]See http://www.ey.com/ZA/en/Issues/Business-environment/EY-africa-attractiveness-survey-2015, last accessed on April 19, 2019.

2.2 The effects of FDI and ODA on economic growth

Empirical work on growth gained momentum in the late 1980s and 1990s, spurred notably by the availability of the Summers-Heston dataset (Temple, 1999). Important contributions from this early literature include Mankiw, Romer, and Weil (1992) and Barro (1991). Since then, if aid and FDI were sometimes included in the analyses, they were most often studied separately. But, given the level reached by both of them, omitted variable bias in either literature is becoming a legitimate concern. In particular, the evaluation of aid effectiveness has been the focus of an extremely large number of papers, but very few of them take FDI into account.[3] We now turn to the literature on FDI and ODA, starting with how they might affect a receiving country's growth.[4]

2.2.1 How could ODA and FDI affect economic growth?

Some of the most evident ways in which aid can foster development is through its potential effects on capital accumulation, investment and government consumption. As shown in figure 2.2, aid can provide up to the equivalent of 42% of a country's GDP. For instance, C. Arndt, S. Jones, and Tarp (2015) investigate a cross-section of developing countries over the 1970-2007 period. Their findings suggest that aid contributes to the expansion of 'modern' sectors, such as industry, and has a positive effect on investment. Juselius, Møller, and Tarp (2014) found similar results with a sample of 36 Sub-Saharan African countries observed from the mid-1960s to 2007.

Nevertheless, a potentially large chunk of the aid might be allocated to consumption, rather than investment (C. Arndt, S. Jones, and Tarp, 2010). This can limit the extent to which aid enhances investment and therefore capital accumulation. But government consumption in education and health can improve human capital, which in turn can improve productivity (Juselius, Møller, and Tarp, 2014). Aid could also substitute to, and therefore discourage necessary government spending. The latter could instead be directed towards non-productive government consumption, such as an over-sized public sector and rent-seeking, or simply be reduced via tax cuts (Juselius, Møller, and Tarp, 2014; Djankov, Montalvo, and Reynal-Querol, 2008). More broadly, thanks to aid, a large chunk of government revenues does not depend on the taxes raised from citizens and businesses, meaning that there might be less incentive for accountability on the part of the government (Djankov, Montalvo, and Reynal-Querol, 2008). In practice, however, there is little evidence of these detrimental effects. In their study, Juselius, Møller, and Tarp (2014) found no evidence of such a harmful fungibility, and C. Arndt, S. Jones, and Tarp (2015) find that aid does reduce poverty as well as other social and health-related outcomes. In sum, the evidence suggests that aid's impact should at least not be negative. Nonetheless, according to C. Arndt, S. Jones, and Tarp (2015), the weight of evidence is shifting towards a positive effect of aid on growth. Let us leave aid for now and turn to the FDI literature.

First of all, like aid, FDI can enhance capital accumulation. As shown by figure 2.2, FDI is equivalent to nearly 40% of GDP in the top three recipients in Africa in 2012. In addition, there are good reasons to think that FDI is more productive than domestic investment

[3] This is true of the most influential contributions to this literature (see for instance Boone, 1996, Burnside and Dollar, 2000, Rajan and Subramanian, 2008 and more recently C. Arndt, S. Jones, and Tarp, 2015).

[4] Note that this review of the potential effects of aid and FDI on recipients is not exhaustive. For instance, in the case of FDI, issues of land appropriations will not be discussed, but are clearly detrimental to the local development. In the case of aid, a Dutch disease phenomenon can occur, as described in Rajan and Subramanian (2011).

(Graham and Krugman, 1991, cited in Borensztein, De Gregorio, and Lee, 1998). Because domestic firms have a better knowledge of local markets and a well-established access, a foreign firm which decides to enter the market must compensate for these advantages (e.g. by benefiting from lower costs and higher productive efficiency than its domestic competitors). This also means that FDI could be the main channel through which technology is transferred to the domestic market (Borensztein, De Gregorio, and Lee, 1998; Gohou and Soumaré, 2012; Cleeve, Debrah, and Yiheyis, 2015). In practice, evidence suggests that it is indeed the case. For instance, Managi and Bwalya (2010) show that FDI does participate in technology transfers in Kenya, Tanzania and Zimbabwe.[5]

On the other hand, if foreign firms are too advantaged, competition may drive domestic firms out of business (Kosack and Tobin, 2006). Empirical evidence on that matter suggests that this is the case for Africa. Indeed, Adams (2009) finds that in Sub-Saharan Africa, FDI does not affect GDP per capita growth and tends to crowd out domestic investment, which is, in turn, growth-enhancing. On top of that, technology transfers and spillovers do not necessarily trickle down from foreign to domestic firms. Indeed, it is often argued that developing countries lack the 'absorptive capacity' to exploit the technology that is being employed (Borensztein, De Gregorio, and Lee, 1998; Gui-Diby, 2014). Borensztein, De Gregorio, and Lee (1998) find that although the overall effect of FDI on economic growth is positive, the magnitude of the effect depends on the stock of human capital in the domestic economy. In fact, this effect can become negative for countries with very low levels of human capital. Given the relatively low levels of human capital in Sub-Saharan Africa, Borensztein, De Gregorio, and Lee's (1998) results suggest that technology transfers to those countries might be limited. More broadly, FDI in Sub-Saharan Africa has long been oriented towards the primary sector (Gui-Diby, 2014). In other words, multinational enterprises mainly get involved in the extraction and exportation of raw materials or commodities. Such activities do not require extensive knowledge or absorptive capacity (Gui-Diby, 2014), since the technology is often embodied in capital-intensive production (Akinlo, 2004). Moreover, this type of investment typically does not establish strong connections with local firms and is less likely to create well-remunerated jobs (Gui-Diby, 2014; Akinlo, 2004). Athough this trend has declined in recent years, to the benefit of consumer-market oriented industries and infrastructures, coal, oil and natural gas still account for a quarter of the foreign investment flowing to Africa.[6] Notice also that most of the top five FDI recipients in 2012 were still resource-rich countries, as can be seen in figure 2.2.[7]

Hence, ex ante, it is unclear how FDI might affect growth in recipient countries. The findings of the empirical literature on the matter are mixed, albeit most studies find FDI to stimulate growth (Gohou and Soumaré, 2012). The next paragraph outlines some of the papers that empirically study both the effects of FDI and ODA on growth in developing countries.[8]

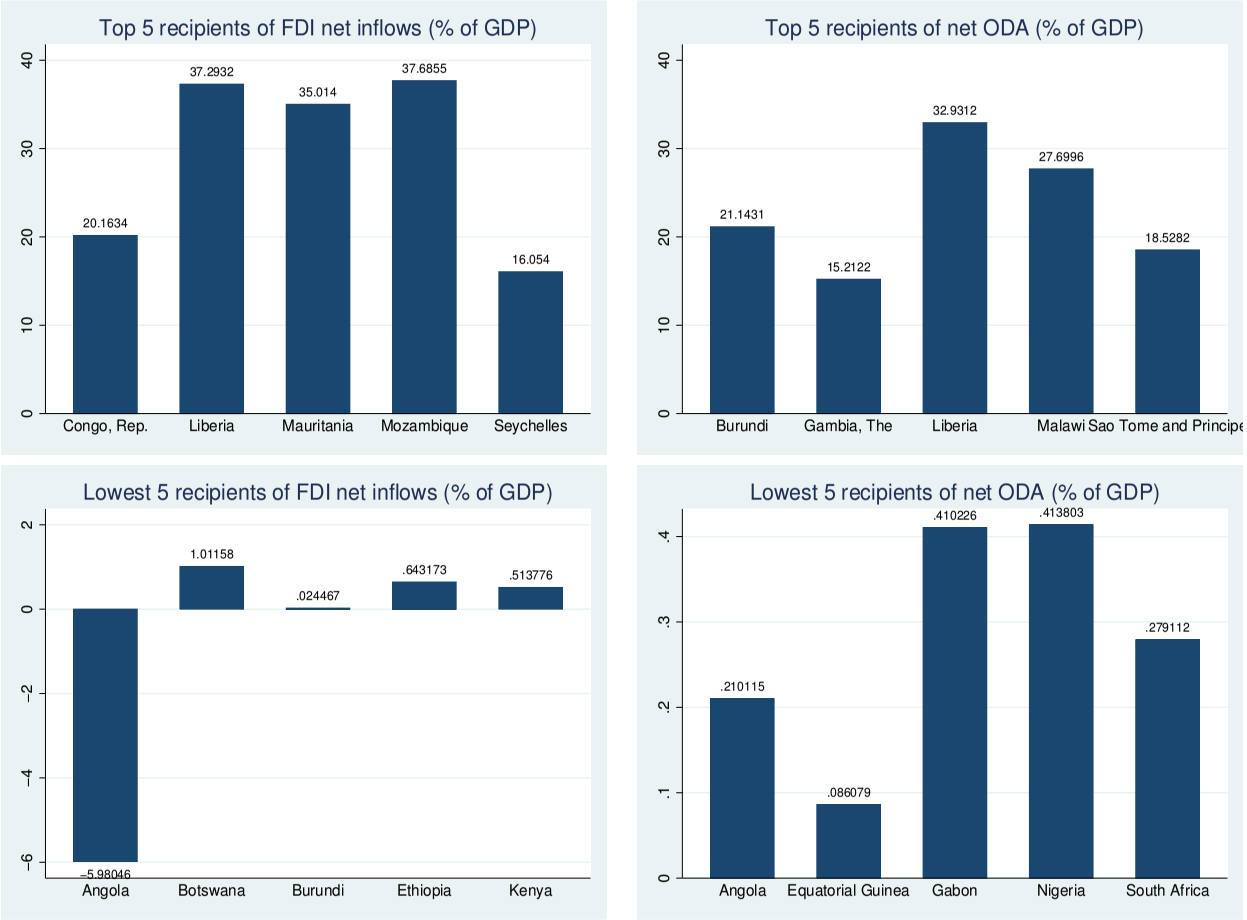
[5]The authors find evidence of regional, horizontal and vertical spillovers in Kenya, whereas only the latter two take place in Zimbabwe, and Tanzania only shows positive evidence of regional spillovers.

[6]See http://www.ey.com/ZA/en/Issues/Business-environment/EY-africa-attractiveness-survey-2015, last accessed on April 19, 2019. Note that this report includes North African countries.

[7]Mozambique's assets include natural gas, coal, titanium and hydroelectric capacity. Liberia and Mauritania have a wealth of mineral resources, among others, while oil is now the mainstay of the Republic of the Congo (see https://www.cia.gov/library/publications/the-world-factbook/wfbExt/region˙afr.html, last accessed on April 19, 2019).

[8]At this point, it is useful to point out that FDI and ODA flows might affect each other. For instance, large ODA flows might deter investment, as they might suggest a poor economic environment. This issue is beyond the scope of this paper, and will not be discussed any further. The interested reader can refer to Asiedu, Y. Jin, and Nandwa (2009), Kimura and Todo (2010), U. T. Yogo and Mallaye (2011), and Selaya and Sunesen (2012) and for a focus on Sub-Saharan Africa, Yasin (2005) and Chauvet and Mesplé-Somps (2006). Yasin (2005) found that

Figure 2.2: ODA and FDI repartition in Sub-Saharan Africa in 2012



2.2.2 Existing empirical literature comparing FDI and ODA

An early contribution is the paper by Kosack and Tobin (2006), who study a panel of 103 developed and developing countries observed between 1970 and 1999. Using system-GMM, they find that aid contributes positively and significantly to economic growth and human capital, whereas FDI appears to slow the rate of human development in less developed countries. Chauvet and Mesplé-Somps (2006), on the other hand, find that neither ODA nor FDI were pro-poor. To be specific, they find that FDI is never significant, whilst ODA tends to slightly reduce the income shares of the middle and upper classes in low income countries without increasing the share of the poorest. This divergence of findings may be explained by the differences in samples and in estimation techniques, as Chauvet and Mesplé-Somps (2006) focus on developing countries and perform GMM on income equations by deciles. In fact, the results differ again when the sample is constituted exclusively of African countries. With a panel of 36 Sub-Saharan African countries observed over 1980-2007, Ndambendia and Njoupouognigni (2010) find that FDI and foreign aid have a positive and significant effect on economic growth. They apply panel estimation techniques based on auto-regressive distributed lags specification, namely, the mean group estimator (MG), the pooled mean group estimator (PMG) and dynamic fixed effects (DFE).[9] C. Calderón and Nguyen (2015) have a very similar dataset (38 Sub-Saharan African countries from 1979-2012), but have a different econometric strategy. In a first step, they estimate the impact of growth on ODA and FDI using rainfall as an instrument. In a second step, they plan to estimate the impact on growth of the residuals from the previous step (which are thus are not driven by GDP per capita growth). However, since the capital flows do not have a significant effect on growth in the first step, the authors use actual capital flows as the explanatory variable in the second step. They also address the omitted variable issue in this second step by including time fixed effects, a proxy for the growth of trade partners and the international price index of the country's main commodity. In the end, they find that both ODA and FDI have a significant and positive effect, although ODA's effect is larger.[10]

Most recently, a few papers have started to take into account remittances along with aid and FDI. Indeed, in recent years, developing countries in general and Sub-Saharan Africa in particular saw remittances reach levels similar of those of ODA and FDI (Driffield and C. Jones, 2013). The reasons why they are not considered in the present paper will be explained in section 2.3.2. Examples of this literature include the papers by Driffield and C. Jones (2013), Benmamoun and Lehnert (2013) and Nwaogu and Ryan (2015). Driffield and C. Jones (2013) have a panel of developing countries observed from 1984 to 2007 and use 3SLS 'within' estimation. In their base estimation, they find that FDI and remittances have a positive and significant impact on per capita GDP growth, with the FDI coefficient slightly larger. On the other hand, ODA is found to have a negative and significant impact. Benmamoun and Lehnert's (2013) data are similar, but their estimation technique differs, as they use system GMM. This may explain why their results are slightly different from those of Driffield and C. Jones (2013). If the effects of FDI and remittances are still positive and significant, the remittance coefficient is now larger than that of FDI. ODA is also positive

ODA had a significant and positive impact on FDI inflows, whereas Chauvet and Mesplé-Somps (2006) found that although aid tended to compensate for the lack of external private capital, it did not promote FDI.

[9] With the first method, neither aid nor FDI are significant, but with the other two they are both positive and significant. The coefficient for FDI is larger with PMG, and both coefficients are relatively similar with DFE.

[10] They also estimate the impact of sovereign debt, but it is found to have no effect on growth. Conversely, growth does not affect any of the capital flows under study.

and significant, although it has the smallest effects of the three variables.[11] However, none of the financial flows was found to significantly affect growth in middle income countries. Finally, instead of separating the sample by income levels, Nwaogu and Ryan (2015) choose to analyze separately African countries and Latin American countries. Their African sample consists in 53 countries observed between 1970 and 2009. With this sample, they find that only FDI has a positive and significant effect on economic growth, whereas the coefficients of ODA and remittances are not significant. However, when included in separate equations, only FDI and foreign aid affect growth, and once again the impact is positive. These results are obtained with a dynamic spatial model, whereby the growth in one country depends on the growth of its neighboring countries. Endogeneity is controlled for by using the lagged values of FDI, foreign aid and remittances as instruments.

In sum, the results are mixed, depending on the estimation method and on the sample. This points towards the importance of focusing on similar groups of countries, and checking results with a variety of econometric techniques. Overall, in Sub-Saharan Africa, FDI is found to have a positive effect on growth, whereas the results for ODA are either positive (Ndambendia and Njoupouognigni, 2010; C. Calderón and Nguyen, 2015; Nwaogu and Ryan, 2015) or non-significant (Nwaogu and Ryan, 2015). This is broadly consistent with the results presented below, as FDI is found to have a positive effect and ODA has no significant effect on growth. Our results are also obtained with an original instrumental strategy, so that the findings presented here complement those described above and provide more confidence. This strategy is what we turn to next.

2.3 Building an empirical analysis of the impacts of FDI and ODA on growth

2.3.1 Specification: theory

Of course, the growth process is a complex one, so that some of its aspects will inevitably be missed when building an empirical specification. We try to be as rigorous as possible, drawing on the theoretical and empirical literature, and given our data constraints. We start with the well-known relationship derived from the Solow growth model:

$$GY = G(GK, GL, GA) \tag{2.1}$$

The growth rate of output depends on capital accumulation, the rate of technological progress and population growth. Arguably, GDP per capita growth is not the best measure of economic and human development. In particular, it says nothing about welfare or inequality.[12] C. Arndt, S. Jones, and Tarp (2015) address this criticism to some extent, by having as outcome variables other final outcomes (poverty, inequality and value added in the different sectors of the economy) as well as secondary outcomes (sub-components of GDP, components of government revenue and spending, aggregate education and health

[11] To be more specific, only the difference between remittances and ODA is statistically significant. The authors also add an 'FDI dependency" dummy, which is found to be positive and significant. When this dummy is included, the differences between the three coefficients become statistically significant.

[12] See for instance https://www.weforum.org/agenda/2016/01/gdp?utm˙content=bufferc1308&utm˙medium=social&utm˙source=facebook.com&utm˙campaign=buffer, last accessed on April 19, 2019.

outcomes and monetary and financial sector-related outcome). When data availability permitted, these outcome variables were also analyzed. The results, albeit preliminary, are available upon request.[13]

Population growth is considered to be exogenous in the short-term, and so it is directly included in the specification. The same cannot be said of capital accumulation and technological progress. The rate of capital accumulation could be measured by the gross fixed capital formation, which is widely available. However, including this variable directly might be problematic, notably because of reverse causality and omitted variables. A natural move would be to instrument it. Nevertheless, as will be clear later, a few variables will need to be instrumented in our regression. Thus, we choose to control for the *determinants* of the growth of capital stock. These are very likely to include aid and FDI (see section 2.2.1), but also government investment, institutions (financial and political, see for instance R. Bates, 2001), and catastrophes, be they natural or conflict-related (for obvious reasons). Hence, in mathematical terms:

GK = GK (ODA, FDI, government investment, institutions, catastrophes).

Technological progress, on the other hand, cannot be measured, so that it has to be proxied by other variables. Here, it will be broken down into technological level and human capital. Human capital itself is further decomposed into health and education components, simply because a more qualified and healthy labor force is likely to be more productive and to innovate more. Technology can also be imported from abroad, assuming the country is open to foreign influence. This idea is usually translated by the addition of a trade variable into the equation, whether it is the Sachs-Warner index or the sum of exports and imports in percentage of GDP. However, here, this kind of influence should be already captured by FDI. On top of that, as will be shown in the robustness checks section, the trade variable enters negatively and insignificantly in the model. For these reasons, it is not included in the core specification. So, in the terms of the model:

GA = GA (human capital[health, education], technology/FDI).

Finally, as underlined in section 2.2.1, FDI and ODA might have an impact on government spending, human capital and technology diffusion. The above relationships are therefore modified in the following way:

GK = GK (ODA, FDI, government investment (ODA), institutions, catastrophes).
GA = GA (human capital[health, education](FDI, ODA), technology/FDI).

These relationships are summarized in figure 2.3. The equation to be estimated is therefore

GY = G(ODA, FDI, institutions, government investment, catastrophes,
human capital[health, education], GL)

Now, these theoretical relationships must be translated into the available data. This is done in the next section.

[13]Overall, aid might positively affect a range of outcomes; namely, infant mortality, life expectancy, fertility, political constraints and investment. Nonetheless, both donors and recipient should be aware of a potential detrimental effect on the manufacturing sector. As to FDI, its impact on the recipients' economy is not likely to be limited to growth. Potential positive effects include an increase in primary enrollment, a decrease in under five mortality and perhaps an increase in investment. But it might also be detrimental to value added in the service sector.

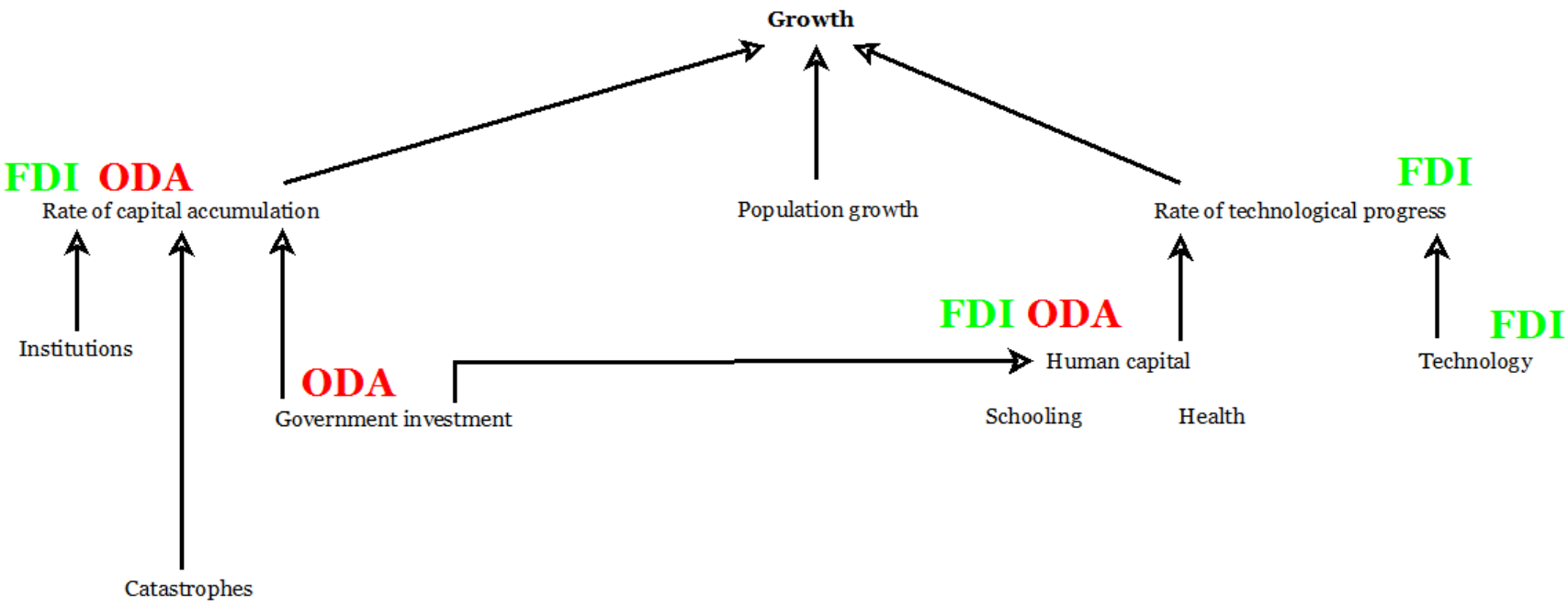


FIGURE 2.3: Summary of the relationships between the variables of the model

2.3.2 Specification: in practice

The data sources and precise descriptions of each variable are provided in the data appendix. Summary statistics are presented in table 2.1. The dependent variable is :

- **GDP per capita growth (annual %)**.

The variables of interest are the following.

- **ODA (% of GDP)**. ODA is expressed in percentage of GDP, in order to account for the economic size of the country.[14]
- **FDI (% of GDP)**. FDI is also expressed in percentage of GDP.

The controls included in the regressions are the following.

- **Capital stock accumulation (*GK*)**

  1. **Institutions: M2 (% of GDP)**. M2 refers to money and quasi money. This variable is included to provide a measure of financial development, also called financial deepening (Akinlo, 2004). Financial development should encourage investment and capital formation, so that its relationship with growth should be positive. On the other hand, more developed financial institutions might encourage capital flight, by facilitating international capital transfers to countries where risk-adjustment is higher (Akinlo, 2004). In this case, the relationship between growth and financial development would be negative.
  2. **Institutions: Political Constraints Index**. This index measures the feasibility of policy change, or the extent to which a change in any political actor's preferences may lead to a policy change. It ranges from 0 to 1, with higher scores indicating more political constraint. Higher scores would therefore indicate that changes in policy are relatively hard to implement, suggesting higher political stability, and consequently increased capital accumulation and growth.
  3. **General government final consumption expenditure (% of GDP)**. Of course, not all kinds of government expenditure will affect capital accumulation in the same way. Detailed and disaggregated data would have been ideal here, but it does not seem to be widely available for Sub-Saharan Africa.[15] A priori, the direction of the effect of government spending on growth is unclear. On the one hand, government consumption is likely to have a positive effect on human capital. On the other hand, according to Barro (1991) (cited in Gui-Diby, 2014), high levels of government consumption can also introduce distortions through taxation or spending programs. This would not contribute to private sector productivity and could therefore reduce economic growth. Ex ante, it is unclear which of these effects will dominate.
  4. **Catastrophes: Conflicts**. This is a dummy variable indicating whether a given country was involved in at least one conflict in a given year. Clearly, conflicts should negatively impact growth.

[14] In some papers, ODA is expressed per capita as opposed to divided by GDP. Although it is also informative, here the latter option is preferred for several reasons. In particular, as C. Arndt, S. Jones, and Tarp (2015) point out, the real cost of providing public services tends to increase with GDP. Hence, dividing ODA by GDP allows to isolate the economic relative purchasing power of aid.

[15] The most complete data came from the United Nations website (the World Bank, the OECD and the IMF websites were also checked), but using it would have meant leaving out at least ten countries from an already limited sample. Aggregated data were therefore preferred.

5. **Catastrophes: Natural disasters**. This is a dummy variable equal to one if at least one disaster occurred during the year. Again, it should negatively impact growth.

- **Population growth rate** (*GL*)

  1. **Population growth (annual %)**.

- **Technological progress** (*GA*)

  Human capital

  1. **School enrollment, primary (% gross)**. Secondary schooling is often used as a measure of human capital, but much of the data are often missing: for instance, in the World Bank data, about 43% of the observations are missing for Sub-Saharan Africa (37% for the sample used in the present study). Primary enrollment is more complete, with only 24% missing (18% for our sample), and therefore it is used as a proxy for human capital.
  2. **Life expectancy at birth, total (years)**. This variable is included in order to capture the health dimension of human capital.

The reader will notice that a few variables that are normally included in growth regressions are left out. This is the case for example of trade or globalisation, as mentioned earlier, but also of inflation. These variables are investigated in the robustness checks section. Their impact is found to be insignificant, hence their absence in the core specification. Remittances are also a good candidate for inclusion. As explained in section 2.2.2, many papers have started to take them into account, at the same level as ODA and FDI. They are not included in the main regression due to the lack of data availability. The most complete remittance data are compiled by the World Bank and has 34% of missing values for Sub-Saharan Africa.[16] When restricted to the sample of this study, there are still 30% missing. Hence, a remittance variable is only added in the robustness checks session, with caveats that will be explained below.

2.3.3 Data and missing observations

The dataset is an unbalanced panel consisting of 41 countries (N) observed from 1980 to 2012 (T). Prior to 1980, a lot of data are missing. In addition, many African countries became independent in the 1960s or 1970s, so that econometric analysis in this period may not provide insights for the present context. 2012 was chosen as a cut-off, as one of the variable from the Quality of Government institute (*political constraints*) was not available after 2012 at the time.

Not all of the African countries are included, for two reasons. One is that a small group of countries drastically affect the results, and are therefore excluded from the sample. These countries are Liberia, Equatorial Guinea, Comoros, Seychelles and Cabo Verde. The last three could be easily argued to be fundamentally different from the other African countries, being small islands with economies centered on tourism. This is not the case for Liberia and Equatorial Guinea. The reason why Equatorial Guinea might stand out from the sample

[16] To be specific, these data are World Bank staff estimates based on IMF balance of payments data. The variable is called *Personal remittances, received* and here we use the version in percent of GDP. It comprises personal transfers and compensation of employees. Personal transfers are also available, but 83% of the data are missing for Sub-Saharan Africa. Note that these availability figures were compiled at the time the paper was first written, which is mostly in 2015/2016.

Table 2.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
GDP per capita growth (annual %)	0.835	4.928	-29.674	30.344	1002
Net FDI inflows (% of GDP)	2.714	5.319	-28.624	46.494	1002
Net ODA received (% of GDP)	11.351	9.864	-0.252	74.137	1002
Conflict dummy	0.161	0.367	0	1	1002
Money and quasi money (M2, % of GDP)	28.862	20.209	0.831	151.549	1002
Population growth (annual %)	2.681	0.983	-6.342	10.258	1002
School enrollment, primary (% gross)	85.698	29.762	17.292	161.127	1002
Life expectancy at birth, total (years)	52.843	6.428	27.064	73.566	1002
Government consumption (% of GDP)	15.802	7.377	2.804	69.543	1002
Political Constraints Index	0.149	0.185	0	0.661	1002
Disaster dummy	0.614	0.487	0	1	1002
Donors' arms exports	1992998078.757	3098254408.747	-88277871456	8673222054	1002
Donors' ethnic fractionalization	0.149	0.478	-14.786	0.637	1002
Donors' tax revenue	24.617	112.452	-3521.526	127.086	1002
Donors' GDP per capita	23999.213	107163.932	-3354733.875	149600.096	1002
Donors' Pareto Lorenz coefficient	1.294	6.26	-195.729	10.291	1002
Donors' use of alternative and nuclear energies	15.03	69.775	-2170.87	91.808	1002
Donors' energy depletion	0.898	1.559	-23.543	16.588	1002

is the very low levels of foreign assistance. Indeed, the World Bank and the IMF have cut their foreign assistance programs in 1993, due to corruption and mismanagement. On top of that, Equatorial Guinea is now a middle-income country, rendering it ineligible for most donor assistance.[17] Liberia, on the other hand, relied heavily on foreign assistance, as is evidenced by figure 2.2. Indeed, the country has been at war during a great part of the period studied here. Hence, if Equatorial Guinea and Liberia might not be different at first glance, some elements do suggest that they are in fact outliers in the sample. The same could be argued of other African countries, notably South Africa. Nonetheless, removing it from the estimation barely affects the results, and so it is kept in the sample.[18] The main regression was also run on winsorized data, to ensure that extreme values were not driving the results.[19] The coefficient on *fdi* was found to increase with the level of winsorization, whilst remaining significant.[20] This could imply that countries with extreme observations are causing a downward bias on the coefficient in the regular estimation, and hence that the coefficient found previously is a lower bound of the effect of FDI on growth. Beyond that, the results were broadly unchanged, and are available upon request.[21]

The second reason why some countries and years are missing is simply a lack of observations. Table 2.2 displays the countries and years used in the estimation. As can be expected, missing data are often not random. For instance, Somalia is not included, which comes as no surprise given that it has long been a failed state. Rwanda also misses the years 1993-1996, which correspond to the genocide. It follows that the results of this study will not be applicable to those exceptional circumstances that disrupt data collection. But, even if the data were available, the results may not be very informative. Indeed, it is unclear what insights could be drawn from the estimation of a growth equation in a war-torn country or in a failed state. Nonetheless, log-interpolation was performed on the data and the results were found to be similar.[22]

The quality of the data can also be questioned. In particular, changes in the statistical definitions of ODA and FDI mean that the data are not homogeneous over the time period. For instance, in the case of ODA, the forgiveness of loans originally extended for military purposes was excluded from ODA computations only in 1992 (for more details on the historical ODA computations, see OECD, 2011). In addition, in the case of investment, 'round-tripping' may occur, whereby domestic capital is routed offshore and brought back as foreign investment. A way to reduce these biases is to consider them as measurement errors, and thus to instrument FDI and ODA. Incidentally, instrumentation can also mitigate the endogeneity issue. The latter is the object of the next section.

[17] See https://www.cia.gov/library/publications/the-world-factbook/wfbExt/region˙afr.html, last accessed on April 19, 2019.

[18] Results available upon request. The *fdi* coefficient is unchanged and significant at the same level.

[19] Winsorization consists in setting values beyond a chosen percentile to that specific percentile. For instance, a 5% winsorizing procedure on a variable sets all of its values below the fifth percentile to the value of the fifth percentile, and all values above the 95th percentile to the value of the 95th percentile.

[20] In what follows, the variables are written in italics and lower cases.

[21] To note perhaps is the potential underidentification in the case of the 5% winsorizing (as measured by the Kleibergen-Paap rank statistic), although the p-value is only slightly higher than the critical p-value, at 0.1003.

[22] Variables were first centered around 1, by subtracting the minimum and adding 1. Then, the log of each variable was taken. Linear interpolation was carried out using the Stata command *ipolate*. Then, the exponential of each variable was taken to come back to levels. Finally, the reverse of the transformation described above was carried out (i.e. adding the minimum and subtracting 1). Results are available upon request.

Table 2.2: Our sample

Country	Years available
Angola	2007-2011
Benin	1980 -2006 2008-2012
Botswana	1980-2009
Burkina Faso	1980-1996 1998-2012
Burundi	1985-1993 1995-2012
Cameroon	1980-1992 1994-2012
Central African Republic	1980-1992 2001-2012
Chad	1985-2012
Congo, Dem. Rep.	1980-1988 1990-1995 2002 2007-2012
Congo, Rep.	1980-2012
Côte d'Ivoire	1980-2003 2006-2012
Djibouti	1991-1992 1995-2007
Eritrea	1996-1997 1999-2011
Ethiopia	1992-2006
Gabon	1980-1989 1992 1994-1997 1999 2001-2003
The Gambia	1980-1997 2003-2012
Ghana	1980-1997 1999-2012
Guinea	1989-2011
Guinea-Bissau	1987-1989 1992-1998
Kenya	1980-1995 1998-2009
Lesotho	1980-2012
Madagascar	1980-1985 1988-1996 1998-2012
Malawi	1980-1996 1998-2002 2004-2012
Mali	1980-2012
Mauritania	1980-1991 2005-2012
Mauritius	1980-2012
Mozambique	1989-1995 1998-2002 2004-2012
Namibia	1991-2012
Niger	1980-2012
Nigeria	1981-1996 1999-2002 2004-2010
Rwanda	1980-1992 1997-2005
Sao Tome and Principe	2003-2005 2007-2012
Senegal	1980-2012
Sierra Leone	1980-1986 1988-1991 2000-2001 2011-2012
South Africa	1994-1995 1997-2009 2012
Swaziland	1980-2007 2009-2011
Tanzania	1990-2010 2012
Togo	1980-1992 1994-2007 2009-2011
Uganda	1985 1988-2011
Zambia	1980-1991 2010
Zimbabwe	1980-1993 1995-2003

2.3.4 Empirical strategy

2.3.4.1 The endogeneity issue

The aim is to evaluate the dynamic impact of ODA and FDI on GDP per capita growth. Admittedly, both are likely to have long-term effects on growth, especially ODA. Many of the benefits brought about by aid are likely to take years to materialize, not to mention the potential cumulative effects of aid. While this is likely to be the case, this type of long-term effects is not the focus of the present paper.

Going back to our empirical strategy, let us assume that the relationship between aid, FDI and growth is linear, so that from the initial equation,

GY = G(ODA, FDI, institutions, government spending, catastrophes, human capital, technology/FDI, GL).

the equation to be estimated becomes:

$$y_{it} = \alpha_i + \pi_t + \beta x_{it} + \gamma p_{it} + \delta e_{it} + \epsilon_{it} \tag{2.2}$$

where y_{it} is growth, α_i are country-fixed effects, π_t are time fixed-effects, x_{it} are the controls, $p_{it} = [FDI_{it}, ODA_{it}]$ and ϵ_{it} is the error term. e_{it} is defined below. Now, who are the players involved in this situation? The local government clearly plays the main role in the growth process, but is probably not the lead decision maker for the policies of interest, namely, FDI and ODA. Foreign investors and aid donors are more likely to be the key policy makers in that respect (see Azam and Laffont, 2003).

In fact, the main endogeneity issue stems from the fact that the latter act on preferences and variables that are unknown to the econometrician. Specifically, the foreign policy makers are assumed to observe both x_{it} and e_{it} before the beginning of the period, and to derive p_{it} from their observations (of x_{it} and e_{it}) and from their preferences, denoted θ_{it}. Then, at t, they observe y_{it}. On the other hand, the econometrician observes x_{it}, p_{it} and y_{it} at t, but never e_{it}, so that s/he cannot control for it. Thus, e_{it} embodies any piece of asymmetric information between the foreign policy makers and the econometrician: it could be a political characteristic, or insider information about the country's management. Such variables are likely to also affect growth, and hence cause an omitted variable bias. In addition, growth could be at the same time the outcome variable and a potential determinant of FDI and ODA. This kind of reverse causality would mean that any observed correlation between aid and growth would not reflect causation. Both issues will be addressed by our empirical strategy.

On top of that, in a process as complex as growth, the control variables may not be perfectly exogenous. Here, institutional variables such as financial development and the political institutions index are assumed to be more 'sluggish' than other variables in the model (Burnside and Dollar, 2000 make the same assumption). Thus, their endogeneity should be limited. Variables related to human capital are also assumed to be fixed in the short-run: massive gains in life expectancy or schooling cannot be expected to occur from one year to the next. A similar argument holds for the population growth rate. Natural disasters should also be exogenous. This leaves us with government expenditure, and conflicts. Regarding the former, there are no Keynesian mechanisms in African countries and no rigid nominal wages, so that government expenditure cannot be used to boost growth and therefore should be exogenous. Conflicts, on the other hand, could be triggered by a

bad economic environment or a lack of resources (e.g. when the government is unable to credibly commit to a transfer to a rebel group, see Azam, 2006). Hence, it is also considered as endogenous. The question now arises: how to take these endogeneity issues into account? Our preferred strategy will be a two-stage least squares estimation, with preference proxies as instruments.

2.3.4.2 A preference proxies strategy

The first thing to note is that in such a linear model, neither ordinary least squares (OLS) nor two-stage least squares (2SLS) will be able to identify the policy trade-offs, unless some extreme assumptions are made. The reader must therefore keep in mind that the results should be interpreted in terms of near identification. Still, 2SLS used with preference proxies as instruments can be shown to potentially narrow the identification gap, compared to OLS (Azam, 2016). Preference proxies are variables which are correlated with the policy makers' preferences θ_{it}, but not included in x_{it}. Of course, they must be correlated with the FDI and ODA flows, and uncorrelated with the recipient country's economic performance y_{it}. Which preference proxies might be relevant here?

First of all, the foreigners' own economic environment might affect the amount of funds sent abroad: if their economic climate is bad, FDI and ODA might be reduced. In fact, Chong and Gradstein (2006) found that richer countries are likely to provide more aid than poorer ones. Hence, donors' GDP is included as a preference proxy, (see also the paper by Bobba and Powell, 2007, who also use donor's GDP as an instrument). Admittedly, a bad economic environment is unlikely to be limited to donor countries and might also affect the recipient, making the exogeneity of donors' GDP questionable. Nevertheless, year dummies are included and would capture global economic booms or downturns. In addition, exogeneity tests will be carried out to make sure this is not an issue.

Chong and Gradstein's (2006) empirical findings also suggest that donors' tax revenues positively affect the aid disbursements, while inequality negatively affects them.[23] A simple explanation for the former would be that a higher tax revenue translates into a larger government budget, which means that more resources will be available for aid. In practice, larger government budgets do tend to be associated with larger aid budgets (Dreher and Langlotz, 2015). Furthermore, in a given country, a relatively large tax revenue compared to other years might be a consequence of a large tax burden for the period, meaning that investors might be looking abroad for opportunities and hence that FDI might increase. As to inequality, Chong and Gradstein (2006) explain its impact on aid in the following way: '... lower degrees of income inequality lead to more affluent, politically decisive voters and higher levels of political support for more generous giving.' Hence, the Pareto Lorenz coefficient is included as an instrument.

A less evident variable that could also have an impact on both ODA and FDI flows is the donor countries' population diversity, or ethnic fractionalization. In the case of ODA, Azam and Berlinschi (2010) show that donors manage to limit the migration flows through aid, so that countries with a relatively homogeneous population would tend to give more aid. Moreover, Dreher and Langlotz (2015) show that government fractionalization tends to increase governments' budget, and that in turn a larger government budget tends to increase the aid budget. In the case of FDI, it might be the case that people who migrated from a

[23] Note that Chong and Gradstein (2006) also find that government inefficiency in the donor country affects the disbursement of aid. This variable was also tried as an instrument, but it was found to be too weakly correlated with the endogenous variables.

recipient to a donor countries are more inclined to invest in their home countries: this is called diaspora investment. In practice, its importance is limited, but it does take place and hence might be a potential determinant of FDI flows (UNIDO, 2011).

Another important aspect to take into account for FDI is Africa's wealth in terms of natural resources. This means that investment might be driven by the investors' country's needs in that sector. Here, such needs are measured by energy depletion (as a percentage of GNI) and alternative and nuclear energy use (as a percentage of total energy use). Energy depletion refers to the value of the stock of energy adjusted for the remaining lifetime.

There still remains to find variables that could explain the occurrence of conflicts (although the previously described instruments could have an unanticipated effect on conflicts). Finding such preference proxies proves difficult, as donors are not likely to be directly involved in conflicts, except of course in colonization wars, most of which were finished by 1980. Nonetheless, they may be indirectly involved, notably by providing arms to one of the belligerent. Thus, donors' arms exports are also included as a preference proxy.

Now, how should these preference proxies be taken into account in the estimation? A strategy employed in a few other papers consists in exploiting a bilateral dataset. Such datasets are used to build fitted values for aid at the recipient/year level. In turn, these fitted values are used as instruments (see for example Rajan and Subramanian, 2008 and Dreher and Langlotz, 2015 for ODA). However, bilateral data for FDI are not as complete and not as insightful as that for ODA. About 27% of the data are missing for Sub-Saharan Africa (compared to pretty much 0% for ODA) and more than 70% of the non-missing data are made up of zeros (the figures are similar for the sample used in this study). This strategy would therefore be impossible to replicate in our setting, and so an original alternative is proposed here. In a nutshell, the instruments are weighted averages of the main donors' characteristics, with the weights being a proxy for each donor's involvement with each recipient country.[24] Let us be more specific. First, take the five top ODA donors in each country and for each year.[25] These donors (d) are likely to have historical relationships and strategical motives in each recipient country (r) and are therefore also likely to invest there. In fact, the top investors and the top donors in Sub-Saharan Africa are often the same countries: Europe (particularly the U.K.), and the U.S. (UNCTAD, 2014).[26]

For each of these top five donors, the proportion of aid supplied in a given recipient-year is computed (aid supplied by donor over total aid received by the recipient for a given year and from all individual donors, or $Prop_{drt} = Aid_{drt}/\sum_d Aid_{drt}$). This provides a proxy for the involvement of each donor with each recipient country, relative to other donors. This proxy is then multiplied by a preference proxy variable ($Preference_{dt}$), i.e. a variable which could affect one of the endogenous variable from the donor's perspective, such as GDP ($I_{drt} = Prop_{drt} \times Preference_{dt}$). The idea behind this is that the preference proxy variables are likely to affect the recipient proportionally to the involvement of the donor. The product

[24]This is similar to how C. Calderón and Nguyen (2015) create their index of the growth of trade partners, used as a control in the second step of their estimation. This index is a weighted average of the country's trade partners' growth, where the weights are the share of the country's export to the partner.

[25]Using three or one donors does not yield exploitable results. In particular, with three donors, the results are very similar but the p-value of the under-identification test is 0.4465, indicating that the instruments are not sufficiently correlated with the endogenous variables. This suggests that the characteristics of all five top donors are necessary to explain FDI, ODA and conflicts.

[26]See also https://www.aiddata.org/ and http://www.oecd.org/dac/stats/statisticsonresourceflowstodevelopingcountries.htm (Table 29 with the Net Disbursements of ODA to Sub-Saharan Africa by donor), last accessed in 2015.

of this multiplication (I_{drt}) is then summed across the five donors for each recipient-year, providing an index for each recipient-year (for a given r and a given t, $index = \sum_{d=1}^{5} I_{drt}$). Thus, for each recipient-year, there are in total seven of these preference proxy indexes, plausibly correlated with the endogenous variable and exogenous to the recipients' growth process. These are used as instruments.

One potential issue with this strategy is that we are instrumenting ODA with variables which contain the sum of all of the ODA. However, only the bilateral aid is taken into account in the instrument, whereas in the aid variable, all aid is included, whether bilateral or multilateral. In addition, if the instruments were to be too correlated with the aid variable, they would be detected as endogenous in the statistical tests, which is not the case (see section 2.4.2). But, to be sure, the instruments are also computed using a simple 'order weight". That is to say, the top donor was assigned the number one, the second highest donor the number two, and so on. The weight was computed by subtracting this order variable from six and then dividing by fifteen. The results will be presented in the robustness checks section.[27] Nonetheless, there are still potential issues to keep in mind when assessing and interpreting the results, and this is what is covered in the next paragraphs.

2.3.4.3 Potential issues with the 2SLS solution

First of all, the fact that three variables are considered to be endogenous complicates identification. This is clearly something that needs to be kept in mind when going through the results. On the other hand, if a variable is treated as exogenous when it is actually endogenous, the parameters will be inconsistent, which might be more problematic. The removal of *conflicts* may not solve the problem, as it may cause an omitted variable bias. Therefore, it seems that having three endogenous variables is the least questionable solution.

Second of all, there is a trade-off involved with the number of instruments used. On the one hand, the instruments should explain as much as possible of the variations of the endogenous variables, and so, the more instruments the better. However, 2SLS estimators that are based on many identifying restrictions can cause finite sample problems (Wooldridge, 2002). Given the large number of instruments, this should also be kept in mind.

Hence, the results presented here must be taken with a pinch of salt. But so far, it has proved difficult, if not impossible, to come up with a specification that would resist all criticisms, especially in the aid literature. The added value of this paper is not to provide a flawless strategy, but simply to propose a new methodology that allows to estimate the effect of FDI and ODA on growth and that can bring some new evidence to the literature. Furthermore, the fact that the specification passes all the tests of instrument validity can provide us with some confidence that our results are relatively robust.

[27] There are other ways of including the preference proxy variables in the model. One possibility is to include directly the donors' variables into the first stage, without the weights. This raises the issue of the number of instruments: indeed, seven variables for five donors make thirty five excluded instruments, which is too large. Another possibility is to have only the top donor's preference proxies, but then the explanatory power of the excluded instruments would be low (see footnote 25). Another idea would have been to use fixed shares of aid throughout the estimation. However, this raises the issue of which year to take to compute the aid shares. Although the main donors remain the same throughout the years, their shares of aid have shifted since 1980. For instance, the United States wasn't always so involved in aid giving. Using fixed shares of aid would neglect this dimension.

2.3.4.4 Final empirical considerations

Given that $N > T$, this panel is taken to be short and so the methods relevant for such a data structure are applied (see Cameron and Trivedi, 2009, chapters 8 and 9). Consider once again equation 2.3.4.1. α_i are country specific effects, which are likely to be correlated to the regressors. In particular, geographical characteristics are fixed over time and probably have an impact on many covariates. For instance, whether a country is landlocked is likely to affect the inflow of FDI coming to the country. This would suggest that a fixed effect model would be preferable to a random effect model. Finally, according to Wooldridge (2002), econometric analysis of large geographical regions conceptually violates the random sampling assumption, as units are not likely to be independent. Adding time dummies addresses this concern to some extent, as it captures continent-wide effects on top of worldwide business cycles.

2.4 Findings and their robustness

2.4.1 Main results

All the estimations were carried out on Stata 13, using the command *xtivreg2* written by Schaffer (2012). Column (1) of table 2.3 shows the base results. The first stage equations are provided in section A.2 of the appendix. Briefly, all of the instruments used are significant in at least one of the first stage equations, except for *donors' use of alternative and nuclear energies*. Removing it barely affects the results: the coefficient of *fdi* drops to 0.7389 but remains significant a the 5% level (p-value of 0.05). It is retained as an instrument in all future estimations, as it still provides some explanatory power. There are, however, a few surprises in terms of signs and significance. This suggests that although donors' characteristics do affect FDI, ODA and conflicts, they might do so by other channels than those described in section 2.3.4.2. That said, the parameters from a first stage equation are mongrel parameters and do not reflect causal effects, so that no definite conclusion can be drawn from their analysis (see Azam, 2016).

Let us now come back to the main results from table 2.3. One thing to look at before going to the analysis of the results is whether the instruments are good, in the sense of identification and orthogonality. The bottom of the table indicates that the specification passes the test of underidentification, which is here the Kleibergen-Paap rank statistic, as well as the Hansen test of instrument validity. Even though this is no definite proof, it can provide some initial confidence as to the orthogonality of the set of instruments. Of course, more tests will be carried out in the robustness checks session, after the results' description.

The coefficient for *fdi* is quite large and significant. The magnitude indicates that a one percent increase in FDI inflows (in percentage of GDP) would increase GDP per capita growth by almost one percent, which is sizeable, but not out of line with existing findings. For instance, Gui-Diby (2014) finds that the coefficient on FDI roughly ranges between 1.80 and 2.00. In the paper by Ndambendia and Njoupouognigni (2010), it ranges between 0.07 and 0.19 whereas Nwaogu and Ryan (2015) find it to be 0.40. The coefficient for *oda* is however much lower in magnitude and not significant, contrary to the findings by Ndambendia and Njoupouognigni (2010) but consistently with the findings of Nwaogu and Ryan (2015). A one percent increase in ODA (as a percentage of GDP) would increase GDP per capita growth by less than 0.01%. The effect of *conflicts* is negative but non-significant. This may be due to the fact that when conflicts are a real impediment to growth, data collection stops, so

Table 2.3: Robust 2SLS and LIML estimation with GDP per capita growth as dependent variable (with year dummies)

	(1) 2SLS	(2) LIML	(3) FLIML
Net FDI inflows (% of GDP)	0.8329**	1.1568*	1.0258*
	(0.3884)	(0.6446)	(0.5326)
Net ODA received (% of GDP)	0.0078	-0.0172	-0.0071
	(0.2049)	(0.2937)	(0.2552)
Conflict dummy	-2.9285	-3.7218	-3.4093
	(5.9281)	(10.2984)	(8.3664)
Financial development (M2, % of GDP)	-0.0863***	-0.0809**	-0.0831**
	(0.0285)	(0.0353)	(0.0323)
Population growth (annual %)	-0.7394**	-0.7395*	-0.7394*
	(0.3575)	(0.4139)	(0.3894)
School enrollment, primary (% gross)	0.0016	0.0019	0.0018
	(0.0178)	(0.0224)	(0.0204)
Life expectancy at birth, total (years)	0.1271	0.0862	0.1027
	(0.0795)	(0.1097)	(0.0961)
Government consumption (% of GDP)	-0.1108*	-0.1249*	-0.1192*
	(0.0569)	(0.0737)	(0.0665)
Political Constraints Index	5.3458***	6.7427**	6.1789**
	(2.0694)	(3.0022)	(2.5892)
Disaster dummy	-0.1802	0.0173	-0.0623
	(0.5629)	(0.7455)	(0.6663)
Observations	1002	1002	1002
F-test	3.2474	2.5288	2.7965
F-test p-value	0.0000	0.0000	0.0000
Weak Ident.	1.4259	1.4259	1.4259
Underident.	10.3936	10.3936	10.3936
Underident. p-value	0.0648	0.0648	0.0648
Hansen J stat.	3.7117	2.6535	3.0403
Hansen p-value	0.4464	0.6174	0.5511

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.010$

that those episodes are not included in the dataset. Nonetheless, the weak-identification robust tests of joint significance of the endogenous regressors all suggest that the endogenous regressors are significant.[28] Hence, the specifications might suffer from weak identification. This issue will be further explored in section 2.4.2.1.

The other significant variables are *financial development*, *population growth*, *government consumption* and *political constraints*. They all have the expected sign. The sign of government consumption was uncertain, and the results indicate that it is negative. This might mean that in African countries, government consumption might introduce distortions, as mentioned in section 2.3.2. The effect of financial development could also have gone either way, and here the coefficient is negative, as in Akinlo (2004). This suggests that financial development could increase capital flight. Note also that the magnitude of the *political constraint* index is quite large: a one-standard deviation increase would raise GDP per capita growth by at least 0.9990% (0.185 times 5.3458).

2.4.2 Robustness checks

2.4.2.1 Econometrics-based checks

To start with, the validity of the instruments should be further investigated, both in terms of exogeneity and in terms of strength. Regarding the former, a few tests can be carried out beyond the Hansen test statistic. One widespread strategy is to compute the C-statistic (or difference-in-Sargan statistic). In Stata, this test is easily obtained by adding the option *orthog* to the command *xtivreg2*. Another possibility, which is perhaps less sophisticated, is to simply add the instruments, one by one, in the second stage rather than the first. Finally, C. Arndt, S. Jones, and Tarp (2010) suggest to save the residuals and regress them against the excluded instruments. Our specification passes all three tests.[29]

The result of the Kleibergen-Paap rank statistic test of underidentification is reported in table 2.3 and suggests that the specification does not suffer from underidentification. All first stage equations individually pass the first-stage Angrist-Pischke chi-squared and F tests of underidentification and weak identification, respectively. However, the Kleibergen-Paap test statistic for weak identification from table 2.3 is quite low. Stata does provide the Stock and M. Yogo (2005) critical values, but these are only valid for i.i.d. errors, which isn't the case here. Hence, weak identification might still be an issue. But there exists other estimation methods which are more robust to weak identification than 2SLS. This is the case of the limited-information maximum likelihood (LIML) and of Fuller's modified LIML estimation techniques. Table 2.3 therefore presents the 2SLS findings along with those obtained using the two LIML estimations, with LIML results in column 2 and Fuller's modified LIML results in column 3.[30] The coefficient of *fdi* is slightly larger than with 2SLS, but remains a similar size. The *oda* coefficient, however, becomes negative, but remains insignificant and of extremely small magnitude. Thus, overall, the results are similar, suggesting that weak identification is probably negligible.

[28] These are the Anderson-Rubin Wald F and Chi square tests and the Stock-Wright LM S statistic, with p-values of respectively 0.0482, 0.0372 and 0.0357.

[29] Results available upon request.

[30] In Fuller's modified LIML estimation, the alpha parameter is chosen to be one, providing estimates that are approximately unbiased (Davidson and MacKinnon, 2003).

Next, the instrumented variables are tested to check whether they truly are endogenous, using the Hausman test.[31] The Hausman test is carried out by manually performing the control function approach. That is to say, the residuals from the first stages are saved and plugged into the second stage regression, along with the endogenous variables. The Hausman test consists in testing whether the three residuals are jointly significant. This is the case here, with a p-value of 0.0855. The Hausman test also provides some further reassurance as to the relevance of the instrument, as it shows that the correction provided by 2SLS compared to a simple OLS is effective.

The data were also tested for autocorrelation, and the null hypothesis of no serial correlation was rejected.[32] Following Burnside and Dollar (2000) and Gohou and Soumaré (2012), the equation is estimated using the Newey-West robust method. Indeed, robust estimations based on the Newey-West (or Bartlett) kernel provide standard errors and statistics that are robust to heteroskedasticity and arbitrary autocorrelation. Several bandwidth were tested, and the results with the bandwidth 2, 3 and 4 are displayed in the appendix table A.2.[33] The specification now fails the test of underidentification, although not by much (with p-values ranging from 0.1029 to 0.1305, depending on the bandwidth). Otherwise, the results are mostly unchanged. This suggests that serial correlation should not highly affect the results. If one was worried about the underidentification result, simply dropping the instrument *donors' use of alternative and nuclear energy* allows the regression to pass the underidentification test and does not change the results.

So far, econometric analysis has provided some evidence as to the exogeneity and explanatory power of the instruments. Of course, one can never be certain, but the fact that the specification has passed a large number of very diverse tests can provide some confidence as to the validity of the empirical strategy. To go further, C. Arndt, S. Jones, and Tarp (2010) suggest to test whether the results hold across various estimators with differing properties. The results obtained with LIML and Fuller's modified LIML were shown in table 2.3. Results obtained with two-stage GMM (GMM2s) and continuously-updated GMM (CUE) are displayed in appendix table A.3. The *fdi* coefficients are remarkably stable, evidencing the robustness of the findings across estimation methods. The only changes with respect to the 2SLS estimation are that *oda* has a negative, but small and insignificant effect on growth, whereas *life expectancy* becomes significant with GMM2s.

2.4.2.2 Robustness to specification and data changes

All of the robustness checks are performed using 2SLS, and their results can be found in the section A.2 of the appendix. We will first describe changes with respect to the instruments, followed by changes in the specification.

First of all, it might be interesting to vary the set of preference proxies. Indeed, the 2SLS regression analysis provides a Local Average Treatment Effect, so that trying different preference proxies would allow to have a more general idea of the effect of aid and FDI on

[31] Another similar test proposed by Stata is based on the difference between two C-statistics. It is obtained with the option *endog* available with *xtivreg2*. The results are the same as with the Hausman test.

[32] The post-estimation command *xtserial* written by Drukker et al. (2003) provides the result of the test proposed by Wooldridge (2002). This test consists in taking the residuals from the regression of the first-differenced variables and regressing them against their lags. Under the null hypothesis of no serial correlation, the residuals should have an autocorrelation of -0.5, so that the coefficient on the lagged residuals should be -0.5. *xtserial* carries out a Wald test of this hypothesis.

[33] Higher bandwidth gave similar results to the main regression, but with a slowly worsening underidentification p-value. The bandwidth is equal to one plus the maximum lag order of autocorrelation.

growth. Nonetheless, we quickly found that there was a core group of preference proxies without which the estimation failed. These are presented in column (1) of table A.4. They are the same as those used in the main regression, without *donors' inequality* and *donors' use of alternative and nuclear energies.* The results are very close to those obtained with the baseline specification, the *fdi* coefficient being of similar magnitude and the *oda* effect being negative, but small and insignificant. Additional, alternative instruments can also be used, as shown in columns (2) and (3) of table A.4. Column (2) shows results obtained with the set of preference proxies from column (1), plus *donors' largest government party orientation.* The reason this instrument was tested is that right-wing government might be less inclined to provide foreign aid than their left counterpart. With this preference proxy, the aid coefficient becomes positive again, albeit still not significant. In column (3), colony trends are included, on top of the instruments from column (1) of table A.4. Once again, the aid coefficient becomes positive but remains insignificant. All this variation in the *oda* coefficient suggests that the aid result might be highly dependent on the instruments used, and that in consequence a lot of care has to be applied in this respect. This also means that the present paper might not have used the preference proxies that best explain the aid variation.

Another way to vary the instrument is to change the weight in the computation of the preference proxy indices. Instead of using the aid shares, we use the simple numerical weight described in section 2.3.4.2 (that is to say, six minus the order of the donor, divided by fifteen). This addresses the concern of using a transformation of the *aid* variable in the instrument. The results are shown in table A.5. In the first column, the usual set of instrument is used, i.e. the one from table 2.3. Even though the results look unchanged, the Hansen test suggests that the instruments are not exogenous. A quick test with the 'orthog' option of Stata shows that it is the *donors' gdp* preference proxy which is responsible for this result. Thus, it might seem that despite all the tests performed above, *donors' gdp* may not be orthogonal. Perhaps its endogeneity was previously mitigated by the aid share variation. In any case, removing it allows the specification to pass the Hansen test. The *fdi* coefficient is now a lot higher and a lot more significant, while the *aid* coefficient is positive and relatively large, but not significant. There is no notable change apart from these two results. This addresses to some extent the concern that *donors' gdp* might be endogenous, since the results still hold, even without it (although dropping *donors' gdp* with the aid share instrument does change the results a lot, with *fdi* losing its significance and the *p*-value for the underidentification test rocketing to 0.72).

Let us now examine whether the main findings are robust to the addition and replacement of some variables. Results are shown in the appendix table A.6.

To start with, most papers usually control for the importance of trade. There are multiple ways to control for this, and here we use the sum of exports and imports as a percentage of GDP. The results are displayed in column (1). There are no notable changes, and *trade* enters the equation insignificantly and with a negative sign, contrary to what is expected and usually found (although Adams, 2009 also finds a negative coefficient, significant or not depending on the specification). This might be due to the *fdi* variable capturing countries' international openness. Removing *fdi* indeed changes the sign of *trade* and allows it to become significant (although in this specification, the Hansen test fails).

Inflation is also often included in growth regressions as a proxy for macroeconomic instability (Ayanwale, 2007; Asiedu, 2006; Gohou and Soumaré, 2012). Column (2) of table A.6

shows the results when inflation is added to the specification. The first thing to notice is that the specification suffers from underidentification (as assessed by the Kleibergen-Paap rank statistic, with a p-value of 0.4444). *inflation* itself is negative and insignificant, as well as very low. Finally, the coefficient on *fdi* increases and remain significant, whereas *government consumption* loses its significance. Perhaps *inflation* and *government consumption* proxy for the same government behavior.

As explained in section 2.2.1, remittances now constitute an important financial flow into Sub-Saharan Africa and as such, are more and more included in the growth regressions that compare FDI and ODA. The issue here is that remittances are likely to be endogenous, particularly in terms of reverse causality. For instance, low growth in the home country might give incentive for people to migrate and send remittances back home. In this framework, it means that remittances should be instrumented. The instruments included before should also affect remittance flows, notably *donors' gdp*, which might attract migrants, and *donors' fractionalization* which might proxy for the extent of migrant networks in the donor country. But simply adding a *remittance* variable to the specification yields unreliable results: although the specification passes the Hansen test, it fails the Kleibergen-Paap rank statistic of underidentification (with a p-value of 0.8507). The *fdi* coefficient drops to 0.0225 and becomes insignificant, while *oda* and *remittances* are negative (-0.4608 et -0.6186, respectively) and insignificant. In order to still have an idea of the relative impact of each capital flow, *conflicts* is temporarily dropped from the list of endogenous variables. As mentioned earlier, this is likely to cause inconsistency in the parameters, so that the result are not fully reliable. The results of this specification change are shown in column 3 of table A.6. The coefficient for *remittances* is negative and non-significant. *fdi* is, however, of roughly the same magnitude as before and significant at the 10% level. A surprising result is that *political constraints* is not significant anymore, for the first and only time in any of the growth equations presented here. It is unclear why this might be the case and what mechanisms are at play here. Perhaps this is due to *conflicts* not being instrumented. In any case, it seems that the FDI result is robust to the inclusion of remittances, with the caveat described above.

As was seen in section 2.2.1, FDI in Sub-Saharan Africa is largely driven by natural resources. Therefore, columns (3) and (4) show the results when total natural resources rents and oil production are controlled for, respectively. There are no notable changes for the variables of interest in either specification. To note is the positive and significant coefficient of the *oil production value* coefficient, meaning that oil production has a positive impact on growth, independent from that of FDI.

2.5 Conclusion

This paper set out to evaluate the relative impacts of ODA and FDI on growth in Sub-Saharan Africa. To do so, the empirical strategy relied on the two-stage least squares methodology. Excluded instruments were found by looking at the political and economic relationships between the sources and the recipients of those international flows. To be more specific, donors' GDP, inequality, tax revenue, ethnic fractionalization, energy needs and arms exports were taken into account. Of course, no estimation is immune from concern, but the specification was found to pass all tests of exogeneity and underidentification, and the LIML estimations suggested that weak identification should not be too much of an issue. The results were also replicated with a variety of changes, both in terms of econometric estimation and in terms of specification. The main finding is that FDI has a positive dynamic impact on economic growth, contrary to ODA, which seems to have no such impact.

Several conclusions can be drawn from this result. The first one, and perhaps the most evident, is the necessity to take FDI into account in any growth regression, particularly one involving Sub-Saharan Africa. But the most important conclusion of the paper is probably that aid is not the only way that developed countries can act to contribute to developing countries' development, at least in Sub-Saharan Africa. In particular, it is possible that the positive effect of aid on growth found in some papers comes from potential positive feedback on FDI and negative feedback on conflicts. Yasin (2005) did find some evidence of such a positive relationship between ODA and FDI in Sub-Saharan Africa, although Chauvet and Mesplé-Somps (2006) didn't. In any case, FDI could potentially be a way forward. To come back to the introduction, this result can therefore provide some confidence as to the initiatives taken by the E.U. and the U.S. to create more investment links with Sub-Saharan African countries. Whether what is being done at the moment is optimal is another question, left to further research. Further understanding of how exactly FDI (and ODA) might affect growth could provide some insights in this respect. Is it through capital formation, or technology transfer? Does it improve the business environment? Answers to these questions should be of great interest, policy-wise.

Indeed, if this paper provides some answers, it also raises some questions. Two in particular come to mind. The first relates to the type of FDI inflows. Indeed, if FDI as an aggregate has a positive effect in growth, is it the case of all types of FDI, in all sectors? Going back to the discussion of section 2.2.1, this is unlikely to be the case, especially with regards to FDI related to natural resources extraction. The impact of both FDI and ODA may also be different in different countries. For instance, Klobodu and Adams (2016) found the effects of FDI and ODA to be negative in Ghana, contrary to our results. The second concern is related to the size of the FDI flows to Sub-Saharan African countries. These flows are huge, in relation to the economic size of these countries. Is there a risk that the recipient becomes dependent on these flows? Might they crowd out local investment and local initiative? The results by Adams (2009) suggest this might be the case. On the other hand, perhaps foreign investors are in a better position to invest in Sub-Saharan Africa. Indeed, investment there might be risky, so that it may be preferable for a bigger, more diversified foreign investor to take this risk, rather than a relatively small local investor. But this might backfire, since such high risk-high return strategies might not benefit the local citizens, as exemplified in Azam, Biais, and Dia (2004) for the West African banking sector. Hence, is there a way to reap the benefits of FDI without endangering the long-term development of its recipients? Future research should also investigate such long-term measures, and in particular what they might be and when they should be enforced. Examples of such an initiative include Malaysia and Angola. In Malaysia, companies must reserve a fixed percentage of ownership shares to purchases by the Bumiputra ethnic group, in order to encourage their participation in the economy.[34] In Angola, foreign investors have to team with local partners (UNCTAD, 2014). Even though this policy might be detrimental in the short-run[35], it might yield substantial benefits in the longer-run. But will it? Are there other ways? Such interrogations are crucial, and an answer is necessary before any policy recommendation can be made.

[34]See https://www.state.gov/e/eb/rls/othr/ics/2012/191191.htm, accessed on January 9th, 2018.
[35]FDI in Angola was negative in 2012, see figure 2.2.

Chapter 3

The New Mercantilism: An Hourglass Approach to Global Value Chains

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Mercantilism is the term coined by Adam Smith to refer to the dominant economic doctrine from the sixteenth to the late eighteenth century. According to this doctrine, the states should be aiming to enrich themselves by encouraging exports and restricting imports (LaHaye, 2008). At the time, trade was believed to be a zero-sum game, so that a country's gain was another country's loss (LaHaye, 2008; Findlay and O'Rourke, 2007). Governments also had to give something to their mercantile class, in exchange for the taxes and levies they paid to finance the nations' armies. Payback took the form of policies to protect the merchants against foreign competition (LaHaye, 2008). Hence, to maximize trade rents, governments had a double incentive to limit the competition faced by their merchants. This incentive translated into laws such as the Navigation Acts in England, but also into the creation of national trading companies like the Dutch East and West Indies Companies, and even military interventions and wars (see for example what the Western Squadron was up to in the English Channel and the Western coast of Europe in the eighteenth century). The number of traders between the Southern colonies and their Northern 'motherland' was therefore artificially low.

Today, in a few sectors and markets, commodities are produced in the global South by small producers, and consumed in the North, where they are transported and transformed by a small number of intermediary firms. The resulting trade structure is therefore comparable to the one prevailing during the Mercantilist era.[1] It can be compared to an hourglass: many producers on one end, many consumers at the other end, and a bottleneck in-between, enjoying a dual position of oligopoly and oligopsony. Buyer concentration and multiplicity of suppliers are notably found in the supply chains for cocoa, coffee, tea, sugar, cotton, bananas and various legumes and grains (De Schutter, 2010 and Asfaha, 2008, cited in Podhorsky, 2015). These goods are often impossible to produce in the North, due to climate necessities or to the labor intensity of the production, and are therefore produced in the South. There, small producers are often more efficient than large-scale firms. On the other hand, two factors have contributed to the emergence of a bottleneck downstream from farmers. First, an expansion in the scale of operation of manufacturers has led to the domination of few large-scale primary processors that were able to meet the manufacturers'

[1] We are only comparing the resulting trade structures, and abstract from the policies that led to it.

volume and timing requirements (Deardorff and Rajaraman, 2009).[2] Technological developments also allowed the development of large scale operations. Second, and at the same time, state buying agencies in producing countries were being closed to comply with structural adjustment programs (Deardorff and Rajaraman, 2009). They had offered farmers guaranteed minimum price and buying quotas. Together, these two forces reinforced the trend towards the hourglass trade structure. Three examples of such value chains are outlined below: cocoa, coffee and cocaine. At this point, it is worth emphasizing that this hourglass comparison is a simplification of the actual structure of value chains. As is illustrated in appendix B.1 for cocoa and coffee, there are usually a few players between producers and intermediary firms, and between intermediary firms and consumers. The exact organization can also differ from country to country. Here, we focus on the 'meso-level' interactions between Southern producers, intermediary firms and Northern consumers, and leave aside the 'micro' and country-specific aspects of value chains. However, our framework is general and flexible enough that adjustments can be made to fit more specific contexts. In any case, as will be clearer in the next sections, these 'hourglass' value chains are becoming a key element in the economic fabric of developing countries. For instance, cocoa farming contributes to the livelihoods of forty to fifty million people, according to a 2012 World Cocoa Foundation report.[3] For them, cocoa often constitutes the main or only source of cash income (Gayi and Tsowou, 2016). Understanding the mechanisms of the value chains to which they are the basis is therefore crucial. This is all the more so if the firms they sell to are in a position of oligopsony, as is the case in hourglass value chains. This makes the study of these value chains crucial to the discipline of development economics.

The purpose of the present paper is to develop a unified and flexible theoretical framework to study these 'hourglass' value chains. We propose a two-sided, Cournot competition model of oligopsony and oligopoly. This model is then confronted to the case studies of cocoa, coffee and cocaine. Beyond the (unintended) alliteration, these are an unusual combination to study together. The reason for our choice is simply to exemplify the range of situations our model can apply to. Our objective is to have a global North-South theoretical scheme framing our reasoning and allowing us to ask good questions. In a sense, the method of this paper is close to the analytic narrative approach, developed by R. H. Bates et al. (1998). This methodology combines analytical tools drawn from economic theory and political science with the narrative form, more frequent in history (R. H. Bates et al., 1998). The aim is not to derive any 'universal laws of human behavior', but to use game theory and rational choice theory to identify and study the mechanisms that give rise to particular outcomes. In the words of the authors, 'By modelling the processes that produced the outcome, we seek to capture the essence of stories.'

The paper starts by a short review of the relevant literature in section 3.1. We explain along the way how our contribution fits into this literature, and how it may complete existing insights. In section 3.2, we introduce the three case studies that will be confronted to our model: cocoa, coffee and cocaine. The model is introduced in section 3.3, and an example of its comparative statics are developed in section 3.4. We make the number of intermediaries vary, and see how producers, firms and consumers are impacted. We apply our analysis to the cocaine 'sector' and the War on Drugs, and show how the latter did not have the expected effect. Section 3.5 shows how the model can be adapted to fit a situation where the Southern country imposes a minimum price. We demonstrate how a minimum

[2]Primary processors are for example cocoa grinders, which transform the cocoa beans into an intermediate chocolate product.

[3]Available from http://www.worldcocoafoundation.org/wp-content/uploads/Cocoa-Market-Update-as-of-3.20.2012.pdf, and last accessed on June 3, 2017.

price often leads to excess supply of the primary commodity, and can be highly detrimental for farmers. We apply the framework to the example of the 2016-2017 cocoa crop in Côte d'Ivoire. In the last part of the section, we compare the minimum price system with a quota system, like the one implemented by the International Coffee Association (ICO) between its creation in 1963 and 1989, and show how this quota system allowed to avoid many of the pitfalls of the minimum price solution. Finally, section 3.6 concludes.

3.1 Theoretical literature related to global value chains

Of course, the present paper is related to the trade-theoretic literature on value chains. This strand of literature has focused on different aspects of a value chain, and has studied it under a variety of names (fragmentation, outsourcing, trading tasks...). Some papers have concentrated on incorporating the idea of international fragmentation of production processes into neoclassical trade models, and have studied its impact on specialization, factor prices and welfare. Examples of such contributions are S. W. Arndt (1997), R. W. Jones and Kierzkowski (2001), Deardorff (2001), Grossman and Rossi-Hansberg (2008) and Feenstra and Hanson (1997). Another strand of literature has looked into the international organization of production, i.e. questions of firm location and vertical integration or arm's length contracting. This is notably the case of Grossman and Helpman (2005), McLaren (2000), Antràs (2003) and Antras and Helpman (2004).

Now, how does our contribution fit in this literature? Obviously, we also construct and study a theoretical model of trade. However, unlike most of the frameworks cited above, ours does not belong to the pure-competition tradition of trade models. As will be clear further on, our model is set up in a two-sided Cournot competition setting. Neither is it a general equilibrium model, like in Antràs (2003) or Grossman and Helpman (2005). We also do not seek to answer the same questions. For example, we do not look at vertical integration or location; rather, location and arm's length contracting are exogenously imposed. We also do not investigate country specialization or factor prices. Overall, our model is not as general as those cited above: it focuses on one specific type of value chains, namely, the 'hourglass" shaped ones described earlier (i.e. with industrial concentration in the middle, and many atomic producers and consumers at either end). In that sense, the papers most closely related to the present work are outlined below.

3.1.1 Theoretical literature on buyer concentration in value chains

Deardorff and Rajaraman (2009) develop a theoretical model to study the implications of buyer concentration in primary commodity markets in developing countries. More specifically, they study the impact of an export tax imposed to mitigate buyer power, and find that although the tax reduces the quantity exported even more, it allows the supplying country to extract some of the intermediaries' profits. If it is set at an appropriate value, the tax can benefit all factor owners through redistribution. Deardorff and Rajaraman's set-up is quite similar to the one that will be presented here: there are many producers in the South, with one or few intermediaries that sell the commodity on the world market. In their introduction, the authors even make the parallel between current buyer concentration in those market and the concentration in colonial times, citing the British East India Company as an example. Nonetheless, there are a few differences. The main one is that while Deardorff and Rajaraman (2009) focus on an export tax, the present framework is more general. Furthermore, in Deardorff and Rajaraman's model, the intermediaries are price-takers in the international market. Here, we assume that they can sell directly to consumers and that they can affect the price at which they sell their final product. This allows to study together

the two types of market power the intermediaries can exert (see section 3.2 for evidence). Details of the models also differ. For instance, in Deardorff and Rajaraman (2009), the intermediaries do not process the commodity, i.e. they do not have a production function. Here, they do. While this is not undertaken in the present paper, this feature allows to study the impact of the transformation carried out by intermediaries (transformation v.s. retailing) and the impact of returns to scale. Finally, at no point do we look at general equilibrium effects, whereas Deardorff and Rajaraman (2009) do it in the last section of their paper.

Oladi and J. Gilbert (2012) build on the work by Deardorff and Rajaraman (2009) and consider the same value chain structure, but introduce the fact that the number of supplying countries is low.[4] In such a context, the government must act strategically both with respect to intermediaries and with competing suppliers. The export tax is found to be beneficial only if the export supply is sufficiently elastic. Otherwise, a subsidy is best. The work by Kireyev (2010) is close to that of Oladi and J. Gilbert (2012), since he looks at modeling the export tariff for a large country, under both perfect competition and oligopsony. Both models are then calibrated for the case of cocoa exports from Côte d'Ivoire. He finds that a country in a position to influence a commodity's international price can use an export tax to alter the terms of trade in its favor. The welfare impact of such a tax is not necessarily positive in the large exporting country, but even if it is, it will be at the expense of its trading partners. While considerations related to the concentration at the level of supplier countries are obviously relevant and necessary, we do not take it into account in the model presented here. Instead, we focus on 'meso' interactions between producers, intermediaries and consumers. In other words, we look at another aspect of value chain relationships, complementing the work of Deardorff and Rajaraman (2009), Oladi and J. Gilbert (2012) and Kireyev (2010).

Podhorsky (2015) also studies how market power in value chains can be inefficient and inequitable, but instead looks at the Fairtrade program as a potential solution. The theoretical set-up differs slightly from the papers above, for one main reason: the chain is modeled in its entirety, from producers to consumers. Farmers market their raw commodity to oligopsonistic intermediaries, who then sell it to monopolistically competitive final good producers on the world market. In the last stage, consumers purchase the final good from the latter. The preferences of the consumers are modeled, notably with respect to certification. In that sense, Podhorsky's paper is closer to our contribution, since we also include consumers in the model (as opposed to letting intermediaries sell in the competitive world market). However, we model their preferences in a much more basic way. Podhorsky (2015) finds that the program does decrease the market power of intermediaries, and hence that even the wage of farmers who do not participate in the certification program is increased. The model also evidences a trade-off between improving the efficiency of the raw commodity market and maximizing the welfare of consumers.

Conversely, Swinnen et al. (2015a) and Swinnen et al. (2015b) show how smallholders can benefit from inclusion in international value chain, even in the presence of monopsonistic/oligopsonistic buyers. Indeed, market imperfection in developing countries gives an incentive to buyers to engage in interlinked contracts with their suppliers, providing them with inputs in order to enable high-standard production. But contract enforcement issues raise hold-up opportunities on both sides. In particular, the suppliers may have incentives to side-sell or to divert the inputs to other uses. Thus, the buyer may choose a self-enforcing

[4]Examples of such value chains structure are soy bean, rice, wheat and coffee (to a lesser extent) (Oladi and J. Gilbert, 2012).

contract, and pay the supplier an 'efficiency premium" in order to make sure s/he will comply. In such settings, buyer competition might even harm suppliers, since it can threaten the feasibility of contracts through various channels (including reducing the reputational cost of hold-up, for instance). This analysis demonstrates the necessity of studying the micro aspect of a value chains, including the local legal environment and input markets, and is clearly very informative as to what goes on at the producer/intermediary level. But it is silent on the consumer side of the value chain. In comparison, our work 'de-zooms", so to speak, to look at meso-level interactions between producers, intermediaries and consumers. Hence, these two approaches can complement each other.

Finally, it follows that the present paper is also linked to the literature on price transmission along the chain. Theoretical contributions include Swinnen et al. (2015c) and Fafchamps and Hill (2008). The former looks at price transmission in the context of interlinked contracts under the circumstances described above, and shows how the possibility of hold-up makes price transmission non-linear. Specifically, if buyer hold-up dominates, suppliers might indeed lose out under weak price transmission. However, if supplier hold-ups dominate, weak price transmission might benefit them. On the other hand, Fafchamps and Hill (2008) study why the farm-gate price of Ugandan farmers is not responsive to international price changes. They develop a model, which they then test with survey data. They uncover that this lack of responsiveness is due to the entry of traders, taking advantage of farmers' ignorance of international price. Hence, in this instance, more competition at one of the intermediary levels prevents farmers from benefiting from increases in prices. These two pieces of work differ from the present paper, as they are clearly more micro-oriented. They demonstrate the need for a good knowledge of the specifics of each value chain to understand its inner workings.

Next, we turn to the description of the cocoa, coffee and cocaine value chains.

3.2 Some 'mercantilist' value chains

3.2.1 Cocoa

The cocoa tree thrives in tropical areas (Gayi and Tsowou, 2016), and so production is concentrated in a few developing countries. In 2012, Côte d'Ivoire, Ghana and Indonesia accounted for respectively 34%, 15% and 15% of the world production (Poelmans and Swinnen, 2016). 90% of the world cocoa supply is grown by smallholders, who cultivate less than ten hectares and often rely on family and informal labor (Fold and Neilson, 2016). They are more competitive than commercial plantations, due to high labor costs, high risks linked to pests and diseases, and modest economies of scale (Fold and Neilson, 2016). Moreover, they do not always go through cooperatives. In Côte d'Ivoire, for example, 80 to 85% of cocoa is produced by individual farmers who do not belong to any cooperative or organization (ILRF, 2014, cited by Gayi and Tsowou, 2016). On the purchasing side, marketing channels for cocoa beans are often controlled by a limited number of agents (Gayi and Tsowou, 2016).

The largest players in the cocoa chains are grinders and manufacturers. Grinders manage the early processing stages of cocoa as well as the production of industrial chocolate. Manufacturers focus on the manufacturing and marketing of final chocolate products (Araujo Bonjean and Brun, 2016). The latter are then usually sold through grocery retail channels (Gayi and Tsowou, 2016). Both the grinding and the manufacturing segments are highly oligopolized, with a handful of multinational companies controlling large shares of

the market (Barrientos, 2016).[5] For grinders, three companies were handling 54% of total grindings in 2014/15 (Barry Callebaut, Cargill and ADM, Gayi and Tsowou, 2016).[6] Note also that, as pointed out by Deardorff and Rajaraman (2009), market segmentation means that producers in any single country are more likely to deal with one rather than several buyers. As to manufacturers, Mars Inc, Mondelēz International Inc., and Nestle SA had market shares of respectively 9, 8 and 6% of global confectionery sales (Gayi and Tsowou, 2016). Although the concentration in the manufacturing sector is not as high as in the grinding sector, market differentiation can play a major role, notably through branding and product innovation (Araujo Bonjean and Brun, 2016). Finally, and in line with the mercantilist comparison, chocolate is mainly consumed in Northern countries, as evidenced by the map shown in appendix B.2.1.

As is well known, industrial concentration is not necessarily harmful to consumers or producers. For example, an industry with economies of scale may be more efficient if it is concentrated. This seems to be the case for chocolate (Gayi and Tsowou, 2016; Fold, 2002). It is unclear, however, whether the resulting benefits are fairly passed onto the various stakeholders. Regarding farmers, the literature is inconclusive. Ajetomobi (2014), Anang (2011) and Wilcox and Abbott (2004) (all quoted in Gayi and Tsowou, 2016) find no evidence of any exercise of market power in West Africa, except in Côte d'Ivoire (Wilcox and Abbott, 2004; De Schutter, 2010). However, Traoré (2009) (cited in Gayi and Tsowou, 2016) argues that in West Africa, the cost savings were rarely passed onto farmers, even though concentration improved efficiency. On the consumer end, the price of the final product and its relationship with world market price would tend to indicate non-competitive behavior (Araujo Bonjean and Brun, 2016).[7]

3.2.2 Coffee

Like cocoa, coffee production is relatively concentrated in a few developing countries. The four biggest producers in 2016 were Brazil, Vietnam, Colombia and Indonesia, with respectively 36, 17, 9 and 8% of world production.[8] 80% of coffee farmers are smallholders, owning a few hectares of land or less.[9] The structure of the coffee chain is best explained by a quote by De Schutter (2010): 'Coffee is grown by about 25 million producers. At the other end of the chain, there are around 500 million consumers of coffee. Yet, just four firms carry out 45% of all coffee roasting, and only four firms carry out 40% of all international coffee trading.'

Hence, here as well, farmers sell their output to oligopsonistic intermediary traders, which supply the commodity to the world market. The traders take advantage of their marker power, and pay the farmers a price that is below their marginal revenue from selling on the world market (Podhorsky, 2015).[10] Trading companies include Gruppe, Volcafé and ECOM, which trade 50% of the world's green coffee beans (Panhuysen and Pierrot, 2014).

[5] Even though some firms span all the processes, most often two distinct types of firms focus on each industrial segment (Fold and Neilson, 2016).

[6] Cargill has since acquired ADM's chocolate business, see http://www.cargill.com/news/releases/2015/NA31877259.jsp, accessed on January 17th 2017.

[7] There is also anecdotal evidence of collusion. For example, in 2007, Cadbury tipped Canada's competition bureau that it had colluded with other firms (including Mars and Nestlé) to artificially raise chocolate prices in Canada (see http://www.confectionerynews.com/Manufacturers/Canada-chocolate-price-fixing-Mars-and-Nestle-win-evidence-battle, accessed on March 2nd, 2017).

[8] Percentages computed from the ICO statistics, available from http://www.ico.org/prices/po-production.pdf and accessed on August 3rd 2017.

[9] See http://www.fairtrade.org.uk/en/farmers-and-workers/coffee, accessed on August 3rd, 2017.

[10] see also Deardorff and Rajaraman (2009) for evidence on buyer collusion on the purchase price.

The green coffee is then sold to manufacturers. The latter roast and grind the beans, and sell the final product to consumers through supermarkets or grocery wholesalers (Podhorsky, 2015).[11] Here again, the industry is dominated by three very large transnational corporations (Nestlé, Mondelēz and DE Master Blenders 1753) and a few big coffee roasters (like Smucker's, Strauss, Starbucks and Tchibo) (Panhuysen and Pierrot, 2014). At this end of the chain, product differentiation among coffee brands allows the producers of final goods to set their consumer prices at a markup over their marginal costs (Podhorsky, 2015).

3.2.3 Cocaine

The cocaine market is evidently, and in many ways, very different from the cocoa and coffee markets. To start with, nowhere in the world are cocoa and coffee illegal, to the best of our knowledge. Nonetheless, as will be clear at the end of this section, their market structures are relatively close. Cocaine is a natural product extracted from coca leaves, and is produced almost exclusively in Colombia, Bolivia, and Peru (EMCDDA, 2016). In 2014, coca production was estimated to be of 69.1 thousands of hectares in Colombia, 42.9 in Peru and 20.4 in Bolivia.[12] In Peru and Bolivia, some coca growing is permitted, since coca leaves have an important cultural role when chewed or consumed as tea (EMCDDA and Europol, 2010; EMCDDA, 2016). They are also used to provide international soft drinks manufacturers with decocainised flavoring agents (EMCDDA, 2016). The chewing of coca leaves and the drinking of coca tea seem to be tolerated for some communities or regions in a few South American countries, including Colombia (EMCDDA and Europol, 2010). Nevertheless, cocaine itself is mainly consumed in the North. North America is home to 33% of the total global number of cocaine users. Western and Central Europe follows, with 20% of global users. South America, together with the Caribbean and Central America, accounts for 17% of global users (UNODC, 2017).

The production of cocaine takes place in three main stages. In the first one, coca leaves are transformed into coca paste. This requires little skill or financial investment, and it is often coca growers themselves who carry it out (EMCDDA and Europol, 2010). Most of them are small farmers, relying extensively on family labor (at least in Colombia, EMCDDA and Europol, 2010). Second, the coca paste is transformed into cocaine base. While this stage necessitates more skill and investment, many coca growers also take care of it (EMCDDA and Europol, 2010). Finally, cocaine base is refined into cocaine hydrochloride (the final product), using a complex process usually performed in jungle 'laboratories' by organised crime groups (EMCDDA and Europol, 2010). Bolivia, Colombia and Peru account for the majority of the global production of cocaine hydrochloride (EMCDDA, 2016), meaning that the raw commodity is mainly transformed in the South, and it is the final product that is exported. Finally, like cocoa and coffee, the cocaine market exhibits the hourglass shape, albeit through very different mechanisms. There is evidently a large smallholder base in the South and many consumers at the other end of the globe. The intermediaries in-between are also in limited numbers, but this time, the barrier to entry is violent and bloody competition.[13] In that way, the cocaine value chain is not unlike the mercantilist value chains of

[11] One key difference between coffee and cocoa is that coffee is also consumed in many producer countries. Notable examples are Brazil and Ethiopia (see appendix B.2.2).

[12] See https://www.washingtonpost.com/world/the˙americas/in-a-blow-to-us-policy-colombia-is-again-the-worlds-top-producer-of-coca/2015/11/10/316d2f66-7bf0-11e5-bfb6-65300a5ff562˙story.html?utm˙term=.64ad2803aa82, accessed on November 14th, 2017.

[13] See for instance Wainwright (2016), http://www.nytimes.com/2012/06/17/magazine/how-a-mexican-drug-cartel-makes-its-billions.html, or http://www.wsj.com/ad/cocainenomics/, both accessed on November 14th, 2017.

the XVIth-XVIIIth century. For instance, the Dutch East Indies Company massacred many competitors (especially from Britain), but also local producers.

This concludes the exposition of our case studies, and we now set up our model.

3.3 A Model of modern Mercantilist Trade

Assume that there are n identical intermediary firms, indexed by i. While this is a simplifying assumption, it does also hold some truth, as it seems that the biggest -and probably determining- industrial players within value chains are often close in size (see for example the section on cocoa). First, they purchase a quantity q_i^S of a raw commodity in the South, like cocoa in West Africa. They face the smallholders' supply curve, defined as

$$S\left(p^S,\sigma\right), \quad \frac{\partial S}{\partial p^S}\left(p^S,\sigma\right) > 0, \quad \frac{\partial S}{\partial \sigma}\left(p^S,\sigma\right) > 0 \tag{3.1}$$

where p^S is the price received by Southern producers and σ represents any exogenous factor affecting their supply, such as sustainability programs to boost the productivity of cocoa farmers. Second, the intermediaries transport the raw commodity to the North and incur an iceberg cost γ. For example, the cocoa beans are transported to the Netherlands for processing.[14] γ could encompass the transport cost itself, but also the transport technology, export and import taxes, or even the legality of the produce. In the case of cocaine, given the risks involved both with respect to the authorities and with respect to rival traders, γ could be modeled as relatively high. The intermediaries trade with an iceberg cost γ.[15] Third, they process or transform the raw commodities into a final product. For instance, the cocoa beans are first processed into the chocolate couverture (i.e. industrial chocolate), and then final chocolate products. Their production function is defined as

$$q_i^N = f\left(q_i^S,\theta\right), \quad \frac{\partial f}{\partial q_i^S}\left(q_i^S,\theta\right) > 0, \quad \frac{\partial^2 f}{\partial q_i^{S2}}\left(q_i^S,\theta\right) < 0, \quad \frac{\partial f}{\partial \theta}\left(q_i^S,\theta\right) > 0 \tag{3.2}$$

where q_i^N is the quantity of final good produced and θ represents any exogenous factor affecting production, such as quality standards. Notice that f is assumed to be displaying decreasing returns to scale. While increasing returns to scale are likely to be a more realistic assumption, it considerably complicates the comparative statics. We will discuss the results with increasing returns to scale when relevant. Finally, the intermediaries sell the final good on the Northern market, where they face a demand curve defined as

$$D\left(p^N,\delta\right), \quad \frac{\partial D}{\partial p^N}\left(p^N,\delta\right) < 0, \quad \frac{\partial D}{\partial \delta}\left(p^N,\delta\right) > 0 \tag{3.3}$$

where p^N is the price at which the final good is sold in the North and δ represents any exogenous factor affecting demand, such as health trends.

[14] In some value chains, the raw commodity is transformed in the South, and it is the final good that is transported in the North. As seen earlier, this is the case for cocaine. More and more cocoa grinding also takes place in cocoa producing countries (Poelmans and Swinnen, 2016). In any case, imposing the transport cost on the final good is a straightforward change.

[15] In some value chains, the raw commodity is transformed in the South, and it is the final good that is transported in the North. As seen earlier, this is the case for cocaine. More and more cocoa grinding also takes place in cocoa producing countries (Poelmans and Swinnen, 2016). In any case, imposing the transport cost on the final good is a straightforward change.

We assume that there is no free entry, and that intermediaries' choices have an impact on the prices they face.[16] In practice, entry is limited either by technological problems (e.g. technology may be protected), by scale economies, by more diffuse institutional problems (certification, etc.) or by violence, in the case of cocaine. We also assume away any collusion. The intermediaries face the following maximization problem:

$$\max_{q_i^S} p^N f\left(q_i^S, \theta\right) - \left(p^S + \gamma\right) q_i^S \tag{3.4}$$

subject to $p^N = D^{-1}\left(f\left(q_i^S, \theta\right) + \sum_{j \neq i} f\left(q_j^S, \theta\right), \delta\right)$ and $p^S = S^{-1}\left(q_i^S + \sum_{j \neq i} q_j^S, \sigma\right)$.

We only impose one condition for our hourglass equilibrium to exist: the absolute value of the elasticity of demand in the North (η^N) multiplied by the number of intermediaries (n) must exceed one ($\eta^N n > 1$). The reason will be clear soon. This is our equivalent to the existence condition on demand elasticity for a monopoly equilibrium. On top of this, supply must equal demand in equilibrium, in both the Northern and the Southern markets:

$$\sum_i q_i^{S*} = S\left(p^{S*}, \sigma\right) \tag{3.5}$$

$$\sum_i q_i^{N*} = \sum_i f\left(q_i^{S*}, \theta\right) = D\left(p^{N*}, \delta\right) \tag{3.6}$$

Since intermediaries are all identical by assumption, they will all buy and produce the same quantity, because of decreasing returns. Hence in equilibrium, we can write the total quantity supplied and produced as $S\left(p^{S*}, \sigma\right) = Q^{S*} = nq^{S*}$ and $D\left(p^{N*}, \delta\right) = Q^{N*} = nq^{N*}$. We can then derive the first order condition, given in Proposition 1.

Proposition 1 *The first order condition or price pass-through is*

$$p^{N*} = \frac{p^{S*}\left(1 + \frac{1}{\eta^S n}\right) + \gamma}{f'\left(\frac{Q^S}{n}, \theta\right)\left(1 - \frac{1}{\eta^N n}\right)} \tag{3.7}$$

where η^N and η^S are respectively the absolute value of the demand and the supply elasticities, which are given by:

$$\eta^N = -\frac{p^N D'\left(p^N, \delta\right)}{D\left(p^N, \delta\right)} > 0 \tag{3.8}$$

$$\eta^S = \frac{p^S S'\left(p^S, \sigma\right)}{S\left(p^S, \sigma\right)} > 0 \tag{3.9}$$

The detailed computations for the derivation of the first order condition are given in appendix B.4.

It is useful to represent this 'meso' equilibrium as shown in Figure 3.1.[17] The top right quadrant depicts the Northern market, with the consumers' demand curve, $D\left(p^N, \delta\right)$. The other curves in this quadrant will be explained in a moment. The bottom left quadrant shows the Southern market, with the Southern producer's supply curve S. These two quadrants are

[16] The case of perfect competition can be found in appendix B.3.

[17] This four-quadrant diagram is a variant of the one exposed by Marcus H. Miller in the appendix of Johnson (1971).

linked by two other quadrants. The bottom right quadrant is the industry-wide production function. Since all intermediaries are identical, it is straightforward to derive that $Q^N = nf\left(\frac{Q^S}{n}, \theta\right)$. The top left quadrant shows the marginal cost curve of the intermediary firm given by the first order condition (equation 3.7). For each p^S, it gives the p^N that maximizes the intermediaries' profits. Hence, this curve will also be called the price pass-through. It is more likely to be convex, since an increase in p^S leads to an increase in Q^S, and hence to a decrease in f', which is at the denominator of the pass-through. Therefore, it is assumed to be convex. The lighter curve shows the pass-through in the competitive case, for comparison purposes (see appendices B.3 and B.3.1). We now come back to the North-East quadrant, where the last two curves are nothing else but the intermediary's supply curves in the Northern market derived from the other quadrants - again, the lighter one corresponding to the perfect competition case.[18] The dotted paths correspond to the equilibrium path in both the competitive and oligopoly cases, and give the equilibrium quantities and prices. The computations regarding the curvature of the marginal cost curves in the top left and right quadrants are provided in appendix B.4.1.

Unsurprisingly, an oligopsony/oligopoly puts farmers at a disadvantage, since they sell less of their produce, and at a lower price than in the competitive equilibrium. The equilibrium quantity of the final product also diminishes, and is sold at a higher price. Hence, both producers and consumers are worse off under two-sided market power. The hourglass structure introduces an additional wedge between them. Their losses compared to the perfectly competitive case are shown on the graph by the lightly dotted rectangles and the darker triangles. Parts of these losses, i.e., the two rectangles, are captured by the intermediaries, who obviously benefit from this situation. Looking at world welfare, this two-sided market power results in (i) a dead-weight loss measured by the two darkened triangles, and (ii) a transfer from the South to the North, as long as the rectangle of losses in the South is larger than the dead-weight loss in the North.[19]

[18] To trace these supply curves, one starts by picking a quantity at random on the axis for the Northern consumers' demand and reports it on the lower right quadrant. One can then report the corresponding quantity Q^S on the downward y-axis, and deduce p^S through the lower left quadrant. The upper left quadrants allows to derive the corresponding p^N. Finally, the intersection of the horizontal dotted line at this given p^N and the vertical dotted line at the level of Q^N that was initially chosen provides one point of the intermediary firm's supply curve in the North East quadrant. Repeating the exercise several times for different initial quantities allows to have an idea of the shape of the supply curve of the intermediary firms.

[19] And if we consider intermediaries to be from the North (as they often are).

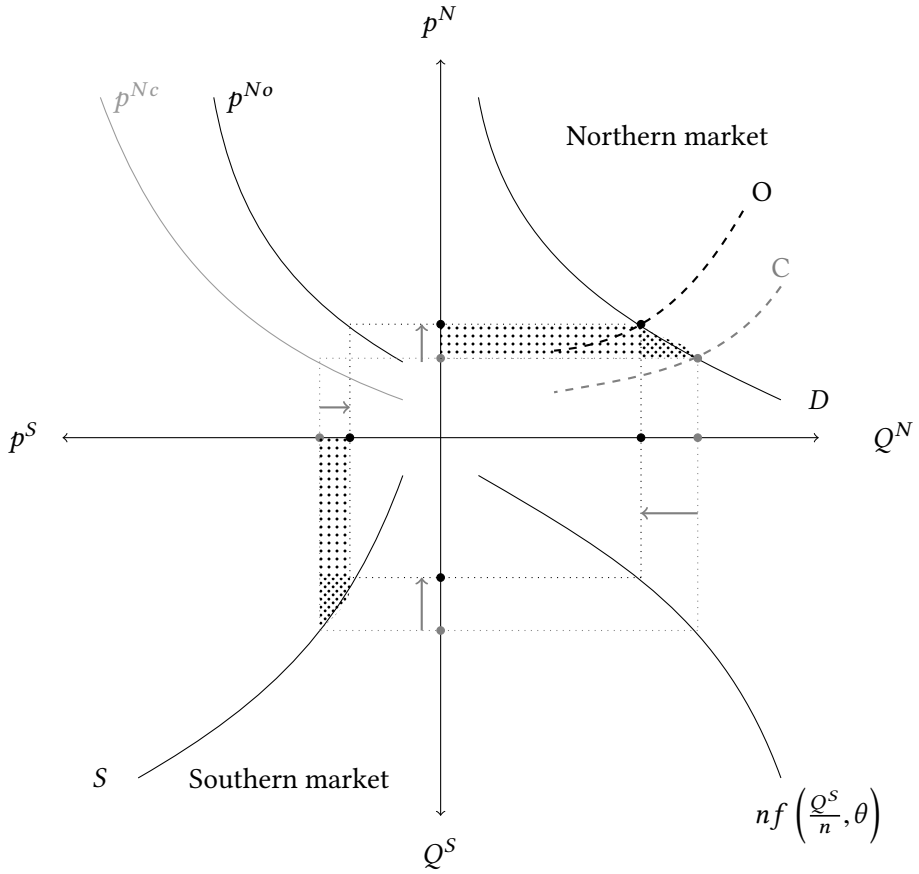


FIGURE 3.1: The impact of the hourglass structure compared to the perfect competition equilibrium

This concludes the description of our model. Next, we introduce some comparative statics.

3.4 Some comparative statics

We now vary the shift parameters of the model one by one and see how they impact its three agents. For brevity, we only look at one example: an increase in competition, i.e. an increase in n. The other comparative statics can be found in appendix B.5, along with some additional material on the comparative statics of n. The comparative statics of σ are the object of Galez-Davis (2018), in the context of the corporate sustainability initiatives in cocoa producing countries.

What happens when n increases? [20] [21] n appears in the industry production function (South-East quadrant), which it will shift outwards because concavity ensures that $f(\bullet) > f'(\bullet)\frac{Q^S}{n}$, but also in the price pass-through (North-West quadrant). Since f is assumed to be concave, the price pass-through will shift downward (the computations and graph are available in appendix B.5.1.1). This will result in the effects described in Proposition 2.

[20] We assume that an increase in n does not cause the market to reverse to perfect competition.

[21] While it would also be interesting to study the dynamics of n, this would take another paper. Moreover, in practice, entry to these industries tends to be barred by factors explained in section 3.3.

Proposition 2 *An increase in n causes a rise in Q^N and a drop in p^N. Either Q^S and p^S both increase, or they both decrease. A decrease in n causes the opposite effects.*

Hence, a rise in n has two effects on our supply chain. First, the lowering of the pass-through means that for a given p^S, p^N will be lower. Because of the increase in competition, firms must charge a lower markup. Second, the outward shift in the industry supply curve means that for a given Q^S, more Q^N will be produced. Admittedly, in many contexts, the assumption that quantities can adjust quickly is simplistic. In the case of cocoa for example, a new tree begins bearing pods after its third year and reaches full production in its fifth year. The same is likely to be true of cocaine: given the illegal nature of the product, quantities might take a while to respond to changes in contexts. This kind of considerations can be incorporated in the model by making S relatively inelastic.

If the first effect dominates, firms are keen to increase the quantity traded to increase profits, as they will not be able to charge consumers as much as before. They loose some of their market power, and with it their incentive to restrict purchases. p^N decreases and Q^N increases, but so do Q^S and p^S. The outcome gets closer to the perfect competition equilibrium. In fact, the perfect competition outcome is a special case of the hourglass case, in which n goes to infinity. Hence, Southern producers and Northern consumers are unambiguously better off. For the firms, the outcome will depend on the size of the elasticity of demand: if Northern demand is elastic or unit-elastic, profits decrease, but if Northern demand is inelastic, the change in profits is uncertain (see table B.8 in appendix B.5.1.1).[22] What is the intuition behind this last result? Why could profits increase? If the elasticity of demand in the North is large, the decrease in p^N has a large impact on the quantity demanded, and as long as the increase in costs ($\left(p^S + \gamma\right) q^S$) is not too large, the change in profits is positive.

If the second effect is relatively larger, firms are still able to charge a markup, and hence they still have an incentive to restrict their purchases to keep p^S down. Consequently, Q^S, p^S and p^N go down, while Q^N go up. If demand elasticity is equal to or above 1, profits increase (see table B.9 in appendix B.5.1.1).

Remember that these results hold under the assumption that f is concave, i.e. that f exhibits decreasing returns to scale. The reverse is not necessarily true when f displays increasing returns to scale. The industry's supply curve would shift downwards as n rises, but the change in the price pass-through is not so straightforward. Indeed, when f exhibits increasing returns to scale, the price pass-through can be either upward or downward sloping. And even when the price pass-through is upward sloping, a change in n has ambiguous effects on the first order condition. In sum, the effects of an increase in n under increasing returns to scale are uncertain, and may not benefit any of the players. But let us come back to our main analysis, with decreasing returns to scale.

The 'War on Drugs' actually provides a good case study for this comparative static. In his book, Cockburn (2015) explains how the Americano-Colombian strategy of the 1980s and 1990s to fight drug traffic massively backfired. The aim was to (quite literally) cut the heads of criminal organisations smuggling cocaine into the U.S.A. Once these heads were cut, however, it turned out that they had been quite efficient in limiting their competition. Indeed, once this barrier to entry had been removed, new intermediaries entered the market. This increased the amount of cocaine sold in the U.S.A., and decreased its price. A lot

[22] We assume that elasticities are constant throughout.

more cocaine was now available in America at a much more affordable price, which was not quite the aim of the initial policy. Citing the UN Office on Crime and Drugs, Cockburn (2015) reports that the US price of cocaine fell by 40% between 1990 and 2010, after 20 years of "the war against the kingpins". The same result transpires in the paper by G. Calderón et al. (2015), which shows that in Mexico, the same 'leadership strategy' had local 'hydra" effects and presumably increased intra- and inter-cartel violence, as well as violence against the population. There is even evidence of spillover effects in neighbouring municipalities. According to the authors, '...these increases in general violence might be explained by leadership removals damaging the chain of command that keeps local criminal cells more or less under control.'

Hence, our model is consistent with the increased amount of cheap cocaine available in the Northern market, since in both of the scenarios described above, the quantity of the final good increases and its price decreases. What is unclear is which scenario is applicable to this particular context. Still, if the first scenario analyzed above prevailed, the Southern producers may have benefited from this increase in competition (financially speaking, since supplying a drug cartel is probably not without danger).

The remainder of the comparative statics can be found in appendix B.5. The next section demonstrates another way in which the model can be exploited, by introducing a minimum price.

3.5 Imposing a minimum price for the raw material

3.5.1 Theory

Suppose that the government in the South imposes a minimum price for the Southern good. This is what Côte d'Ivoire started doing for cocoa in the 2011/2012 season. The government started setting a minimum guaranteed farmgate price based on the average price received from forward sales of the country's anticipated cocoa crop.[23] The Northern firms' maximization problem becomes:

$$\max_{q_i^S} p^N f\left(q_i^S, \theta\right) - \left(p^S + \gamma\right) q_i^S \tag{3.10}$$

s.t.

$$p^S = \max\left\{p_{min}^S, \quad S^{-1}\left(q_i^S + \sum_{j \neq i} q_j^S, \sigma\right)\right\} \tag{3.11}$$

$$p^N = D^{-1}\left(f(q_i^S, \theta) + \sum_{j \neq i} f(q_j^S, \theta), \delta\right) \tag{3.12}$$

Equation 3.11 shows that the firms loose their oligopsonistic power when they hit p_{min}^S. Proposition 3 gives the equilibrium conditions.

[23] See https://af.reuters.com/article/ghanaNews/idAFL5N1211LX20151001, accessed on November 6th, 2017.

Proposition 3 *In a minimum price equilibrium, the following three equations must hold.*

$$nf\left(\frac{Q^S}{n},\theta\right) = D\left(p^N,\delta\right) \qquad \text{(Northern market clearing)}$$

$$S\left(p^S_{min},\sigma\right) \geq Q^S \qquad \text{(Output ceiling)}$$

$$p^N \geq \frac{p^S_{min}+\gamma}{f'\left(\frac{Q^S}{n},\theta\right)\left(1-\frac{1}{\eta^N n}\right)} \qquad \text{(Pass-through floor)}$$

As long as $\eta^N n > 1$, the slope of the new first order condition is steeper than under perfect competition, but flatter than under oligopoly/oligopsony. Since there are three equations, two scenarios are possible, depending on the level of the minimum price chosen. Before looking into these scenarios, we investigate whether there is a second-best optimal minimum price, p^{S*}_{min}, that gets rid of the oligopsonistic power without creating additional distortions. p^{S*}_{min} solves simultaneously

$$nf\left(\frac{Q^S}{n},\theta\right) = D\left(p^N,\delta\right) \qquad \text{(Northern market clearing)}$$

$$S\left(p^S_{min},\sigma\right) = Q^S \qquad \text{(Southern market clearing)}$$

$$p^N = \frac{p^S_{min}+\gamma}{f'\left(\frac{Q^S}{n},\theta\right)\left(1-\frac{1}{\eta^N n}\right)} \qquad \text{(Pass-through floor)}$$

As shown in appendix B.6, such a point exists, under mild conditions for the demand function D. Proposition 4 summarizes.

Proposition 4 *The optimal minimum price exists and is the fixed point of the following mapping.*

$$p^{S*}_{min} = D^{-1}\left(nf\left(\frac{S\left(p^{S*}_{min},\sigma\right)}{n},\theta\right),\delta\right)f'\left(\frac{S\left(p^{S*}_{min},\sigma\right)}{n},\theta\right)\left(1-\frac{1}{\eta^N n}\right)-\gamma \tag{3.13}$$

Governments can set their minimum price at the optimum, but they can also set it above or below (as they often do). Hence, we have two possible scenarios, one which we will further decompose into two sub-scenarios. They are shown in figure 3.2, which holds everything constant but the minimum price.[24]

We first look at the case depicted in figure 3.2a, corresponding to a scenario where the minimum price is below p^{S*}_{min}. The imposed p^S means that intermediaries lose their incentive to restrict their purchases in order to keep the price down.[25] Instead, the intermediaries purchase more of the Southern commodity (Q^S), and hence they produce more of the final good (Q^N). This pushes down p^N. Consumers are very responsive to this decline, and

[24]The position of the new price pass-through relative to the perfect competition and oligopoly/oligopsony pass-through can also affect the outcome. This new relative position depends on the size of $\eta^S n$. If it is relatively large, the bracket multiplying p^S in the oligopoly/oligopsony price pass-through is relatively close to one. Hence, the price pass-through will not move a lot when a minimum price is imposed. The resulting distortion will be lower. In the remainder of this analysis, we assume a fixed minimum price pass-through relatively equi-distant from the two other pass-through curves. The competitive equilibrium is not represented on these graphs, as it is not needed for the analysis below (see figure 3.1 for how it would be represented)

[25]Note that this reasoning is similar to the analysis of Stigler (1946) in the case of a minimum wage.

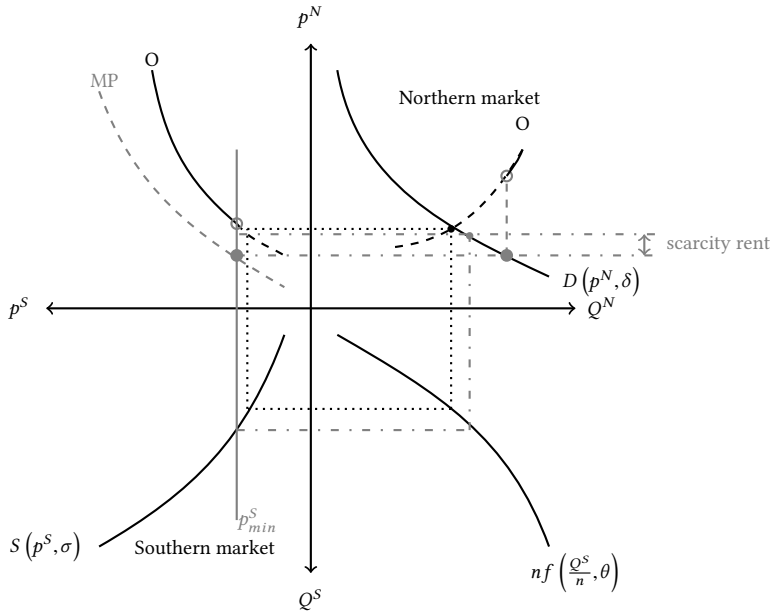
demand even more of the final good, which would result in excess demand if the Northern price did not adjust. As shown on figure 3.2a, p^N rises above the minimum price pass-through to equate demand of the final good to its supply. We call this 'the scarcity rent'. The equilibrium quantities and prices are shown on the graph by the dash-dotted lines.[26] Overall, producers and consumers are unambiguously better off, and intermediary firms should, at first sight, be unambiguously worse off, since p^S_{min} is, by assumption, not the profit maximizing price. However, recall that they pocket the scarcity rent from consumers (i.e. the increased p^N that equates supply to demand in the North), so the total effect on the firms' profits is not clear.

We now look at the opposite scenario, when the minimum price is above p^{S*}_{min}. We first look at the case when no rationing schemes is implemented (Benassy, 1982), while the next sub-section describes the use of producers' quotas. There are two 'sub-scenarios', depicted in figures 3.2b and 3.2c. Let's start with 3.2c, in which the minimum price is set beyond the level such that $p^N = p^{No}$. The very large p^S_{min} entices Southern producers to enter the market and/or produce more, resulting in a very high Q^S. Nonetheless, the higher price in the South also translates into a higher price in the North, and consumers demand less. In the end, the result is a large excess supply of the raw commodity. Southern producers who are the most remote or new entrants to the market with little connections are likely to be excluded. Everyone is worse off. In the long run, p^S cannot adjust, since it is already at its legal minimum value. p^N does not adjust either, since the Northern market is in equilibrium. Thus, either the minimum price must change, or the supply curve in the South must shift upwards. In the meantime, the excess supply is likely to rot. This scenario occurred recently in the Ivorian cocoa sector. The 2016 minimum price was set at a high level, following the previous years' relative scarcity. But the 2016-2017 crop was abundant, thanks notably to favorable weather. The price fell, and many exporters canceled their orders. This cocoa was put back on the market, and the Ivorian ports became congested with this extra supply.[27]

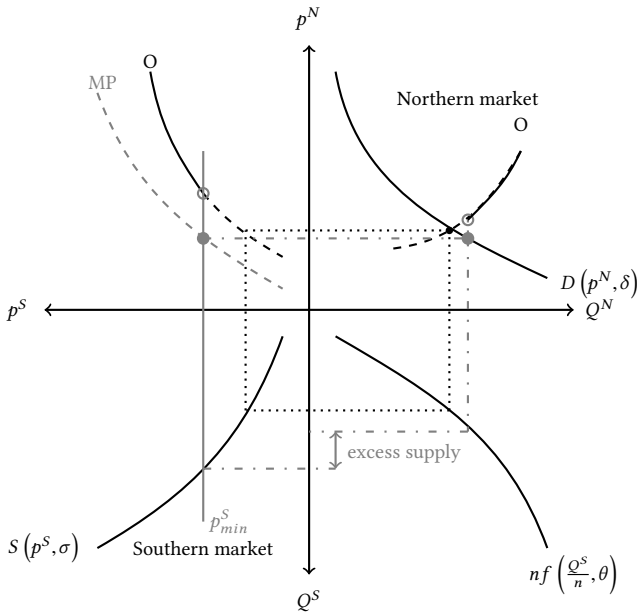
In the other sub-scenario, the minimum price is high, but below the p^S_{min} which equalizes p^N to p^{No}. It is shown in figure 3.2b. As in the previous case, the higher p^S entices raw-commodity producers to produce more, but not quite as much. p^N is also pushed down compared to the oligopoly case, but not down enough to equate demand to supply. Hence, we have excess supply once again. This time, however, it is not so large, and consumer and producer surpluses increase. In the long-run, the minimum price must change, or the supply curve in the South will shift upwards as producers will uproot their orchards.

[26] To be perfectly rigorous, this graph and the other ones should display the intermediary firms' supply curve in the Northern market. However, the graphs are already quite busy, and so these curves are not drawn.

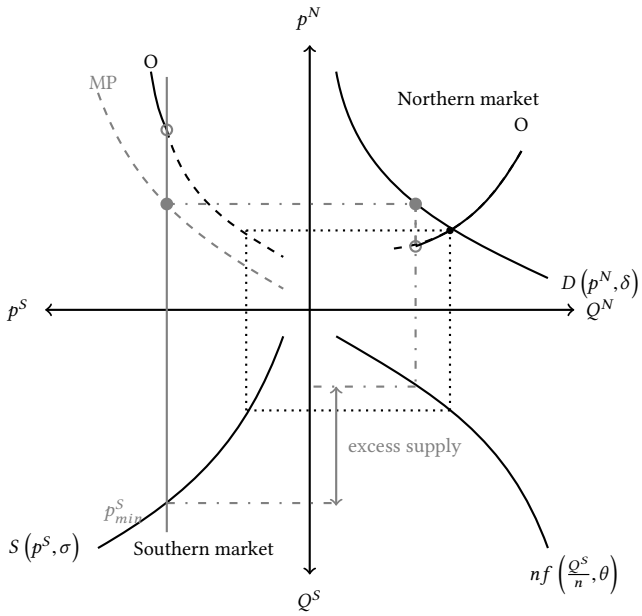
[27] See http://www.lemonde.fr/afrique/article/2017/02/16/comment-la-cote-d-ivoire-se-retrouve-avec-400-000-tonnes-de-cacao-qui-pourrissent-dans-ses-ports˙5080789˙3212.html, accessed on April 11th, 2017, and https://www.gro-intelligence.com/insights/ivory-coast-cocoa-prices, accessed on November 7th, 2017.



(A) The scarcity rent (a low minimum price)



(B) Excess supply (an intermediary minimum price)



(C) Excess supply (a high minimum price)

FIGURE 3.2: The scenarios of a minimum price

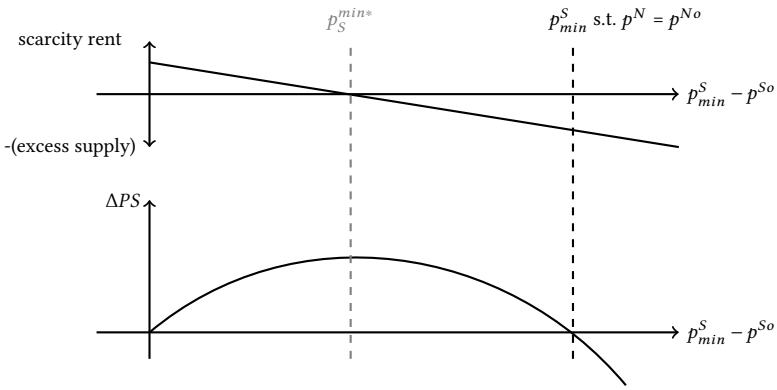


FIGURE 3.3: The optimal minimum price

Holding everything constant but p_{min}^S, the situation can be summarized as in figure 3.3. The scarcity rent occurs when p_{min}^S is 'too low', i.e. close to the original hourglass price, and excess supply occurs when it is 'too high'. The pivotal p_{min}^S is the optimal minimum price, p_{min}^{S*}.

What can we conclude from this analysis? First, in two out of the three scenarios (3.2a and 3.2b), this policy, devised to reduce market power in the South, also has beneficial effects in the North. Because intermediaries lose their incentive to exercise their market power in the South, they behave in a more competitive way in both markets. Further research could also investigate the dynamics of a competitive measure in the North, and its effect in the South. Second, when even the equilibrium price in perfect competition is low and does not yield a high enough income for the Southern producers, governments could be tempted to impose a much higher minimum price. But as shown in these last few paragraphs, having a very high minimum price can be counter-productive, not only for firms and consumers but also for the producers themselves. This is exemplified by the Côte d'Ivoire cocoa sector during the 2016-2017 season. In the case of crops like cocoa or coffee, diversification or seasonal migration to complete earnings may be interesting alternatives to consider. Section 3.5.2 looks into another system that has been used to guarantee producers a high enough farm gate price.

3.5.2 Quotas and the International Coffee Organisation

The narrative in this section is drawn exclusively from the works of Robert Bates on analytic narratives (R. H. Bates, 1998; R. H. Bates, 1999).

The ICO was created in 1963, following the first International Coffee Agreement (ICA) which entered into force in 1962. It brought together both coffee exporters and importers.[28] Nowadays, it counts 44 exporting members and 7 importing members (one being the European Union), which represent 98% of the world production and 83% of world consumption.[29] Between its creation and 1989, the ICO regulated the world's exports of coffee by imposing quotas (R. H. Bates, 1998; R. H. Bates, 1999). It first set a target price, between \$1.20 and \$1.40 a pound in the latter years, and then established quotas for each exporting country, to ensure the price target was met. If the market price rose above the range, quotas were relaxed, while they were tightened if the price fell below the range. In essence, they were

[28] See http://www.ico.org/icohistory˙e.asp, accessed on January 17th, 2018.
[29] See http://www.ico.org/mission07˙e.asp?section=About˙Us, accessed on January 17th, 2018

'prorationing' the supply of coffee.[30] For the big coffee producing countries, the aim was of course to secure a relatively high and stable world coffee price. On the other hand, it is less clear why consumer countries would support such a system. The answer is twofold. First, when they went to the United States to submit their proposals, the governments of Brazil and Colombia argued that high coffee prices would help address the communist threat in Latin America. Second, the big intermediary firms - including General Foods, Nestlé, Procter and Gamble - were able to sign bulk contracts with dominant producer countries at a discounted price. In the words of R. H. Bates (1998): 'By structuring the regulation of the market so as to increase the price of raw materials, and by securing rebates from the dominant producers of those raw materials, the larger roasters were able to increase the costs of raw materials to their competitors, thereby achieving a cost advantage.' Colombia was also happy: the country increased its sales by 17% in the North American market, and secured political services from General Foods. How? Because General Foods, as well as the other large roasters, were also lobbyists and members of national delegations. In particular, they assisted the United States government in maintaining and regulating the coffee trade. They were even critical players for the entry of the U.S. in the ICO, testifying before the Congress and contributing to secure its support.

In the model, firms would solve pretty much the same maximization problem as under the minimum price, except that p^S is the target, and Q^S is fixed. The situation is summarized in figure 3.4. Recall that in this quota system, if prices fell above the range of target prices, quotas were relaxed, while if they fell below they were tightened. We investigate the case where quotas are tightened following a drop in prices. We assume that they are binding, i.e. set at a level of quantities slightly below the equilibrium. Indeed, the quota does not remove the oligosponistic power, which is based on the ability to reduce purchases. We also restrict our analysis of the effect of the quota to a symmetric equilibrium without collusion among the buyers. The reason why will be clearer below. In the case that we are investigating, the quota imposes a new quantity Q^S to the buyer, which is lower than in the equilibrium. The quantity of coffee on the Northern market decreases, and its price increases. Normally, this would feedback in the South, through the pass-through, and stimulate supply. However, the quota restricts the quantity that firms can purchase. This is where we must assume that firms cannot collude on p^S, and that the raw commodity is auctioned off. Then, the quota creates a scarcity rent for producers, as shown on the graph.

Compared to the previous analysis of the minimum price, this quota system ensured that producers enjoyed a high and relatively stable price. In addition, in the minimum price system, in the case where there was a scarcity rent, it was pocketed by intermediaries; while in the quota system it is pocketed by producers. The quota system also limited the possibility of excess supply, since the quota was adjusted to take into account changes in economic conditions. As a practical comparison, we can try and imagine how the quota system could have been applied in Côte d'Ivoire in the 2016-2017 season. Recall that previous to 2016, Ivorian cocoa crops had not exactly been plentiful, leading to high producer prices. Quotas would have been relaxed, since the equilibrium would naturally ensure that prices were high. At the beginning of 2017, once it was clear that the crop was going to be much larger than anticipated, quotas could have been tightened. According to the model, this would have sheltered producers from the large drop in producer price that followed, by providing them with a scarcity rent. However, the quota system may not have solved the issue of excess supply in this case. It presupposes the existence of storage and preservation solutions, which were clearly absent in Côte d'Ivoire at the time.

[30] For a similar example with petroleum, see Yale Law Journal (1942).

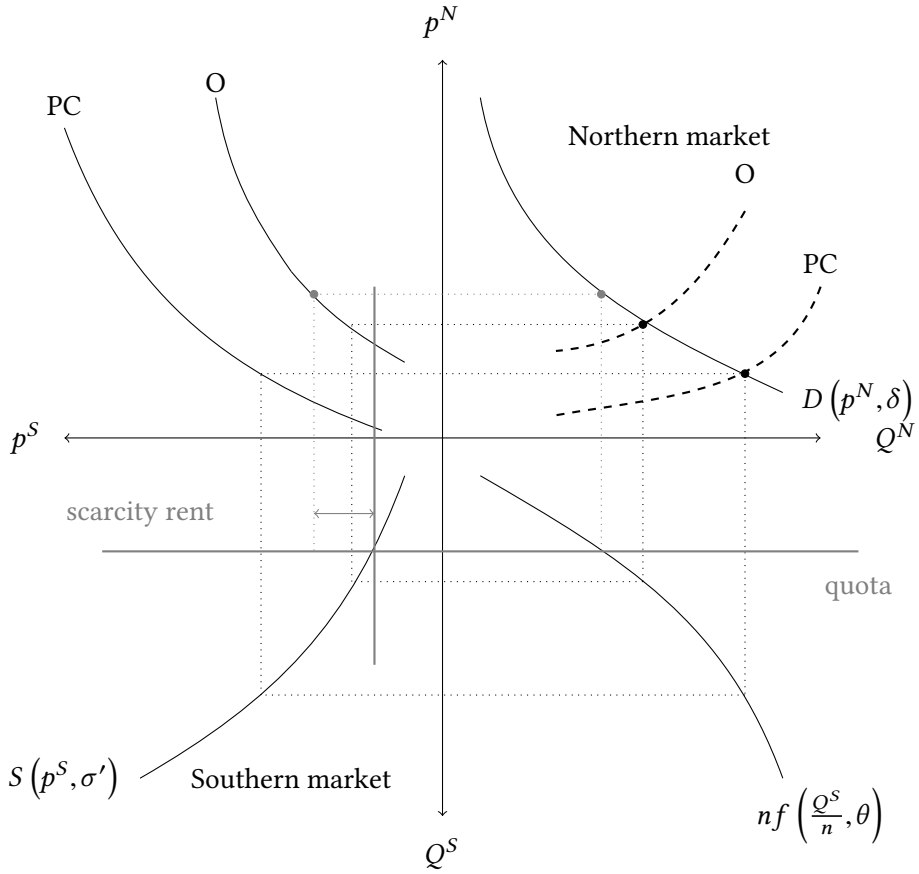


Figure 3.4: The coffee market regulated by the ICO in 1962-1989

The ICO eventually broke-up, for several reasons. First, the mix of coffees demanded by consumers changed, but the quota system did not allow to adjust to these new preferences. Second, because of the price differential between member markets and non-member markets, the large roasting firms were worried that their competitors would deviate and illicitly import coffee from non-member countries. It is in this atmosphere that, in the 1980s, two changes triggered defection (R. H. Bates, 1998). First, there was a 'large-scale movement of European roasters to Berlin, attracted by favorable tax policies.' Second, the European firm Nestlé entered the North American market, and the incumbents feared that Nestlé could access cheap coffee from the non-member countries of Eastern Europe. On top of that, by the late 1980s, the communist threat had pretty much disappeared. The United States therefore lost all incentive to support ICO and to regulate the coffee trade. On July 4th 1989, the International Coffee Council decided to suspend quota and control provisions, starting from October 1st, 1989.[31]

3.6 Conclusion

Many global value chains today have an 'hourglass' structure, with many producers in the South, many consumers in the North, and few intermediaries in between. Due to this similarity with Mercantilist trade, we have nicknamed this trade structure 'New Mercantilism'. We started by reviewing the relevant literature, explaining along the way how our paper compared with and complemented existing work. Then, we gave three detailed examples of sectors in which a 'mercantilist' structure prevails: cocoa, coffee and cocaine. After setting up the model, we showed two examples of comparative statics, which we applied to different case studies. Specifically, the model implied that new cocaine trafficking intermediaries benefited from the War on Drugs due to the increase in competition it caused. We also demonstrated another use for our framework, by studying the introduction of a minimum price for the raw commodity in the South. We showed how in some cases a minimum price can lead to excess supply, like for the 2016/2017 cocoa season in Côte d'Ivoire, and explained how ICO agreements between the 1960s and 1980s allowed to avoid that and to guarantee relatively high and stable prices for producers (drawing extensively on R. H. Bates, 1998).

As already explained, one key aim of the analysis carried out here is to ask good questions about the dynamics and interactions in 'hourglass' value chains. It follows that the results described above are not exactly findings, but rather avenues to investigate further and more rigorously. In addition, there are many other ways that the model could be extended. First, the minimum price was an instrument to reduce market power in the South. But what if firms have no market power in the North instead? Adding intermediaries may also be an interesting exercise. Nevertheless, even though it is flexible, the model does not (and cannot) apply universally. In particular, it does not allow to study other types of market power. For instance, product differentiation is a feature of many final goods markets, including coffee and chocolate. In that case, we would have to leave Cournot's framework to use the concept of monopolistic competition *à la* Chamberlain. Our model is also silent on micro-level issues like the ones raised by Swinnen et al. (2015d) and on general equilibrium effects. While these limitations must be kept in mind, this is a choice we made to keep our analysis relatively general and tractable. The main added value of our model is that it is simple but adaptable, thus allowing to study a wide array of applications and to investigate the main meso-level dynamics at play under today's New Mercantilism.

[31] More details at http://www.ico.org/icohistory˙e.asp, accessed on January 17th, 2018.

Chapter 4

In-House Sustainability Initiatives in the Chocolate Value Chain

A few years ago, there was a 'cocoa scare' that the world might be running out of cocoa. The falling productivity of existing plantations coupled with the rise in chocolate demand in industrializing countries like China and India meant that the world cocoa supply was threatened.[1] The firms of the sector are too aware of the social and economic issues plaguing their supply chain. More details will be given in section 4.3.2, but in brief, productivity on cocoa farm is low, farmer incomes are low, the sector is not attractive to the younger generation, etc. And there are of course the issues of child labor that were exposed in the early 2000s.

The biggest firms of the sector - Nesté, Mondelēz, Mars, etc. - have responded to these concerns. They all now have their own sustainability cocoa program. But their strategies are not exactly the same. Some firms rely mainly on independent certification like Fairtrade, but still have sustainability programs on the grounds to help provide infrastructure to communities (Mars, Cargill). Others use independent certification schemes to some extent, but their sustainability strategy also includes a sustainability label, with which products can be stamped. What does this entail, exactly? How do they differ from certification schemes? Why do firms not entirely rely on certification schemes? The present article delves into these questions. Given the scale of the cocoa sector in producing countries, the threats faced by the sector and the lack of evidence regarding these in-house sustainability programs, these are important questions to address. This article provides a background for future research, and some clues as to where to look for answers.

Before getting to the heart of the matter, let me clarify some definitions of the key concepts used here. First, I follow Auriol and Schilizzi (2015) to define *certification* '... as a process whereby an unobservable quality level of a product is made known to the consumer through some labelling system, usually issued by a third independent party. There are both product and process certifications, the first linked mostly to consumption, the second linked mostly to production.' Here, the certification is a process certification, and provides consumers with some assurances as to how sustainable and/or fair the cocoa production was. If production meets a certain number of pre-defined *standards*, it will be awarded certification. After production is verified, a *label* will be affixed to the final product, testifying of the certification.[2] What I am interested in here are in-house certification programs. By 'in-house', I mean that the standards that the product must match are defined by the firm. The programs are still audited by a third-party. These in-house certification programs then allow firms to put their quality labels on their products. Finally, these programs are often part of

[1] See for instance https://www.forbes.com/sites/simransethi/2017/10/10/why-an-oversupply-of-cocoa-is-bad-for-chocolate-lovers/#6a45fb378f21, accessed on November 8th, 2017.

[2] See http://www.fao.org/docrep/006/y5136e/y5136e07.htm, accessed on May 15th, 2018.

	Shareholders Social preferences	Shareholders Classical preferences
Stakeholders Social preferences	*Not for profit CSR* Mixed effects on profits	*Strategic CSR* Profit maximization
Stakeholders Classical preferences	*Not for profit CSR* Reduction of profits	*No CSR* Profit maximization

Table 4.1: Taxonomy in Kitzmueller and Shimshack (2012), reproduced from Figure 2 in the original article

firms' Corporate Sustainability Strategies (CSR). The World Bank (cited in Kitzmueller and Shimshack, 2012) define CSR as '... the commitment of businesses to behave ethically and to contribute to sustainable economic development by working with all relevant stakeholders to improve their lives in ways that are good for business, the sustainable development agenda, and society at large.'

The first section of the paper discusses the existing literature on the concepts defined above, and outlines how the issue analyzed here relates to them. In the second section, I introduce the so-called 'hourglass framework' developed in Azam and Galez-Davis (2018), as a tool to analyze the cocoa/chocolate value chain. Then, in the third section, I describe the cocoa/chocolate sector, its structure and the challenges it faces, while the fourth section describes the existing sustainability initiatives of the sector. In the fifth section, I discuss the different strategies chosen by firm to address sustainability issues, and provide several potential explanations. In particular, I re-introduce the hourglass framework and interpret its results in the light of the descriptions made in the previous sections. I conclude in the sixth section, and provide some broad implications for the actors in the sector.

4.1 Literature

This paper contributes to several strands of literature. First, firms' programs in cocoa producing countries are sometimes presented as part of their Corporate Social Responsibility (CSR) initiatives. Hence, the next sub-section summarizes the major findings of this literature. Since I am also investigating why firms choose to create their own sustainability label, this paper also fits in the literature on quality disclosure and certification, outlined afterwards. Much of the discussion in these two section is drawn from the following literature reviews: 'Economic Perspectives on Corporate Social Responsibility' by Kitzmueller and Shimshack (2012), 'Quality Disclosure and Certification: Theory and Practice' by Dranove and G. Z. Jin (2010), and 'On the Economics of Labels: How Their Introduction Affects the Functioning of Markets and the Welfare of All Participants' by Bonroy and Constantatos (2014).

4.1.1 Corporate Social Responsability

4.1.1.1 Emergence of CSR

First, why does Corporate Social Responsability (CSR) emerge? Kitzmueller and Shimshack (2012) propose a theoretical taxonomy of CSR, depending on the values of shareholders and stakeholders, shown in table 4.1.

In practice, the empirical literature goes against the 'not-for-profits' CSR explanation, and is more favourable to strategic CSR (Kitzmueller and Shimshack, 2012). In that case, what are the strategic motives of firms to implement a CSR strategy? Kitzmueller and Shimshack (2012) propose some explanations, two of which are discussed below.

One strand of explanation is rooted in market structure and mechanisms. First, if the economic conditions are favourable and if consumers value CSR, implementing CSR might mean improving financial performance. CSR might also be a way for firms to introduce product differentiation, to advertise, or to build brand loyalty. All the empirical evidence points to CSR affecting consumers' assessments, decisions and willingness-to-pay, albeit with some disparities. With heterogeneous consumer preferences, theory and empirics both suggest that a sorting equilibrium will emerge. In our case, while firms all have a sustainability program, they might be able to strategically allocate their sustainable supply across their brands (e.g. Mars owns Bounty and Maltesers). Consumers are also likely to differ by subgroups, like geographical regions, so that cocoa sector firms might also choose to arbitrate across countries. Finally, firms' ability to implement CSR is likely to depend on the market structure in which they evolve. Indeed, a more competitive environment will reduce a firm's ability to charge a mark-up to increase CSR. This may explain the prevalence of CSR in the cocoa sector firms: along the chain, the two main types of actors (grinders and manufacturers) evolve in a concentrated context (more details in section 4.3).

An alternative motivation is related to public and private politics (Kitzmueller and Shimshack, 2012). By implementing a CSR strategy, firms could be 'hedging' against future risks of civil society campaign, government regulation, etc. In a similar fashion, Neilson (2008) explains that corporate self regulation improves shareholder value through effective risk management, and provides the firm with a defence against accusations of social and environmental neglect. The empirical evidence does support this hypothesis. For instance, financial studies find that consumer and union boycotts result in economically important and statistically significant stock price declines among targeted firms. In addition, CSR decisions might be strategic with respect to the regulator: CSR might be a way to secure preferential treatments by the authorities later on, to preserve their competitive position in case of a new regulation, or even to discourage such new regulation. Neilson (2008) has a similar argument: according to him, self regulation allows to pre-empt formal regulation and hence to free business from government intervention. Qualitative and quantitative evidence do support the existence of such strategic calculations. In particular, strategic CSR to improve relationships with regulators is confirmed in the data, as are rewards for good behaviour. In the cocoa sector, firms might have a particularly strong incentive to 'befriend' regulators in cocoa producing countries, particularly Côte d'Ivoire and Ghana, the biggest producers.

4.1.1.2 Impact of CSR

What are the effects of CSR? According to Besley and Ghatak (2001, cited in Kitzmueller and Shimshack, 2012), CSR can only achieve a second-best level of public goods provision. It will only be efficient if the government itself fails to deliver. In their later paper, Besley and Ghatak (2007) (cited in Kitzmueller and Shimshack, 2012) find that whether the total surplus is maximized under CSR or regulation depends on the relative benefits and losses of those which care about the social issue in question and the neutral group. Clearly, this assumes that the firm's CSR meets its objectives and has a true impact. In the case of the cocoa sector, while the programs' Key Performance Indicators are generally positive, there is no rigorous empirical study checking the true, causal impact. Nevertheless, since transitional economies

typically have limited formal regulation, CSR might play a particularly important role there (Kitzmueller and Shimshack, 2012). This paper contributes to this strand of literature which, according to Kitzmueller and Shimshack (2012), does require more research. But let me set aside the CSR literature, and turn to certification. Indeed, a key aspect of my analysis is the choice of firm to use their own sustainability label, rather than independent certification.

4.1.2 Certification

4.1.2.1 Impact of quality disclosure

The theoretical literature shows that voluntary disclosure and third-party certification by themselves do not necessarily lead to an improvement in social welfare (Dranove and G. Z. Jin, 2010). Overall, for welfare to improve, Dranove and G. Z. Jin (2010) underline the need to carefully design certification systems, to evaluate their effectiveness, and to use the available evidence and theoretical work to improve their design. In practice, consumers are found to respond to disclosure when rankings differ from their prior (Dranove and G. Z. Jin, 2010). The nature of the response is not homogeneous, and notably depends on whether the information disclosed is understandable, and matters to consumers. In that sense, in-house certification may not be easily understandable to consumers, as they are not as well established as Fairtrade or other third-party certification schemes. Furthermore, Dranove and G. Z. Jin (2010) report that there is little evidence that sellers respond to disclosure by increasing quality: '… most studies of seller responses seem to focus on gaming behaviour that often harms consumers.' For instance, if quality is multidimensional but only some dimensions are covered by disclosure, firms may shirk on unreported quality. In the end, Dranove and G. Z. Jin (2010) conclude that they cannot 'state with confidence' that disclosure has unambiguously helped consumers in the sectors of health care, education or finance. In the context of this paper, however, the 'consumer' dimension is somewhat less central. It is important, in the sense that if consumers are not interested in sustainability in the cocoa sector, firms may not be able to market their sustainable products, or to pass on mark-ups to finance their programs. Still, the actual impact of the sustainability programs on poverty and environment is perhaps a more central issue.

Certification labels can also affect market structure. Bonroy and Constantatos (2014) identify a market segmentation effect (i.e. the emergence of a high-quality sub-market), a differentiation effect (i.e. the fact that products can be perceived as imperfect substitute) and a ranking effect (i.e. the effects of input labelling). Let me focus on the first effect (the market segmentation effect), according to which labels might increase concentration in both high and low quality markets. Zago and Pick (2004) (cited in Bonroy and Constantatos, 2014) show that if the high quality market remains competitive, the label is welfare-enhancing, and if the label increases concentration, welfare is reduced. When the concentration is already high, as in the cocoa sector, introducing quality labels might increase it further, potentially leading to large falls in welfare. If this results in an increase in oligopsony power, this could worsen outcomes for farmers as well, despite the fact that the very existence of sustainability programs was meant to contribute to lifting them out of poverty. Hence, certification is not unambiguously beneficial to stakeholders. In that case, *who* decides to disclose, or to incentivize disclosure?

4.1.2.2 Third-party certifiers

Most often, certification is the responsibility of a third party (i.e. neither the firm being certified nor a government), and often this third-party is an NGO. Bonroy and Constantatos (2014) define NGOs as '… organizations intervening in markets where, besides the

informational problem, there is also an externality related to the good's production and/or consumption.' In the cocoa sector, the three main certifying bodies are UTZ, Rainforest Alliance and Fairtrade. All the labels in question, whether industry or NGO-led, relate to the negative aspects and externalities of cocoa production (e.g. low productivity, deforestation...). Bonroy and Constantatos (2014) argue that because NGOs are concerned solely with the externality issue, they will advocate for a stricter standard than the one a social planner would set. Indeed, the latter sees the externality as one part of the social problem.

On the other hand, NGO-led certification schemes are not without issues. First, they might create excessive differentiation, leaving consumers with 'middle-high' willingness to pay worse off. Second, Dranove and G. Z. Jin (2010) point out that third-party certifiers may suffer from conflicts of interest. They give the example of bond-rating agencies. The latter are paid by bond issuers to provide ratings, but might have an incentive to positively exaggerate their ratings in order to secure future business, as bond issuer can use other rating agencies. One could imagine that this could be the case here as well: while the third-party certification schemes in the cocoa/chocolate sector are not-for-profit, they still need to secure business, and so they might have an incentive to make things a little cheaper for firms even if it is to the detriment of farmers. Third, with third-party certifiers, the usual mechanisms of competition, reputation and external monitoring do not necessarily correct incentives (Dranove and G. Z. Jin, 2010). For instance, while competition among certifiers can enhance the information content of quality ratings in some instances, the sole presence of several certifiers does not lead to full information, except under perfect competition (Dranove and G. Z. Jin, 2010). Indeed, noisy grading gives the possibility to firms to extract additional profits from low-quality sellers. In addition, competition might give the possibility to sellers to shop around. This argument is particularly relevant in the cocoa sector. As will be clear in section 4.4, Fairtrade, UTZ and Rainforest all have different principles and work quite differently from one another. Overall, while these findings cast doubts as to the credibility of third-party certification agencies, it is unclear why firms would shy away from them: indeed, most of the shortcomings outlined in this section work to their advantage.

4.1.2.3 In-house certification programs

Bonroy and Constantatos (2014) differentiate between industry-set standards and self-labelling. In their paper, the former corresponds to the situation in which a third-party certifies product at a standard proposed by the industry. This is obviously different from self-labelling. It is unclear which category the in-house certification programs of the cocoa/chocolate sector belong to. While these labels are firm-specific, and hence could qualify under self-labelling, they are also audited by third-parties, and some kind of harmonization is carried out through the World Cocoa Foundation and Cocoa Action (see section 4.4.1.3). Hence, they can be seen as a mix between the two.

Overall, Bonroy and Constantatos (2014) conclude that the optimal standard level for firms can be either less or more stringent than the optimal level for the social planner. The final outcome depends on whether the labelling agency aims to control the supply of the high quality product (overprovision of quality) or not (underprovision). In turn, recall that the social planner's optimal level is less stringent than the optimal level for NGOs. In my analysis below, I assume that, in the cocoa sector, firms behave oligopolistically and aim to control the supply (and provide elements of justification for this assumption). Hence, according to Bonroy and Constantatos's result, both NGOs and firms will oversupply quality. This makes it even less clear why firms might want to create their own sustainability label.

Nevertheless, Auriol and Schilizzi (2015) identify another mechanism, through which the level of certification would be sub-optimal under self-certification. First, a firm's incentive to self-certify is related to the rents it can extract from consumers. The issue is that the firm will not be able to extract the whole surplus of trade. It will only internalize the sales, and so it will under-certify. In the cocoa sector, this worry is perhaps not as important, as firms are also incentivized by the sustainability issues described in section 4.3.2. Second, when several firms self-certify, the sunk cost of certification is duplicated across the industry. This constitutes a 'pure waste' (Auriol and Schilizzi, 2015). From the point of view of the cocoa sector, it means that resources are being wasted, when they could be injected to increase the efficiency and scope of existing programs. Cost duplication also means that there will be fewer entries in the equilibrium, and thus a higher concentration of firms. In turn, this translates into higher consumer prices, less exchange and a lower social surplus (Auriol and Schilizzi, 2015). Hence, asking why companies in the cocoa sector use their own quality labels is an important question.

4.1.3 Existing evidence on firms' in-house sustainability programs

Overall, Neilson (2008) argues that these systems have '… the potential to induce changes across a much broader producer base…'. Swinnen et al. (2015d) (especially chapters 11 and 12) also show how small-holders can benefit from international value chain inclusion, even in the presence of monopsonistic/oligopsonistic buyers. Market imperfection in developing countries give an incentive to buyers to engage in interlinked contracts with their suppliers, providing them with inputs in order to enable high-standard production. But contract enforcement issues raise hold-up opportunities on both sides. In particular, the suppliers may have incentives to side-sell or to divert the inputs to other uses. Thus, the buyer may choose a self-enforcing contract, and pay the supplier an "efficiency premium" in order to make sure he will comply. In such settings, buyer competition might even harm suppliers, since it can threaten the feasibility of contracts through various channels (including reducing the reputational cost of hold-up, for instance). Since many sustainability programs involve some kind of input provision, Swinnen et al.'s analysis suggest that farmers might benefit from in-house sustainability programs, by gaining some bargaining power.

On the other hand, Giovannucci and Ponte (2005) (cited in Neilson, 2008) question whether such sustainability standards in the coffee sector actually benefit developing countries. They raise several issues (i) the 'insufficient transparency and clarity of the standards'; (ii) the 'inadequate participation of producing country actors in standard setting procedures'; (iii) the 'inability to compensate growers for improving performance'; (iv) the squeezing out of 'certified-organic and fair-trade production'; (v) the fact that their credibility is 'undercut by their self-interest industry ties'. Beyond these broad arguments, there is little empirical evidence on such in-house programs. In addition, the few available studies tend to focus on the coffee sector. I outline below two such papers.

Neilson (2008) investigates the local impacts of the emergent regime of global private regulation in the coffee industry in Indonesia. He finds evidence of structural and institutional changes along the value chains. First, cooperative organization systems are prioritized compared to traditional trade networks. Even though traditional networks are ill-suited to traceability and price transparency, the use of cooperatives in Indonesia is perhaps not judicious. Indeed, cooperatives are seen negatively by farmers, due to their association with Suharto-era misuse and their inability to provide farmers with acceptable financial services. Neilson (2008) underlines the need for a supporting institutional framework for a cooperative-type organization to work. Second, the sector is witnessing an increasing

exporter consolidation and upstream involvement of international traders. This could lead to higher farm-gate prices, provided that there is no downward pressure from increased cost of implementation and that increased consolidation does not lead to a monopsonistic environment. Finally, Neilson (2008) describes a 'capture' of farmers within enclosed and exclusive value chains. This may lead to increased farmer access to information, knowledge, and possibly credit, but it could also potentially threatens the competitive buying environment found in many informal trade networks. Overall, while Neilson's first finding is very context-specific, the other two could be a concern in the cocoa sector as well.

One recent study investigates the impact of a coffee firm's in-house initiative on farmers' social and environmental conduct in several South American countries (Giuliani et al., 2017). The authors find that certified farmers belonging to this sustainability scheme displayed better environmental conduct, but that their social conduct was not any better than non-certified farmers. According to them, this can be explained by the '... different incentives and rewards farmers might associate with each type of conduct ...'. Social criteria might be more costly to implement, and yield little immediate return. In turn, environmental criteria might be more easily codified, and hence might be easier to put in place and to monitor. In any case, the authors point out that this finding is in line with other research on the topic. Thus, it is not likely to be specific to in-house certification schemes. The authors also show that farmers' behaviour is probably mediated by the type of local intermediaries they sell to (cooperative vs. private actors) and the institutional strength of the home country. However, the paper does not offer a comparison with independent, third-party standards such as Fairtrade, neither in terms of certification standard, nor in terms of effect on farmer outcomes.

In sum, there is little evidence on the impact on these in-house sustainability programs, whether in absolute terms or in comparison with other existing schemes. Given the number of people they involve in developing countries, their potential issues and the limits of local governments (Kitzmueller and Shimshack, 2012), the study of these programs and the collection of evidence is crucial. The fact that firms are creating their own sustainability labels also warrants scrutiny, as it can either lead to an overprovision of quality (Bonroy and Constantatos, 2014) or an under-provision (Auriol and Schilizzi, 2015). In the latter case, self-certification entails a waste of resources and a negative effect on cocoa producers, which those programs are created to assist.

4.2 Theory: The hourglass framework

As will be clearer in the next section, the cocoa value chain can be represented as an hourglass: there are many smallholders at the beginning of the chain, many consumers at the other end, and few intermediaries in-between. This is also exemplified in figure 4.1.

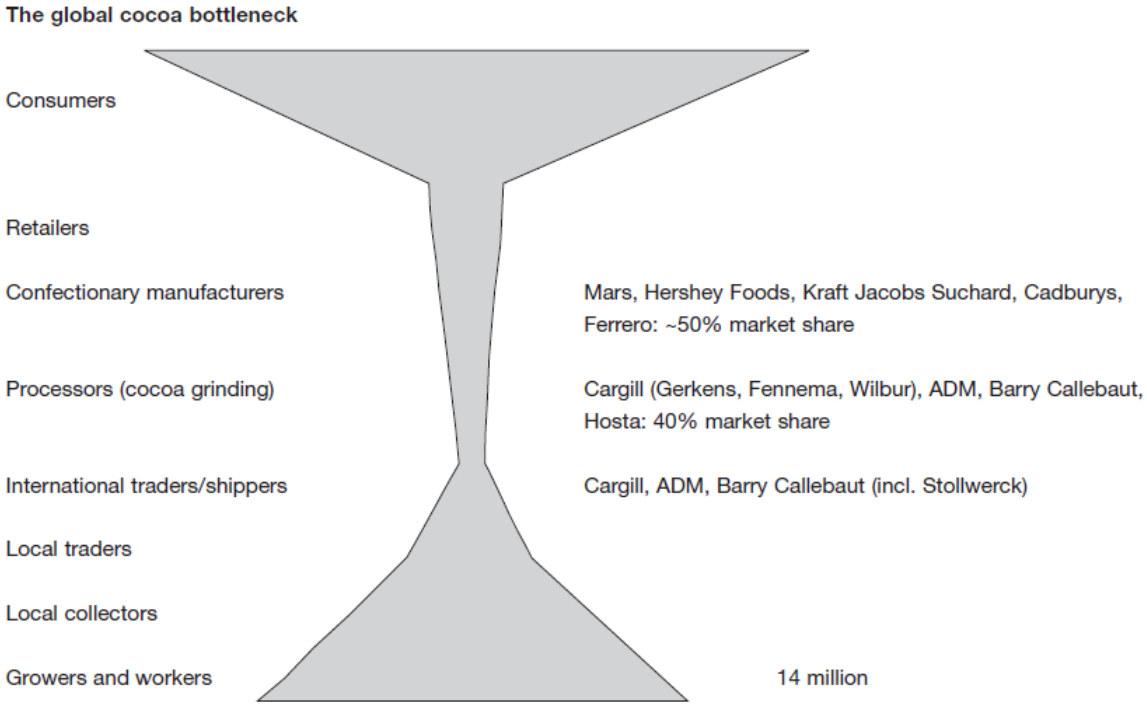


FIGURE 4.1: The cocoa supply chain (Vorley, 2003)

This analysis has also been carried out in Azam and Galez-Davis (2018), where we develop a theoretical framework to analyze such value chains. We apply it to the sectors of cocoa, coffee and cocaine. Here, I use this framework again, but choose to focus on the cocoa sector and the related sustainability issues. Before getting to the heart of the matter, however, I recap the principles of the model.

There are two locations, North and South, and three kinds of players: producers in the South (here, cocoa farmers), Northern intermediary firms (here, grinders and manufacturers), and Northern consumers. Southern producers produce cocoa with the following supply function:

$$S\left(p^S,\sigma\right), \quad \frac{\partial S}{\partial p^S}\left(p^S,\sigma\right) > 0, \quad \frac{\partial S}{\partial \sigma}\left(p^S,\sigma\right) > 0 \tag{4.1}$$

where p^S is the price they receive and σ represents any exogenous factor affecting their supply. For instance, the impact of a training increasing farmers' productivity could be evaluated with an increase in σ. Producers then sell their produce to the Northern intermediaries. The latter are assumed to be identical. While this is a simplifying assumption, it does also hold some truth, as it seems that the biggest -and probably determining- industrial players in the cocoa sector are often close in size. We assume that there are n identical intermediary firms, indexed by i (indexation is only useful when posing the maximization problem, it is dropped later, since firms are identical). Each of them purchases a quantity q_i^S of cocoa, which is then transported in the North. In practice, in 2010, 41.7% of the cocoa supply was transported to Europe, and 10.2% to the U.S. (Poelmans and Swinnen, 2016).[3] The intermediaries trade with an iceberg cost γ. Once the cocoa is in the North, the intermediaries process and transform the raw commodities into a final product. The cocoa beans

[3]More and more cocoa grinding also takes place in cocoa producing countries (Poelmans and Swinnen, 2016). Imposing the transport cost on the final good is a straightforward change.

are processed into the chocolate couverture (i.e. intermediate chocolate product) and into final chocolate products. The intermediaries' production function is defined as

$$q_i^N = f\left(q_i^S\right), \quad \frac{\partial f}{\partial q_i^S}\left(q_i^S\right) > 0, \quad \frac{\partial^2 f}{\partial q_i^{S2}}\left(q_i^S\right) < 0 \tag{4.2}$$

where q_i^N is the quantity of final good produced. f is assumed to be displaying decreasing returns to scale. While increasing returns to scale are a more realistic assumption, it considerably complicates the analysis, as will be shown below. Finally, the intermediaries sell the final good on the Northern market, where they face a demand curve defined as

$$D\left(p^N, \delta\right), \quad \frac{\partial D}{\partial p^N}\left(p^N, \delta\right) < 0, \quad \frac{\partial D}{\partial}\left(p^N, \delta\right) > 0 \tag{4.3}$$

where p^N is the price at which the final good is sold in the North and δ represents any exogenous factor affecting demand, such as health trends. Finally, firms are assumed to compete in a Cournot competition setting.

I assume that intermediaries exert oligopsony power in the South and oligopoly power in the North. This modelling choice is empirically justified in Azam and Galez-Davis (2018). Overall, empirical evidence of firms' exercise of market power in cocoa producing countries is mixed (Gayi and Tsowou, 2016), while the relationship between the price of the final chocolate product and the world market price would tend to indicate non-competitive behaviour (Araujo Bonjean and Brun, 2016).

Thus, I assume that there is no free entry, and that intermediaries take into account the impact of their actions on the prices they face. In practice, entry is limited either by technological problems (e.g. technology may be protected), by scale economies, or by more diffuse institutional problems. The intermediaries' maximization problem is therefore:

$$\max_{q_i^S} p^N f\left(q_i^S\right) - \left(p^S + \gamma\right) q_i^S \tag{4.4}$$

subject to $p^N = D^{-1}\left(f\left(q_i^S\right) + \sum_{j \neq i} f\left(q_j^S\right), \delta\right)$ and $p^S = S^{-1}\left(q_i^S + \sum_{j \neq i} q_j^S, \sigma\right)$.

We assume that in equilibrium, the market clears: all the cocoa produced is sold and transformed, and all the chocolate is consumed. For the hourglass equilibrium to exist, the following condition must hold: the absolute value of the elasticity of demand in the North multiplied by the number of intermediaries must exceed one (in our notation: $\eta^N n > 1$). This is our equivalent to the existence condition on demand elasticity for a monopoly equilibrium. If this holds, the first order condition is given in Proposition 5.

Proposition 5 *The first order condition or price pass-through is*

$$p^{N*} = \frac{p^{S*}\left(1 + \frac{1}{\eta^S n}\right) + \gamma}{f'\left(\frac{Q^S}{n}, \theta\right)\left(1 - \frac{1}{\eta^N n}\right)} \tag{4.5}$$

where Q^S is the total quantity of cocoa on the market. Similarly, Q^N will be the total quantity of chocolate on the market. Since intermediaries are identical, each one buys $q_i^S =$

$q^S = \frac{Q^S}{n}$ of cocoa and sells $q_i^N = q^N = \frac{Q^N}{n}$ of chocolate. η^N and η^S are the absolute value of the demand and the supply elasticities, which are given by:

$$\eta^N = -\frac{p^N D'\left(p^N, \delta\right)}{D\left(p^N, \delta\right)} > 0 \tag{4.6}$$

$$\eta^S = \frac{p^S S'\left(p^S, \sigma\right)}{S\left(p^S, \sigma\right)} > 0 \tag{4.7}$$

respectively. From equation 4.5, the reader can see that $\eta^N n > 1$ must hold, otherwise p^{N*} is negative.

The situation can be represented in a four-quadrant diagram as shown in Figure 3.1.[4] The bottom right quadrant is the industry-wide production function. Since all intermediaries are identical, it is straightforward to derive that $Q^N = nf\left(\frac{Q^S}{n}\right)$. The bottom left quadrant shows the Southern market, with the Southern producers' supply curve S. The top left quadrant shows the marginal cost curve of the intermediary firm given by the first order condition (equation 4.5), and assumed to be convex in the graph. For each p^S, it gives the p^N that maximizes the intermediaries' profits. Hence, this curve will also be called the price pass-through. If we had assumed increasing returns to scale, the curve in the lower right quadrant would have been convex, and the price pass-through could have been either upward or downward sloping. This is why assuming decreasing returns to scale simplifies the analysis: a p^N which increases as p^S falls doesn't make much sense. Finally, the top right quadrant depicts the Northern market, with the downward sloping demand curve from consumers, $D\left(p^N, \delta\right)$. The second curve in the North-East quadrant is simply the intermediary's supply curve in the Northern market. To trace it, I start by picking a quantity at random on the axis for the Northern consumers' demand and report it on the lower right quadrant. I can then report the corresponding quantity Q^S on the downward y-axis, and deduce p^S through the lower left quadrant. The upper left quadrants allows me to derive the corresponding p^N. Finally, the intersection of the horizontal dotted line at p^N and the vertical dotted line at the level of Q^N that was initially chosen provides one point of the intermediary firm's supply curve in the North East quadrant. Repeating the exercise several times for different initial quantities allows me to have an idea of the shape of the supply curve of the intermediary firms. This is shown by the three dots in the North East quadrant of Figure 3.1. The path named *Eq.* corresponds to the equilibrium path, and gives the equilibrium quantities and prices.

[4] This four-quadrant diagram is a variant of the one exposed by Marcus H. Miller in the appendix of Johnson (1971).

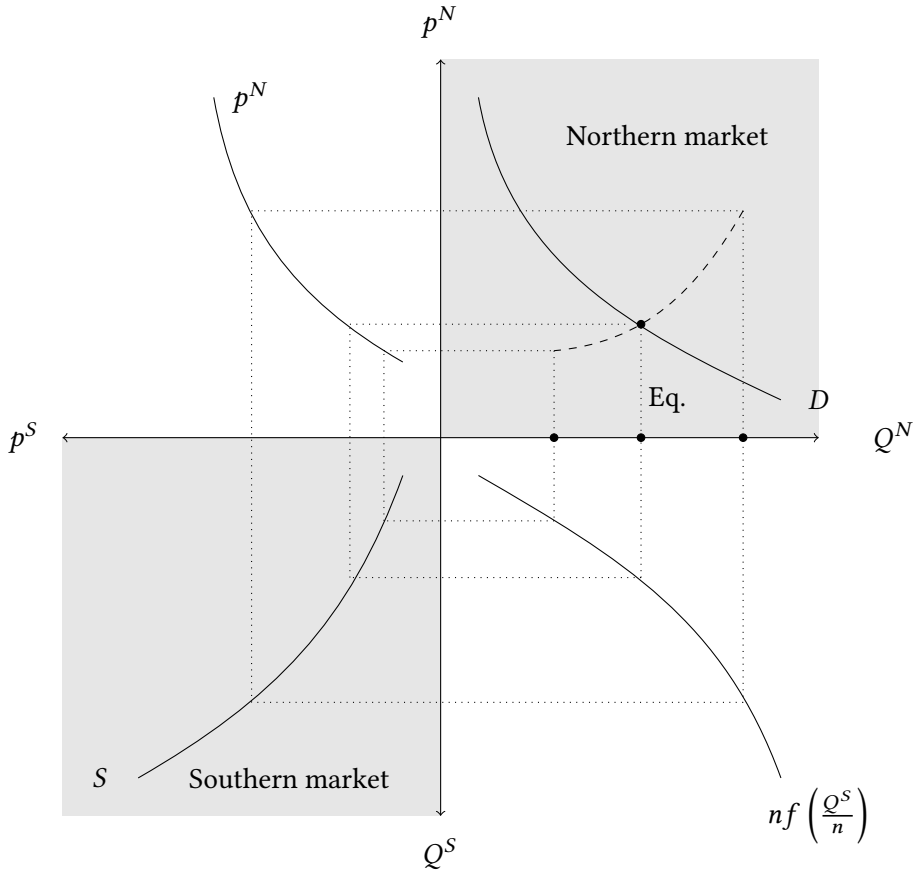


FIGURE 4.2: The hourglass equilibrium

All the relevant demonstrations are provided in the appendix of Azam and Galez-Davis (2018), as well as the comparative statics. For the purpose of this paper, we focus on two of the parameters: σ and δ.

4.2.1 Comparative statics: σ

Proposition 6 gives the effects of an increase in σ in the model. More details are provided in appendix B.5.2.

Proposition 6 *An increase in σ leads to one of three outcomes.*[5]

1. *a decrease in Q^S, p^S and Q^N, and an increase in p^N*
2. *a decrease in p^S and no change in the other variables*
3. *an increase in Q^N and Q^S, and a decrease in p^S and p^N.*

A decrease causes the opposite effects.

The effect of an increase in σ on firms' revenues, costs and profits are complex, notably because an increase in σ may result in several scenarios. Let me start with looking at the

[5]Note that the supply curve in the North can move in five different ways in total: shift up, shift down, rotate upwards, rotate downwards, rotate so that the equilibrium is unchanged. Here, for simplicity, I ignore the situations in which the curve rotates upwards or downwards. Even if I considered these five possible scenarios, there would still be only three equilibrium situations, listed in Proposition 6.

circumstances in which each situation may emerge. As explained in appendix B.5.2, this will depend on how the supply curve of intermediaries in the North will shift. Its equation is

$$\frac{p^S\left(1+\frac{1}{n\eta^S}\right)+\gamma}{f'\left(\frac{f^{-1}\left(\frac{Q^N}{n}\right)}{n}\right)\left(1-\frac{1}{n\eta^N}\right)} = \frac{S^{-1}\left(Q^S,\sigma\right)\left(1+\frac{1}{n\eta^S}\right)+\gamma}{f'\left(\frac{f^{-1}\left(\frac{Q^N}{n}\right)}{n}\right)\left(1-\frac{1}{n\eta^N}\right)} \tag{4.8}$$

Following an increase in σ, $S^{-1}\left(Q^S,\sigma\right)$ at the numerator and $f'\left(\frac{f^{-1}\left(\frac{Q^N}{n}\right)}{n}\right)$ at the denominator both decrease. While S is directly affected by σ, it is less obvious why f' should be affected by a change in σ, and why the pass-through in the North West quadrant should move. The reason is that for each price p^S, the corresponding Q^S is not the same anymore because of the change in σ, and so for each p^S, the marginal productivity of intermediaries is also reduced, because we assumed decreasing marginal returns to scale for f. The overall shift of the intermediaries' supply curve will depend on which of these two changes dominate each other.

Since we have assumed decreasing returns to scale for f, we can deduce that the decrease in f' will be larger for smaller quantities of Q^S, and that in this case, the decrease in the denominator will be more likely to dominate the decrease in the numerator. In this case, the intermediaries' supply curve will shift upward. Situation 1 from Proposition 6 will emerge. What is the impact on firms' profits? As shown in appendix B.5.2, the outcome will depend on the demand elasticity for chocolate. Here, I assume that both the supply of cocoa and the demand for chocolate are inelastic ($\eta^S, \eta^N < 1$). Regarding cocoa supply, a new cocoa tree begins bearing pods after its fifth year (Gayi and Tsowou, 2016), so that supply is likely to be inelastic. Regarding chocolate demand, the reader is referred to Dolan (2010). Given this assumption, in the first situation listed in Proposition 6, profits are predicted to increase (see chart in appendix B.5.2). Intuitively, because the market was starting at a relatively small quantity, the marginal productivity of intermediaries for each Q^S decreases too much compared to the change in S^{-1}. Intermediaries purchase less cocoa, p^S goes down, but p^N goes up. Costs go down, since both Q^S and p^S decrease, but revenues go up, since even though p^N goes up, demand is inelastic, maintaining Q^N relatively high.

Conversely, if we are dealing with large quantities of Q^S, the change in f' is likely to be relatively small, and to be dominated by the change in the numerator. In this case, the supply curve of intermediaries in the North will shift downwards, resulting in the third situation in Proposition 6. The change in profits depend on both the demand elasticity for chocolate and the supply elasticity for cocoa. Since both elasticities are under 1, the impact on profits is ambiguous, as shown in appendix B.5.2. Intuitively, since the decline in their marginal productivity is relatively small, intermediaries buy more cocoa in the South at a lower price, and because cocoa supply is inelastic costs go down. They also sell more chocolate at a lower price, but because chocolate demand is inelastic, revenues go down. It is unclear which of the effect on revenue or cost dominates.

In sum, the same change in σ affects firms differently depending on whether they are dealing with small or large quantities of cocoa. If quantities are small, an increase in σ is likely to increase profits, but if quantities are large, the same increase in σ is likely to lead to an uncertain outcome.

4.2.2 Comparative statics: δ

The effects of an increase in δ are a lot more straightforward, as described in Proposition 7. More details are provided in Appendix section B.5.5.

Proposition 7 *An increase in δ leads to an increase in Q^N, Q^S, p^S and p^N. A decrease causes the opposite effect.*

Following an increase in δ, both prices and quantities increase, so that while there is a rise in revenue, there is also a rise in costs. It is unclear which will dominate, and how the profits will evolve. Here, for simplicity, we assume that an increase in δ will unambiguously increase profits. As will be clearer in the last section, if sustainability initiatives were expected to change δ in a way that would reduce profits, firms would not advertise them so much. Therefore, increasing δ will increase profits. Let us leave aside the model for now, and investigate further the cocoa/chocolate industry.

4.3 The cocoa/chocolate industry

This section heavily draws from the book *The Economics of Chocolate*, edited by Squicciarini and Swinnen (2016), and from the UNCTAD report by Gayi and Tsowou (2016).

4.3.1 Structure

4.3.1.1 Cocoa production

Cocoa production involves growing the cocoa trees, harvesting the pods, and fermenting and drying the beans (Gayi and Tsowou, 2016). The cocoa tree thrives in tropical areas (Gayi and Tsowou, 2016), and so production is concentrated in a few developing countries, mainly in West Africa. Côte d'Ivoire and Ghana accounted for respectively 34% and 15% of the world production in 2012. Indonesia is also becoming a major player, since during that year it accounted for 15% of the world production (Poelmans and Swinnen, 2016). Cocoa is of great economic importance for producing countries, as it generates export revenues, income and employment (Gayi and Tsowou, 2016). For instance, in Côte d'Ivoire, cocoa accounts for 20% of GDP, and was one of the few sectors whose growth proved to be propoor between 2002 and 2008 (Balineau, Bernath, and Pahuatini, 2017). Nevertheless, cocoa remains a crop grown on a little scale: 90% of the world cocoa supply is grown by smallholders, who cultivate less than ten hectares and often rely on family and informal labor (Fold and Neilson, 2016). High labor costs, high risks linked to pests and diseases, and modest economies of scale make smallholders more competitive than commercial plantations (Fold and Neilson, 2016). Even though cooperatives do exist, they do not reach every farmer. In Côte d'Ivoire for example, 80 to 85% of the cocoa is produced by individual farmers who do not belong to any cooperative or organization (ILRF, 2014, cited by Gayi and Tsowou, 2016). Hence, the base of the value chain consists of five to six millions small-scale farmers who operate in a quasi free-market (Barrientos, 2016; Gayi and Tsowou, 2016). Cocoa farming contributes to the livelihoods of forty to fifty million people, according to a according to a 2012 World Cocoa Foundation report.[6] For them, cocoa often constitute the main or only source of cash income (Gayi and Tsowou, 2016).

[6] Available from http://www.worldcocoafoundation.org/wp-content/uploads/Cocoa-Market-Update-as-of-3.20.2012.pdf, and last accessed on June 3, 2017.

4.3.1.2 Cocoa trading

Once the cocoa is ready, farmers sell it at buying stations to exporters' agents or to traders and brokers. The price of cocoa beans futures in international market is used as a reference (Gayi and Tsowou, 2016). Nevertheless, many countries have a set minimum cocoa price, like Ghana and Côte d'Ivoire (Gayi and Tsowou, 2016). Note that at this level, the industry is already rather concentrated: 'In most producing countries, marketing channels for cocoa beans are controlled by a limited number of players.' (Gayi and Tsowou, 2016). For instance, in Côte d'Ivoire, three international firms bought about 50% of the cocoa produced in 2011/2012 through their local agencies (Gayi and Tsowou, 2016). After the purchase, the buyer transports the beans to an exporting company, which inspects them and grades their quality (Gayi and Tsowou, 2016). Once they have arrived at their destination, further quality checks may be carried out before the beans are stored or sold (Gayi and Tsowou, 2016). These sourcing and trading activities used to be done by specialized firms, but since the 1990s, many of them have been driven out by the vertical integration of big, foreign grinding companies (Poelmans and Swinnen, 2016).

4.3.1.3 Cocoa grinding

Downstream, the cocoa processing industry is split into two distinct segments: the grinding of the cocoa beans and the manufacturing of consumer products (Fold and Neilson, 2016). Even though some firms used to span much of the value chain (and some still do), most often two distinct types of firms focus on each industrial segment (Fold and Neilson, 2016; Gayi and Tsowou, 2016). Grinders usually manage the early processing stages of cocoa (Araujo Bonjean and Brun, 2016). They have also vertically integrated into the production of industrial chocolate (Poelmans and Swinnen, 2016). Manufacturers, on the other hand, focus on the manufacturing and marketing of final chocolate products, which are generally sold through grocery retail channels (Araujo Bonjean and Brun, 2016). Both segments are highly oligopolized, with a handful of multinational companies controlling large shares of the market (Barrientos, 2016). The influence of grinders and manufacturers over the value chain has been described by Fold (2002) as a bi-polar governance structure, because of the dual governance roles of dominant processor and manufacturer companies (Barrientos, 2016).

In the grinding industry, it is estimated that in 2012, three companies controlled about 60% of all processing: Cargill, Barry Callebaut and Archer Daniels Midland (Euromonitor, 2012, cited in Fold and Neilson, 2016).[7] Since then, Cargill has acquired ADM's global chocolate business and Olam International Limited has bought ADM's cocoa business (Gayi and Tsowou, 2016). Deardorff and Rajaraman (2009) also point out that market segmentation make producers in any single country more likely to deal with one rather than several buyers. Reasons for this high horizontal integration include the boom in commodity prices (Gayi and Tsowou, 2016). Inputs like cocoa and energy being more expensive, the firms' production costs were higher, and hence their margins narrower. Mergers and acquisitions were thus a way for both grinders and manufacturers to increase cost efficiency and take

[7] Cargill is a large American conglomerate created in 1865. Its activities include agricultural services and food. It entered the cocoa business in 1980, when it built a cocoa-processing plant in Brazil. The Barry Callebaut group is the result of the 1996 merger between the Belgian chocolate maker Callebaut (founded in 1911) and the French chocolate producer Cacao Barry (founded in 1842). It is now based in Zurich, and contrary to Cargill, it focuses on the production of cocoa and chocolate products. All this information is available on the companies' website, which were accessed between January and March 2017 and are listed in appendix C.2.

advantage of economies of scale.[8] This is especially the case for processors, as they compete mainly on costs (C. Gilbert, 2009, cited in Gayi and Tsowou, 2016). Gayi and Tsowou (2016) also underline that both cocoa processing and chocolate manufacturing are capital intensive and require high sunk costs, which could discourage new entrants.

4.3.1.4 Cocoa manufacturing

Like the grinding sector, the manufacturing sector is rather concentrated. In 2008, it was estimated that six companies produced 57.4% of the world market (Barrientos, 2016). Concentration has also increased since then, notably with the acquisition of Cadbury by Kraft Foods (now Mondelēz) in 2010. In 2013, the top-three manufacturers were Mars, Mondelēz and Nestlé (Barrientos, 2016).[9] Although the concentration in the manufacturing sector is not as high as in the grinding sector, market concentration can be a lot higher at the regional or national level (Araujo Bonjean and Brun, 2016). For example, in the U.S., even though the confectionery market is diversified, Hershey and Mars accounted for 65% of the sector's sales in 2014 (Gayi and Tsowou, 2016). Market differentiation also plays a major role in the sector's concentration, notably through branding and product innovation (Araujo Bonjean and Brun, 2016). These activities require consequent investments, which are likely to constitute a barrier to entry (Gayi and Tsowou, 2016). In addition, economies of scale and the boom in commodity prices affect this segment of the value chain as well, similarly to the grinding segment. Finally, Fold (2002) also points to the increasing attention to share value, or 'financialization'. Firms' management is increasingly concerned with financial performance and cash management. But because market volume is increasing slowly, mergers and acquisition are the main ways through which company growth can occur.

To get an idea of firms' relationships along the value chain, it is useful to note that in 2016, Nestlé reported sourcing its cocoa through 28 tier-1 suppliers, of which eight made up about 80% of the total cocoa volume procured from Côte d'Ivoire (Fair Labor Association, 2016).[10] Its suppliers notably include Cargill.[11] A concrete example of chain between a manufacturer, one of its tier-1 supplier and farmers in Côte d'Ivoire is given in appendix C.1 (it is taken from a 2016 Fair Labor Association report).

Therefore, the cocoa sector exhibits a clear hourglass structure, as explained in section 4.2: at one end there are producers, which are numerous, small, and often isolated; while at the other end are many atomic consumers. In the middle are a small number of large players, including notably the grinders and manufacturers, on which this paper focuses.

[8] Cargill's numerous mergers and acquisitions are described in Araujo Bonjean and Brun (2016). Barry Callebaut is itself the result of a merger in 1996, as explained in footnote 7. Similarly to Cargill, over its history it has acquired quite a few other companies or shares of other companies (Araujo Bonjean and Brun, 2016).

[9] Mars is a company based in the U.S.A., and can be traced back to 1880. Like Cargill, it does not specialize in chocolate. Its activities range from pet care brands such as Pedigree to food brands like Dolmio and Uncle Ben's. Mars Inc.'s chocolate brands include Bounty, Celebrations, Galaxy, Maltesers, and of course the Mars bar. Nestlé is a Swiss multinational, dating back from 1866. It does not specialize in chocolate either, and is also active in the pet care and food sectors, owning brands like Purina and Buitoni. Its chocolate brands include Aero, Cailler, Crunch, Kit Kat (except in the U.S., where it is made under licence by a subsidiary of Hershey's) and Smarties. Finally, Mondelēz is an American company, originating in 1923. Since the split of Kraft General Foods, Inc. between Kraft Foods Group Inc. and Mondelēz International Inc., the latter focuses on snacks. It owns brands like LU, Mikado, Oreo and Tuc. Famous chocolate brands owned by Mondelēz include Cadbury, Côte d'Or, Milka and Toblerone. This information is available on the firms' websites, which were accessed between January and March 2017, and are listed in appendix C.2.

[10] Tier-1 suppliers are firms that supply the manufacturer of the final product.

[11] See http://www.cargillcocoachocolate.com/sustainability/downloads/index.htm, accessed on January 20, 2017.

4.3.2 Current challenges

Up until the recent past, chocolate products have only ever been consumed by Northern consumers. However, there is an increasing demand in emerging countries, including China and India (Barrientos, 2016). This would not be an issue if there weren't various factors threatening cocoa production.

4.3.2.1 Falling productivity

First, there is the problem of falling productivity. The flip side of small-scale farming is that productivity is low (Barrientos, 2016), but it seems to be even lower than what farmers could achieve. Indeed, a study funded by Cadbury found that Ghanaian farms were producing only 40% of their potential output (Barrientos, 2016). Reasons for this low productivity included low incomes, poor access to farm-level services, lack of social services and infrastructure and lack of information (Barrientos, 2016).

In addition, most cocoa plantations are relatively mature, which hinders productivity (Fold and Neilson, 2016). Even though cocoa trees can live up to a hundred years, they only begin bearing pods after their fifth year, and are most productive for the first twenty-five to thirty years (Gayi and Tsowou, 2016). There is also what is called a 'forest rent', whereby recently cleared land provides better conditions for cocoa growing. Under these conditions, it seems that cocoa production could be moved elsewhere, but there is no new evident cocoa frontier that could replace the more mature plantations. This makes it all the more crucial to improve productivity on the existing land, and without endangering the environment (Balineau, Bernath, and Pahuatini, 2017; Barrientos, 2016).

4.3.2.2 Low attractiveness of the sector

In turn, the low productivity of cocoa farms means that the average cocoa farmer's income is low. According to a 2014 report by the International Labor Rights Forum (cited in Gayi and Tsowou, 2016), the net earnings of a typical Ivorian cocoa farmer with two hectares of land are between $2.07 and $2.69 a day. Even though this is just above the World Bank poverty line of $1.90/day, a typical rural household in cocoa producing countries is likely to include more than five members (Gayi and Tsowou, 2016). The daily net amount per person may therefore be a lot lower than $1.90/day. Not only is this not much to live with, it clearly prevents investments that would improve the farm and tackle its low productivity. Furthermore, because of the poverty associated with cocoa farming, the latter is seen as an occupation of last resort and is not attractive to younger generations (Barrientos, 2016). Many of them leave the sector to grow more profitable crops, find more remunerative activities outside of farming, or migrate to cities (Barrientos, 2016; Gayi and Tsowou, 2016). Overall, according to one estimate, the indicative cocoa producer share of the cost of a milk chocolate bar is 4%, while other ingredients account for 6% (C. L. Gilbert, 2008, cited in Barrientos, 2016). In comparison, the processor/manufacturer's share rises to 51%, and the retail share to 28% (C. L. Gilbert, 2008, cited in Barrientos, 2016). On top of that, increases in consumer prices have not been passed on to the producers (Barrientos, 2016).

In turn, these issues can have dramatic consequences, aside from the obvious hardships lived by farmers and their families. The aging of the current workforce and the youth exodus reduce the workforce available to work on farms, so that families have to stop sending their children to school and employ them on the farm (Fair Labor Association, 2016). This, as well as all the other reasons listed above, make it all the more urgent to change cocoa production to make it more sustainable. In addition, consumers are increasingly mindful of the social

origins of chocolate, especially since the child labor scandals of the early 2000s. This puts even more pressure on chocolate manufacturers to address the sustainability of their supply chain (Barrientos, 2016). Thus, grinders and manufacturers have a big incentive to try and secure a stable, sustainable and cheap supply of cocoa. As a consequence, they strive to address the sustainability challenges of the cocoa sector, by helping farmers improve their working conditions and productivity (Fold and Neilson, 2016). In the next section, I review the existing sustainability initiatives in the sector, starting with the programs of the biggest firms: Cargill, Barry Callebaut, Nestlé, Mondelēz and Mars.[12]

4.4 Existing sustainability initiatives in the sector

4.4.1 Industry initiatives

The five biggest firms of the sector now source between 21 and 45% of all their cocoa sustainably (these numbers correspond to Mondelēz and Cargill, respectively). They all have a sustainability program: Cocoa Promise for Cargill, Cocoa Horizons for Barry Callebaut, Vision for Change for Mars, Cocoa Plan for Nestlé and finally Cocoa Life for Mondelēz. These programs do not come cheap. For instance, Cocoa Horizon cost nearly 6 millions of Swiss Francs in 2015/2016, while the Cocoa Plan cost around 30 million Swiss Francs in 2016.[13] All of the programs are very similar, with some important differences nevertheless. Let me start with what they have in common.

4.4.1.1 Similarities across programs

All the programs in their current form were created in the late 2000s (2009 for Nestlé and Mars) and early 2010s (2012 for Barry Callebaut, Cargill and Mondelēz). They are sometimes built on existing, more quality oriented programs. For instance, Cargill organized quality seminars in 2003, and Barry Callebaut created the Quality Partnership programs in 2005. To the best of my knowledge, no other initiative took place before 2003. All of those industry program are active at least in Côte d'Ivoire and Ghana, the two biggest cocoa producers (except Mars, whose activities focus on Côte d'Ivoire). Many also have a foot in Indonesia and Brazil, as well as other Asian and South American countries.

In terms of content, industry programs all have in common some kind of farmer support. This usually takes the shape of farmer training (field schools, one-to-one coaching, demonstration plots...), provision of quality inputs (planting material, crop protection, tools...), payment of a premium, and financial and credit services (e.g. creation of Village Savings and Loans Associations). In the hourglass framework, this amounts to raising σ. Diversification is generally encouraged. In addition, those industry programs support cocoa communities. Evidently, this involves fighting against child labor. In that respect, firms are increasingly adopting what they call Child Labor Monitoring and Remediation Systems (CLMRS). Firms are also involved in the building or renovating of infrastructure such as schools, canteens, separate toilets for boys and girls, health clinics, water pumps, etc. Industry programs also

[12]This section focuses on the sustainability initiatives from the private sector (firms and independent certification schemes). Other actors are omitted, notably the International Cocoa Association (ICCO), which brings together cocoa producing and cocoa consuming countries.

[13]Note that all the information in this section is taken from the companies' websites, the sustainability programs' websites and publicly available reports. The latter are usually easily found on company websites. There are also external reports on Cargill and Barry Callebaut's activities (respectively, Ingram et al., 2013; Balineau, Bernath, and Pahuatini, 2017). In the case of Nestlé, the Fair Labor Association publishes evaluations on its own website (Fair Labor Association, 2015; Fair Labor Association, 2016). All the references are available in appendix C.2. The research was carried out between January and March 2017, and updated in January 2018.

tend to have an environmental element. This usually involves fighting against deforestation by mapping forests and farms and promoting sustainable agricultural practices to farmers (e.g. the use of shade trees). Finally, some firms have an important R&D element. For instance, Mars funds and leads research programs, and participated in the mapping of the cocoa genome (for which the results are publicly available). All industry programs aim to eventually source all of their cocoa sustainably (except perhaps Nestlé, which nevertheless aims to sustainably source 57% of its anticipated cocoa supply in 2020, and does not yet have an objective beyond that date).

None of the industry sustainability programs are carried out in isolation. They are all the results of a complex web of partnerships with NGOs (such as CARE International or Solidaridad), governments and international organizations (including the International Cocoa Initiative, which promotes child protection, and the U.N.). Firms even partner with each other. In particular, manufacturers are not directly in contact with cocoa farmers, which means that they have to work with their suppliers (see figure C.1 in appendix C.1). For instance, Barry Callebaut and Solidaridad are building the reach of Mondelēz' Cocoa Life program in Côte d'Ivoire.[14] Mondelēz also partners with Cargill in Indonesia. Finally, programs are also verified and/or audited by independent third parties.

4.4.1.2 Differences between programs

Let me now turn to the differences between these programs. First of all, it is very hard to compare their sizes, as the metrics published by firms are not always comparable. Moreover, given the existence of partnerships between firms, it is possible that the same quantity of sustainable cocoa is counted as their own by several schemes. For instance, farmers could belong to both a grinder's and a manufacturer's sustainability programs (see figure C.1 in appendix B.1) (Fountain and Hütz-Adams, 2015). Overall, grinders' programs seem to have a bigger scale than manufacturers', perhaps reflecting the fact that they are closer to farmers in the value chain. According to the 2015 Cocoa Barometer (Fountain and Hütz-Adams, 2015), the major traders and grinders have trained about 500,000 farmers (excluding ADM, which did not provide numbers), while the same figure for manufacturers is of about 150,000. This represents about 12% of the total number of farmers (approximately five and half million). To reach their commitments, companies will have to train three times this amount of farmers (Fountain and Hütz-Adams, 2015).

A key aspect in which the firms' sustainability strategies differ is their relationship with independent certification schemes. Some of the industry programs described above are sustainability programs only, and not labels. This is notably the case for Cargill and Mars. Concretely, this means is that it is not possible to buy chocolate labelled 'Cocoa Promise' (for Cargill) or 'Vision for Change' (for Mars), whereas it is for 'Cocoa Life'(Mondelēz), 'Cocoa Plan' (Nestlé) and 'Cocoa Horizon' (Barry Callebaut). Cargill's scheme is closely linked to UTZ Certified. In fact, the Cocoa Promise training can allow farmers to apply to certification (for the UTZ certification, see Ingram et al., 2013). Although 80% of its sustainable cocoa is UTZ certified, Cargill also offers other types of certified cocoa (8% is supplied by the Rainforest Alliance, 7% by Fairtrade and 5% from other sources). Mars also relies exclusively on third party certification and prides itself of being the only major manufacturer to work with the three major organizations (Fairtrade International, UTZ and Rainforest Alliance). According to their website, they are'... fast on [their] way to becoming the world's largest buyer of certified cocoa.' Still, the exact relationship between their farmer support program

[14]See https://www.cocoalife.org/ /media/cocoalife/Files/pdf/Library/Cocoa%20Life%20Progress%20Report, last accessed on March 27, 2017.

and these certification schemes is unclear (e.g. does the training systematically allow to certify?).

Barry Callebaut's program, Cocoa Horizons, is a label, in the sense that Barry Callebaut's customers can buy chocolate labelled 'Cocoa Horizons'. Note that the program is run and funded by a non-profit organization, called the Cocoa Horizons Foundation. Barry Callebaut is still an important partner, as it appoints two out of three directors at the Foundation's board, and has a large role in its funding (through the purchase of Horizons products and donations). The firm also provides its manufacturer and artisan customers with independently certified chocolate from the three main independent labels, and works with cooperatives to produce certified beans. Still, in 2015, 67% of Barry Callebaut's sustainable cocoa came from its own programs. Similarly, Nestlé's Cocoa Plan is a label, but Nestlé also purchases cocoa from independent certification schemes.[15] In its 2016 report, Nestlé indicates that 'A high proportion of [Cocoa Plan] cocoa was sourced from farms and plantations that meet the UTZ certification Code of Conduct for Cocoa standard … and the Fairtrade certification standard.' In that same report, it is also explained that Nestlé developed its relationship with UTZ '… to extend their work from certification to field KPI collection.' Finally, Mondelēz' Cocoa Life is also a label. Nonetheless, in November 2016, a partnership was announced between Cadbury (which is owned by Mondelēz) and Fairtrade for the whole Cocoa Life program. A notable consequence is that Cadbury products, which used to carry the Fairtrade logo, now display the Cocoa Life logo in the front and the Fairtrade logo on the back.[16]

4.4.1.3 Impact

The impact of these programs is unclear. The reports available on companies' websites usually disclose individual indicators of progress, such as yield improvement and income increase. These are overwhelmingly positive, which is a good sign. There are also some baseline studies available. Other than that, I wasn't able to find a rigorous econometric analysis of the impact of these industry programs on farmers' standards of living. The study by Giuliani et al. (2017) for the coffee in-house sustainability program which was described in section 4.1 provides some insight. Still, they do not compute the impact of program participation on income or standards of living, and do not compare the in-house program with other certification schemes. This kind of analysis is all the more needed that premiums and yield increases may not cover the increased costs that come with the input purchases and farm investments entailed by the program (see in particular Ingram et al., 2013; Balineau, Bernath, and Pahuatini, 2017; Fountain and Hütz-Adams, 2015).

Moreover, the above description of private sustainability plans raises the issue that so many different initiatives increase the risk of 'overlap, replication, and lack of coordination' (Barrientos, 2016). This echoes the concern raised by Auriol and Schilizzi (2015) that self-certification results in a duplication of sunk costs, constituting a 'pure waste'. In 2011, the International Cocoa Organization estimated that there were 60 initiatives to support cocoa farmers in the world (Barrientos, 2016). In addition, the sector's sustainability programs often cover the same groups of farmers, at least in Côte d'Ivoire. There, those groups make

[15] See https://www.forbes.com/sites/bethhoffman/2013/05/22/4-reasons-why-nestles-cocoa-plan-is-not-enough/, accessed on February 12th, 2018.

[16] See http://www.independent.co.uk/news/business/news/cadbury-chocolate-fairtrade-logo-scheme-at-risk-mondelez-international-a7443226.html, accessed on January 25th, 2018. According to the press release, 'Cadbury and Fairtrade will now work together on new innovative programs to enhance the future for farming communities, such as building resilience to climate change … .' The agreement between Fairtrade and Cadbury also stipulates that the farmers should be at least as well off as before.

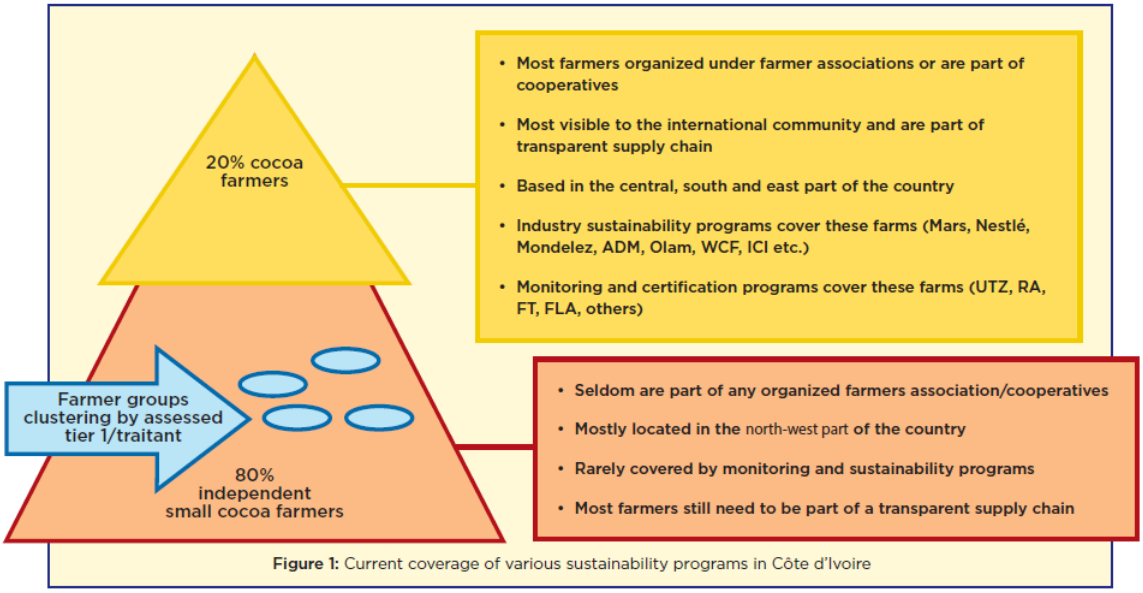


FIGURE 4.3: Current coverage of various sustainability programs in Côte d'Ivoire (Fair Labor Association, 2016)

up about 20% of cocoa farmers (cf. figure 4.3, Fair Labor Association, 2016). In the words of Fountain and Hütz-Adams (2015), 'Even when present, projects often only reach already organized farmers. These "low hanging fruits" are now mostly part of multiple company projects or standard setting bodies.' Not only is this inefficient, it might also considerably confuse farmers.

The industry does coordinate somewhat, notably through the World Cocoa Foundation.[17] Founded in 2000, the WCF is an international membership organization that promotes sustainability in the cocoa sector. Its more than 100 member companies include cocoa and chocolate manufacturers, processors and supply chain managers, representing more than 80 percent of the global cocoa market. Its board of directors is constituted of senior leaders from WCF member companies.[18] All the companies introduced in this paper are members. The WCF was instrumental in the setting up of the industry-wide strategy to accelerate sustainability, CocoaAction. Its objective is to convene the cocoa sector, including companies and governments, in order to '...align complementary roles and responsibilities, leverage scale and efficiency through collabouration, and catalyze efforts to accelerate sustainability...'. All of the aforementioned firms have committed to CocoaAction.[19] The four main standards and certification schemes (Fair Trade USA, Fairtrade International, Rainforest Alliance and UTZ) are also a key partner group of CocoaAction.[20] For now, CocoaAction

[17] Information in this paragraph was found on https://www.cocoalife.org/the-program and pages of the World Cocoa Foundation website (http://www.worldcocoafoundation.org), accessed in March and April 2017.

[18] http://www.worldcocoafoundation.org/wp-content/uploads/CocoaAction-Frequently-Asked-Questions-April-2016˙Final.pdf, last accessed on April 13, 2017.

[19] At this point, it is interesting to note that firms are cautious about antitrust opportunities: 'CocoaAction and its member companies are mindful of the constraints of the antitrust laws. CocoaAction participants shall not enter into discussions, agreements or concerted actions that may have as their object or effect the restriction of competition.' See Cocoa Action's 2016 Annual Report, available from http://www.worldcocoafoundation.org/wp-content/uploads/2016-CocoaActionReport-English˙WEB˙10-30.pdf and last accessed on April 13, 2017.

[20] See footnote 19.

is active in Côte d'Ivoire and Ghana, where it is aiming to train and deliver improved planting material and fertilizer to 300,000 cocoa farmers, and to empower 1200 communities by 2020. [21]The WCF also implements, manages, and participates in programs at the grassroots level for independent family farmers in 15 cocoa-producing countries in Africa, Asia and Latin America. For example, in West Africa, the WCF is implementing since 2009 and until 2019 the Cocoa Livelihoods Program (CLP).[22] The CLP aims to increase farmer income for 200,000 cocoa-growing households in Cameroon, Côte d'Ivoire, Ghana, and Nigeria, between 2009 and 2019. Contributing partners include (but are not limited to) all the firms listed in the previous section. Their involvement with the CLP directly contributes to the their commitments within CocoaAction.

4.4.2 Independent certification schemes

The production of certified cocoa has been growing over the years, with the Rainforest Alliance and UTZ more than doubling the volume certified each year since 2010 (Fold and Neilson, 2016). This evolution is shown on figure 4.4. In 2013, Fairtrade International, UTZ, and the Rainforest Alliance certified about 1.4 million tonnes of cocoa, which represented about 30% of the world market (Fountain and Hütz-Adams, 2015). This figure is perhaps overly optimistic, since double or even triple certification can occur. What this means is that a given tonne of cocoa could be counted as certified by more than one certification scheme (Fountain and Hütz-Adams, 2015). Overall, it is estimated that between 33 and 50% of certified cocoa is in fact not available, meaning that the actual quantity of certified cocoa ranges between 720,000 and 650,000 (Fountain and Hütz-Adams, 2015). In 2013, about 631,000 tonnes of cocoa were sold as certified. Half of this quantity is sold to small 'niche' chocolate companies and home brands, as opposed to big manufacturers (Fountain and Hütz-Adams, 2015). Notice that not all of the actual production of certified cocoa is sold as such (Fountain and Hütz-Adams, 2015; Fold and Neilson, 2016).

Let us now look at each of these certification schemes in turn, starting with UTZ.

[21]See footnote 18.

[22]Reports on each of the programs are available on the website, http://www.worldcocoafoundation.org/category/knowledge-center/reports/, accessed on April 12th, 2017.

FIGURE 4.4: Tonnage (in 000s) of the three major certification schemes (Fountain and Hütz-Adams, 2015)

4.4.2.1 UTZ

UTZ is a Dutch non-profit organization (Barrientos, 2016), created in 2002 by a Belgian-Guatemalan coffee grower and a Dutch coffee roaster, under the name 'UTZ kapeh' (meaning 'good coffee' in the Guatemalan Mayan language of Quiché).[23] In 2007, UTZ expanded its offer to cocoa and tea. Besides UTZ, founding members for the cocoa program were Cargill, Ecom Agroindustrial, Heinz Benelux, Mars, Nestlé, Royal Ahold, but also NGOs Solidardad, Oxfam Novib and WWF.[24] It is now the largest certification program for coffee and cocoa in the world. UTZ' cocoa program (which is also its biggest) involves more than 610,000 farmers, in 20 countries.

[23]Unless indicated otherwise, all the information in this paragraph is available from UTZ' website: https://utz.org/, accessed on February 6th 2018.

[24]See https://www.utzcertified.org/en/features/60-origin/exporters/60-utz-certified-cocoa, accessed on February 6th, 2018.

The UTZ standard includes two sets of guidelines: the Code of Conduct and the Chain of Custody. First, to become certified, producers have to follow the Code of Conduct, which offers '... expert guidance on better farming methods, working conditions and care for nature' (i.e. guidance on increasing σ, in the hourglass framework). Of course, this involves a ban on child labor. Through this Code, producers have access to support and training on how to improve both the quality and the quantity produced. To ensure that they comply, producers (and companies) receive regular checks carried out by independent auditors. Farmers also receive a variable premium in cash for their certified product, which is negotiated between the farmer or farmer group and the first buyer (usually a trader). The premium can be spent for group management costs (like audits), products and services used by the producer group, or in-kind or cash payments to certified group members. UTZ does not dictate any specific allocation of funds, but farmer groups are required to report how the premium is spent to their members. Moreover, the Code of Conduct evolves over time, adding requirements over the years to give farmers time to adapt. On top of the Code of Conduct, the certified product must also follow the Chain of Custody, which covers cocoa from the farm gate until it arrives on the shelves. This provides transparency, by ensuring that the product did originate from a UTZ Certified source.

4.4.2.2 Rainforest Alliance

The Rainforest Alliance is an American NGO created in 1987. It certifies farmers, foresters and tourism entrepreneurs, and is now active in 78 countries, through sustainability training and/or certification programs. Its cocoa activities began in 2006. The scheme's mission is to conserve biodiversity and to ensure sustainable livelihoods. The Agriculture Standard is built around four principles of sustainable farming: biodiversity conservation, improved livelihoods and human well-being, natural resource conservation, and effective planning and farm management systems (i.e. increasing σ). Overall, more than 1.3 million people are trained to the Rainforest Alliance's methods (as of December 2016). Certified farms are audited annually against environmental, social and economic criteria. The Rainforest Alliance's auditing and certification services are carried out by the RA-Cert Division, which is a separate unit from the Agriculture, Forestry, Climate and Tourism programs and from the operational units. Certified farmers are not guaranteed a price premium, but they generally do sell at a higher price thanks to the increasing demand for certified crops.

In January 2018, UTZ and the Rainforest Alliance merged to build a new organization, so as to have a greater impact and '... be a better partner to the many stakeholders [they] work with.' The two schemes will remain separate until the publication of the new certification program in 2019. The name will remain Rainforest Alliance.

4.4.2.3 Fairtrade International (FLO)

The creation of the Fairtrade non-profit organization goes back to the 1988 launch of the first Fairtrade label, Max Havelaar, in the Netherlands, under the initiative of the Dutch organization Solidaridad.[25] Many other initiatives started in the following years across Europe and North America. In 1997, the Fairtrade Labelling Organizations International (FLO) was established in Germany, to unite the national organizations and harmonize global standards and certification schemes. In 2004, the organization split into two independent organizations: FLO, in charge of setting standards and supporting producers, and FLO-CERT, which

[25]Information available from https://www.fairtrade.net, accessed on January 30th, 2018 and February 7th 2018.

focuses on inspecting and certifying producer organizations and auditing traders (Auriol and Schilizzi, 2015). The name 'Fairtrade International' was adopted in 2011.

There are two sets of Fairtrade standards: one applies to smallholders working in cooperatives or other types of democratic organizations, and the other set applies to workers. The objectives of the Fairtrade Standards are to (i) ensure producers receive prices that cover average costs of sustainable production (through a minimum price), (ii) provide a premium that can be invested in (democratically chosen) projects of social, economic and environmental development, (iii) enable pre-financing for producers who require it, (iv) facilitate long-term trading partnerships and enable greater producer control over the trading process, (v) set clear core and development criteria to ensure that the conditions of production and trade are socially and economically fair and environmentally responsible. Most products are assigned a set minimum price, meant to ensure that producers cover their costs and acting as a safety net against volatility. While these objectives do not directly affect farmers' productivity (σ), premiums and pre-financing should allow farmers to make necessary investments on their farms, and hence to make their production more efficient.

4.4.2.4 Impact

According to Blackman and Rivera (2010), the evidence base on the impact of certification is rather thin. To start with, many papers fail to identify the causal impact of certification. For instance, they do not take into account the fact that producers self-select into certification programs. Only 14 studies out of the 37 they looked into construct a 'reasonable counterfactual'. In addition, the literature is not well-balanced, on both the type of certification and the sector of certification. A disproportionate number of studies look at Fair Trade, and most studies focus on coffee, timber and bananas. Compared, the impact of certification in the cocoa sector is largely neglected. Overall, Blackman and Rivera (2010) explain that just 6 out of the 14 aforementioned studies find some evidence that certification has positive socioeconomic or environmental impacts. In their literature review for the FAO, Loconto and Dankers (2014) investigated the impact of certification on smallholders' market access. They find that the evidence base on this issue is also relatively weak, and indicates that such an impact is very much context-specific. In any case, access to certified markets is conditioned to group certification.

Loconto and Dankers (2014) are not the only ones to suggest that the effects of certification largely depend on local characteristics. For instance, Mitiku et al. (2017) and Chiputwa, Spielman, and Qaim (2015) find opposite effect of Fairtrade certification for coffee, in Ethiopia and Uganda, respectively. Chiputwa, Spielman, and Qaim (2015) find that Fairtrade reduces poverty, while Mitiku et al. (2017) find that it only increases coffee income, without increasing household income or reducing poverty. Mitiku et al. (2017) suggest that this difference might be due to the way the coffee supply chain is organized in each country. In Uganda, Fairtrade cooperatives supply private coffee exporters with already milled coffee, and their farmers receive a price that is 30% higher for their coffee. However, in Ethiopia, Fairtrade cooperatives supply dried coffee cherries to the regional coffee union, which takes care of the milling and processing. As a consequence, farmers receive a price that is only 7% higher. Mitiku et al. (2017) also underline the importance of the cooperative characteristics. In their relatively small dataset, it is pretty much impossible to disentangle the certification effect from the effect of belonging to a specific cooperative. Of course, this can bias the results (e.g. if better performing cooperatives tend to certify), but it also renders the certification outcomes highly context specific.

Nevertheless, Dragusanu, Giovannucci, and Nunn (2014) investigate the broad 'Fair Trade' movement (to which Fairtrade International belongs), and overall their conclusions are positive. According to them, Fair Trade achieves many of its objectives. Fair Trade-certified farmers do tend to receive higher prices, have a better access to credit, and experience greater economic stability. In addition, they are also more likely to engage in better environmental practices. On the other hand, there is evidence that Fair Trade farmers are sometimes unaware of the details of the Fair Trade certification, and sometimes distrust cooperative management. Dragusanu and Nunn (2014) also raise the question of the long-term future of Fair Trade. They cite De Janvry, McIntosh, and Sadoulet (2015), who argue that free entry into Fair Trade certification means that the Fair Trade rent will eventually be dissipated. Thus, Fair Trade agencies face a trade-off: they might be keen to spread Fair Trade and its benefits, but it will come at the cost of lower certification rents. Even though that might be true, there are in practice some barriers to entry (e.g. size of farms), as well as some non-monetary benefits to certification (e.g. creating democratic cooperatives). Podhorsky (2015) also finds that the existence of Fair Trade intermediaries allows to decrease the market power of other, traditional intermediaries, and hence to increase the wage of non-certified farmers.

Hence, overall, the effect of cocoa certification is uncertain, and likely to be largely context specific. The available evidence for the broad Fairtrade movement tends to be positive (cf. Dragusanu, Giovannucci, and Nunn, 2014). However, I wasn't able to find a paper similar to the one by Dragusanu, Giovannucci, and Nunn (2014) for UTZ or the Rainforest Alliance, and thus cannot give any general conclusion as to their effects on smallholders.

4.5 Discussion and analysis

4.5.1 Why such a proliferation of industry sustainability programs?

Clearly, there is a need for a holistic approach to make the cocoa sector sustainable (Fountain and Hütz-Adams, 2015). Firms have a responsibility towards the actors along their supply chain, especially farmers. They are also in an excellent position to provide farmers with services, notably inputs and credit (see Swinnen et al., 2015d). The existence of these sustainability programs exemplifies the fact that companies are aware of this and are acting on it. This explains and justifies the existence of so many programs, to some extent. But it doesn't explain why firms don't simply source their cocoa from independent certification schemes like the ones described above. In fact, recall that the literature outlined in section 4.1 did not provide a clear answer to this question. Hence, why do firms all have their own sustainability program? What factors explain this sustainability strategy? What are the implications for farmers and for consumers?

4.5.1.1 A complement to certification

To start with, it is useful to compare the independent certification schemes to the industry in-house programs. They have some similarities, especially UTZ and Rainforest. Both certification schemes are focused on increasing farmer productivity (σ), which is not unlike the farmer support element of industry programs. The key difference is probably the community support efforts of the industry programs. Beyond their commitment against child

labor, UTZ and Rainforest do not support communities in the same ways as firms, i.e. by building schools or other community infrastructure.[26]

Another difference between independent certification schemes and in-house industry programs is the 'burden of results'. Independently-certified farmers are audited regularly, to make sure that they comply with the certification standards. As far as I know, farmers belonging to industry programs are not subjected to such audits. Instead, the firms' programs are surveyed to check whether they are yielding results, and if not why.[27] The accountability shifts from farmer to firm. This could exemplify a different strategy taken by firm, according to which sustainability responsibilities should not be borne by farmers, but by corporations.

Hence, perhaps firms set up their own programs to be able to complement the work of certification schemes. Perhaps they feel responsible, and they want to provide directly for their cocoa suppliers' communities, as part of their Corporate Social Responsibility strategy. Nevertheless, neither of these explanations can account for the different strategies taken by the various industrial players. Why don't all firms partner with certification schemes, like Cargill and Mars do? Why did Barry Callebaut, Nestlé and Mondelēz create their own sustainability labels?

4.5.1.2 A lack of independently certified cocoa

One might think that this is because independent certification schemes do not provide enough cocoa to meet the demand, but the fact is that not all certified cocoa is sold as such, i.e. some cocoa is produced under the right certification conditions, but is not sold as certified. According to farmers, the production of certified cocoa is 'far higher than demand' (Fountain and Hütz-Adams, 2015). As previously explained, double certification also occurs, and even industry programs seem to cover the same communities as certification schemes (see figure 4.3). This suggests that there would be enough resources to cover more farmers. Finally, demand can even foster the creation of new certified areas. The first UTZ-certified cocoa from Indonesia was produced in 2010, as a result of Mars' certification advocacy.[28] In sum, a lack of certified cocoa sources does not seem to be the issue.

4.5.1.3 A corporate skepticism

Another possible explanation is that private, industrial sustainability programs reflect a corporate skepticism of the effectiveness of certification alone (Fold and Neilson, 2016). For instance, according to Fold and Neilson (2016), '… [firms'] programs are increasingly implemented as support programs for improved farm practices, and the adoption of superior technologies and planting materials, which, it should be noted, are not always embedded within existing certification schemes.' In other words, firms believe that certification alone will not be effective enough, and have stepped up. This explanation is substantiated by the following quote from one of Nestlé's Cocoa Plan report:[29]

[26] With certification, premium payments to certified farmers and their organization can be used for community improvements if farmers choose to. Furthermore, while certification schemes do have programs targeted to specific issues, as far as I understand such programs do not involve directly investing in community infrastructure.

[27] See for instance the Fair Labor Association's reports on Nestlé's supply chain.

[28] See http://www.mars.com/global/sustainable-in-a-generation/our-approach-to-sustainability/raw-materials/cocoa, accessed on February 12th, 2018.

[29] Available from https://www.nestlecocoaplanreport.com/ and accessed on January 19th 2018.

We used the highly reputable certification bodies Fairtrade and UTZ to audit and verify that child labor was not present in our suppliers' fields. ... In time, we came to find that without additional support for farmers on the ground, certification alone tended to drive the issue underground. Put simply, when the auditors came, the children were ushered from the fields and when interviewed the farmers denied they were ever there. This is not to put the blame on the certification system, but it merely highlights that it has its limitations. We needed to get closer to the problem ourselves and tackle its causes.

Thus, by using their own label, firms reveal that they believe their contribution to sustainability to be more effective than that of independent schemes. Overall, this 'skepticism' explanation seems to fit the facts quite well, but a few questions remain unanswered. First, if they believe that independent certification is not fully effective, why do they still use it for some of their sustainable sourcing? And why do Cargill and Mars make the choice to entirely rely on them to source their certified cocoa? Second, it seems that firms often partner with certification schemes, notably for training (even Nestlé, who partners with UTZ for field data collection).[30] Thus, why not extend these partnerships, and use the firms' findings to improve certification?

4.5.1.4 A strategic decision

Other answers could point to more 'strategic' motives. At the producer end of the supply chain, grinders and manufacturers may want to secure a loyal (and perhaps dependent) supply of cocoa, in the face of the current challenges of cocoa production. Perhaps creating a program provides firms with greater control over their supply and a 'captive' source of cocoa, echoing the concerns of Neilson (2008). Still, this doesn't explain the different strategies chosen by firms.

Alternatively, existing certification schemes might be too costly to buy from. Perhaps firms want to respond to consumer demands, but are unable to source all of their cocoa from independent certification programs. Hence, firms may create their own label, tailor-made to their budget and their needs: 'There has always been the potential for mainstream partners to co-opt the more convenient elements of broader fair trade at the expense of the more radical edges.'[31] In the next section, we explore this possibility, with the theoretical framework introduced in section 4.2.

4.5.2 Back to the hourglass framework

First, and as pointed out throughout the narrative, all of the sustainability initiatives presented here (whether in-house industry programs or independent certification) aim at increasing farmer productivity, in one way or another. In the theoretical framework, this corresponds to increasing σ. For now, I am agnostic with respect to the relative value of σ for each of the two kinds of sustainability programs. In other words, we do not impose *ex ante* a higher value of σ for one program relative to the other.

As described in section 4.2, the result of the σ comparative statics is uncertain, and depends on the quantity of cocoa firms are dealing with. If quantities are small, an increase in σ is likely to increase profits, but if quantities are large, the same increase in σ is likely to

[30] UTZ also has customized programs with large companies, '... engaging buyers in emerging markets on sustainability, and developing [their] Sector Partnerships program to create a dialogue on sustainability at the local level [in partnership with the Dutch government].'

[31] See https://theconversation.com/its-not-a-very-merry-christmas-for-fairtrade-chocolate-69761, accessed on February 13th, 2018.

lead to an uncertain outcome. Firms may not want to implement a sustainability program, because of this uncertainty, but have to secure a supply of primary commodity in a context where it is threatened. If we apply these two different possibilities (i.e. the different effects of an increase in σ depending on quantities) to firms rather than the whole industry (i.e. we apply the model to an individual supply chain, from its sustainable producers to its sustainable-cocoa-demanding consumers), this difference may contribute to explain firms' choice in sustainability strategies.[32]

Indeed, one could imagine that in-house industry sustainability programs allow to exert more control: by controlling the rise in cocoa farmers' productivity (σ), firms dealing with large quantities of cocoa and chocolate could ensure that the change in marginal productivity is larger than the change in S^{-1}. Using certification schemes would be more risky, profit-wise. Let me now go back to the firms we are talking about. We have on the one hand Cargill and Mars, which rely on certification. We have on the other hand Barry Callebaut, Mondelēz and Nestlé, which have their own label (but also source some cocoa through certification schemes). According to the 2015 Cocoa barometer (Fountain and Hütz-Adams, 2015), in 2013 Barry Callebaut used 1,000,000 tons of cocoa, whereas Cargill and ADM used 500,000 tons each. On the side of manufacturers, and in the same year, Mondelēz has used 450,000 tons of cocoa, Nestlé 430,000 and Mars 390,000. In sum, it appears that the firms which handle the largest amount of cocoa (Barry Callebaut, Mondelēz and Nestlé) created their own sustainability label, while Mars and Cargill rely on independent certification.[33] The model is therefore consistent with what is observed in reality: firms that deal with the largest quantities of cocoa create their own label, in order to control the rise in σ and ensure a positive change in profits.

In addition, as explained earlier, consumers have been shown to be sensitive to CSR (Kitzmueller and Shimshack, 2012), and are increasingly aware of the social and economic origins of chocolate (Barrientos, 2016). Hence, one can expect demand for sustainable chocolate to rise. Here, this can be studied by increasing the δ parameter in the demand function. While all sustainability initiatives will increase δ, choosing independent certification is likely to have a larger impact on demand than in-house certification ($\Delta\delta_{certification} > \Delta\delta_{in-house} > 0$). Certification schemes are now well established and well known by consumers, so that the latter are probably more responsive to them. The situation can be summarized as shown in figure 4.5, which summarizes (and simplifies) the situation in the North East quadrant of the four-quadrant diagram.

Considering only the change in σ, firms dealing with small quantities and choosing certification would be at equilibrium 2, while firms dealing with large quantities and in-house programs would be at 1 or 2, assuming they are successful at avoiding equilibrium 3. Bringing in the change in δ, firms with low quantity and a certification program end up at equilibrium A, and their profits increase further. They have no incentive to use in-house programs. On the other end, firms with high quantities and in-house program would end up either at B or C. If they had chosen certification, they would reach equilibrium D. It is unclear which of B, C or D is more profitable, and hence the introduction of δ does not help explaining these firms' strategy.

[32]This application of the model can also be justified by the fact that, as described earlier, few firms may exert oligopoly or monopoly power over certain specific geographic regions, and on the consumer side the market is segmented.

[33]Nowadays however, and since the merger, Cargill's size must be comparable to Barry Callebaut.

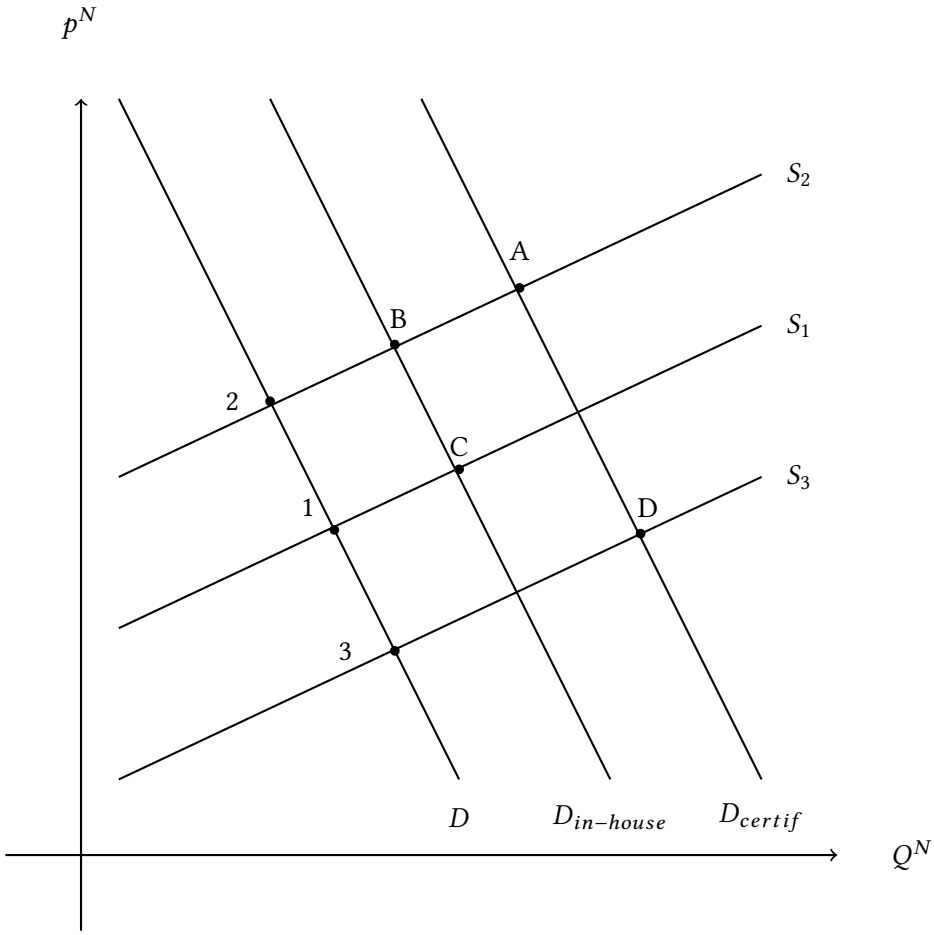


FIGURE 4.5: The choice between in-house programs and certification

Nevertheless, this ambiguity may help explain the fact that even when firms create their own sustainability labels, they continue to use certification. Perhaps they can arbitrate and hedge risk *within* their product range, depending on the anticipated effect on demand and the quantities traded. Certification does have a better visibility, and might have a greater impact in some product lines. This is consistent with the fact that a sorting equilibrium arises under heterogeneous consumer preferences (see section 4.1). In fact, all three certifiers allow mass-balance for cocoa. Mass-balance means that certified and non-certified cocoa are processed together. Firms are required to keep track of volumes and display the certification logo on their end product accordingly. In other words, the total quantity purchased of certified cocoa must match the total quantity of cocoa in the final products displaying the certification logo.[34] Indeed, for commodities like cocoa or sugar, it is near impossible, or very costly, to segregate between certified and non-certified supply in manufacturing plants. In any case, this rule might allow firms to strategically decide how much certified cocoa to buy and for which products.

Note that the cost of these programs, or the cost of sourcing certified cocoa as opposed to standard cocoa, is missing from this theoretical analysis, even though firms are ready to spend millions to promote sustainability. I choose not to model this into the model, and instead assume that such investments are necessary in order for firms to secure their supply and respond to civil society demands, regardless of the cost. The only choice left for them is certification or in-house program. Moreover, the relative sizes of these costs is unknown, i.e. it is unclear which of certification or in-house program is more expensive.

To finish, what would be the impact of either strategies for farmers? On the one hand, in-house programs might allow more coverage, since they are preferred by firms dealing with the largest amount of cocoa. On the other hand, these same firms might have an incentive to limit the increase in cocoa farmer productivity (σ) to ensure that they make a positive profit. While the model brings this trade-off to light, it does not allow to answer this question, which is left to further research. Empirically, one would want to test the impact on farmer productivity and living standards of both kinds of sustainability programs, in similar communities, but also perform a cost-benefit analysis of both types of programs, taking into account program coverage and efficiency.

4.6 Conclusion

I started this paper by outlining the relevant literature, and by introducing the hourglass framework developed in Azam and Galez-Davis (2018). I then described the structure of the value chain, from cocoa production to chocolate manufacturing, and showed how it exhibited the 'hourglass' shape developed in the theoretical framework. I showed that cocoa production faced many challenges which threaten its long-term production, and described the different sustainability initiatives that aim to tackle these challenges. In particular, firms along the value chains have stepped up, taking advantage of their privileged position to reach farmers. The sheer number of these private initiatives raise concerns of 'overlap, replication, and lack of coordination' (Barrientos, 2016). Finally, I described how three independent certification schemes (soon to be only two) also play an important role in the sustainable cocoa sector.

[34] See https://utz.org/better-business-hub/sourcing-sustainable-products/6567/, accessed on February 7th, 2018.

In the discussion section, I wondered why firms had felt they had to create their own sustainability programs, on top of the existing certification schemes. The most convincing answer was the hypothesis that in-house quality labels may be a strategic decision. Strategic with respect to farmers, since it allows firms to perhaps secure their sustainable cocoa supply. Strategic also with respect to consumers, to whom they can advertise the good they do in cocoa producing countries while controlling their costs.

In the last part of the paper, I came back to the hourglass framework to examine this last possibility (i.e. that in-house sustainability programs are a strategic decision). The model showed that sustainable sourcing entailed uncertain profits for firms dealing with large quantities of cocoa and chocolate. Using in-house quality labels might allow such firms to better control the assistance that they provide to farmers. Hence, in the end, the choice of sustainability strategy is likely to depend on the total quantity of cocoa traded. This doesn't prevent firms from arbitrating between the two strategies within their cocoa/chocolate range, taking advantage of potential differences in quantities and demand effects across product lines.

In sum, riskiness seems to be key to firms' strategies to address sustainability issues in their value chain. They may need more control than what certification can provide. In that respect, partnerships between firms and certification, like the one between Cocoa Life and Fairtrade, may be good news. They might allow certification schemes to monitor and have a say in sustainability initiatives, while firms can afford to widen their sustainable sourcing. On the other hand, it is unclear what roles certification have in these partnerships. In the case of Cocoa Life and Fairtrade, the latter is relegated to the role of partner and products display its logo on the back, while the Cocoa Life logo is at the front. This is likely to be confusing for consumers. More broadly, a proliferation of quality labels in the chocolate market may blur the signals that labels are supposed to send to consumers.[35]

On the side of farmers, the paper has shown that there is little evidence on the impact of sustainability programs on their livelihoods, while the model has evidenced that the two kind of strategies may have substantially different effects. In addition, the multiplicity of labels and its potential impact on consumers may also affect demand for sustainable chocolate, and in turn the firms' incentive to keep up the current momentum. Such effects and incentive must be well understood, in order to promote improvements in the cocoa farmers' livelihood.

[35]See http://www.independent.co.uk/news/business/news/cadbury-chocolate-fairtrade-logo-scheme-at-risk-mondelez-international-a7443226.html, accessed on January 25th. 2018.

Appendix A

Appendix

Appendix A

The Political Economy of Foreign Direct Investment and Foreign Aid in Sub-Saharan Africa

A.1 Data description and sources

The variables used in the paper are listed below, by source. Their descriptions are taken directly from their source.

1. **The World Data Bank**
   Accessed on January 15th, 2015 using the 'wbopendata' tool on Stata.

   - **Adjusted savings: energy depletion (% of GNI)**. Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas.
   - **Alternative and nuclear energy (% of total energy use)**. Clean energy is noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others.
   - **Arms exports (SIPRI trend indicator values)**. Stockholm International Peace Research Institute (SIPRI) statistical data on arms transfers relates to actual deliveries of major conventional weapons. To permit comparison between the data on such deliveries of different weapons and to identify general trends, SIPRI has developed a unique system to measure the volume of international transfers of major conventional weapons using a common unit, the trend-indicator value (TIV). The TIV is based on the known unit production costs of a core set of weapons and is intended to represent the transfer of military resources rather than the financial value of the transfer.[1]
   - **Foreign direct investment, net inflows (BoP, current U.S. dollars)**. Foreign direct investment (FDI) are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors. In the analysis, FDI is expressed as percent of GDP in current US dollars (also from the World Bank, see below).

[1] Data and data description come from SIPRI's Arms Transfers Programme, see http://portal.sipri.org/publications/pages/transfer/splash).

- **GDP (current U.S. dollars)**. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.
- **GDP per capita growth (annual %)**. It is based on constant local currency. Aggregates are based on constant 2005 U.S. dollars. GDP per capita is gross domestic product divided by midyear population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.
- **General government final consumption expenditure (% of GDP)** . General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation.
- **Inflation, consumer prices (annual %)**. Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.
- **Life expectancy at birth, total (years)**. Life expectancy at birth indicates the number of years a newborn would live, if the prevailing patterns of mortality at his or her birth were to stay the same.
- **Money and quasi money (M2) as % of GDP** . Money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. This definition of money supply is frequently called M2; it corresponds to lines 34 and 35 in the International Monetary Fund's (IMF) International Financial Statistics (IFS).
- **Net official development assistance received (current U.S. dollars)**. Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25 percent (calculated at a rate of discount of 10 percent). In the analysis, ODA is expressed as percent of GDP in current dollars.
- **Personal remittances, received (% of GDP)**. World Bank staff estimates based on IMF balance of payments data, and World Bank and OECD GDP estimates.[2]

[2]More information available at https://datahelpdesk.worldbank.org/knowledgebase/articles/114950-how-do-you-define-remittances, accessed on January 10th, 2018.

- **Population growth (annual %)**. It is computed as the exponential rate of growth of midyear population from year t-1 to t.
- **School enrollment, primary (% gross)**. This is the total enrollment in primary education, regardless of age, expressed as a percentage of the population of official primary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.
- **Total natural resources rents (% of GDP)**. Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.
- **Trade (% of GDP)**. It is the sum of exports and imports of goods and services measured as a share of gross domestic product.

2. **The Quality of Government institute data (Dahlberg et al., 2015)**.
   Accessed on May 17th 2015 and available from
   http://qog.pol.gu.se/data

   The variable definitions are copied from the codebook for the QoG standard dataset 2015.

   - **Ethnic fractionalization** (Alesina et al., 2003). The variables reflect the probability that two randomly selected people from a given country will not share a certain characteristic, the higher the number the less probability of the two sharing that characteristic. The definition of ethnicity involves a combination of racial and linguistic characteristics. The result is a higher degree of fractionalization than the commonly used ELF-index in for example Latin America, where people of many races speak the same language.
   - **Largest Government Party Orientation** (Beck et al., 2001). Categorical variable with 4 possible values (Right (1); Left (3); Center (2); No information (0); No exective (NA)).
   - **Oil production value in 2009 dollars** (Ross, 2013).
   - **Pareto-Lorenz coefficient** (Alvaredo et al., 2014).
   - **Political Constraints Index III** (Henisz, 2000). This index measures the feasibility of policy change (or the extent to which a change in the preferences of any one political actor may lead to a change in government policy). It is derived from a spatial model and theoretically ranges from 0 to 1, with higher scores indicating more political constraint. The index is composed from the following information: the number of independent branches of government with veto power over policy change, counting the executive and the presence of an effective lower and upper house in the legislature (more branches leading to more constraint); the extent of party alignment across branches of government, measured as the extent to which the same party or coalition of parties control each branch (decreasing the level of constraint); and the extent of preference heterogeneity within each legislative branch, measured as legislative fractionalization in the relevant house (increasing constraint for aligned executives, decreasing it for opposed executives). The index scores are derived from a simple spatial model and theoretically ranges from 0 to 1, with higher scores indicating more political constraint and thus less feasibility of policy change.
   - **Tax revenues** (OECD, 2014). Total tax revenue.

3. **The UCDP/PRIO Armed Conflict Dataset (Gleditsch et al., 2002)**. Version 4-2014a, last presented by Themnér and Wallensteen (2014).
   Accessed on April, 27th 2015 and available from
   http://www.pcr.uu.se/research/ucdp/datasets/ucdp_prio_armed_conflict_dataset/

   - **Conflicts**. This is a dummy variable indicating whether a given country was involved in a conflict in a given year.

   There are two things to note.

   Only the conflict years are listed. It is assumed that if a year is not listed, there was no conflict. One issue is that for one country/year, there may be several conflicts, and hence several observations. This prevents the merging of the 'conflicts' dataset with the master dataset. For simplicity, in the master dataset, only a dummy variable is kept indicating whether or not the country was involved in at least one conflict in a given year. So before merging, all 'duplicates' in the conflict dataset are dropped and a variable always equal to 1 called 'conflict' is created. When merging with the master dataset, the missing observations are recoded to 0 (again, this assumes that if a country/year is not listed in the conflict dataset, there was no conflict in that country/year).

   The *location* variable was used to merge with the master dataset. When there were two locations, the observation was duplicated for the two countries (except once, when the second country was Libya and hence was not part of Sub-Saharan Africa).

4. **Data from EM-DAT, The International Disaster Database (Guha-Sapir, Below, and Hoyois, 2015)**.
   Accessed on April, 27th 2015 and available from
   http://emdat.be/database
   Only the years for which a disaster occurred are listed. It was assumed that if a year was not listed, there was no occurrence. Thus, when merging this dataset with the master dataset, the years for which there were no observations were re-coded to 0.

   - **Disaster**. The variable is a dummy equal to one if there was at least one disaster in a given year.

5. **The website *L'aménagement linguistique dans le monde* (Leclerc, 2015)**.
   Accessed on April 28th, 2015 from http://www.axl.cefan.ulaval.ca.

   - **Colony dummies** (Author). More specifically, there are two dummies, for former French and English colonies.

   The last colonizer before independence was chosen in case there were several colonizers over time.

6. **OECD**
   Accessed on June 7th 2015 and available from http://stats.oecd.org/

   - **ODA: Total Net** (from Table 2.a. Aid (ODA) disbursements to countries and regions [DAC2a]). Detailed data by donor, recipient and year were recovered in constant prices.

A.2 Tables

Table A.1: First stage equations of the IV estimation from column (2) of table 2.3

	(1) FDI	(2) ODA	(3) Conflicts
Money and quasi money (M2) as % of GDP	-0.0122	0.0837***	-0.0000
	(0.0137)	(0.0271)	(0.0009)
Population growth (annual %)	0.1027	0.8659***	0.0063
	(0.1565)	(0.2949)	(0.0184)
School enrollment, primary (% gross)	-0.0079	0.0020	-0.0011
	(0.0135)	(0.0143)	(0.0008)
Life expectancy at birth, total (years)	0.1171**	-0.0705	-0.0058*
	(0.0478)	(0.0641)	(0.0033)
Government consumption (% of GDP)	0.0756**	0.1270**	0.0037
	(0.0383)	(0.0558)	(0.0024)
Political Constraints Index	-3.9690***	4.1799***	0.1200
	(1.1629)	(1.4901)	(0.0867)
Disaster dummy	-0.3702	1.5085***	0.0198
	(0.3904)	(0.4507)	(0.0220)
Donors' arms exports	-0.0000**	0.0000***	-0.0000
	(0.0000)	(0.0000)	(0.0000)
Donors' ethnic fractionalization	7.9341**	-5.5556	0.2775
	(3.4499)	(4.9768)	(0.2430)
Donors' tax revenue	0.0991*	0.2570***	0.0017
	(0.0565)	(0.0797)	(0.0033)
Donors' GDP	-0.0001*	-0.0003***	-0.0000**
	(0.0001)	(0.0001)	(0.0000)
Donors' Pareto Lorenz coefficient	0.0234	0.5742	0.0799**
	(0.6234)	(0.9166)	(0.0340)
Donors' use of alternative and nuclear energies	-0.0317	-0.0564	0.0013
	(0.0504)	(0.0451)	(0.0029)
Donors' energy depletion	-0.1916	0.5184***	0.0217**
	(0.1484)	(0.1840)	(0.0105)
Observations	1002	1002	1002
F-test	4.7613	5.6840	1.7030
F-test p-value	0.0000	0.0000	0.0028

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.010$

Table A.2: Robustness checks with the Bartlett/Newey-West kernel

	(1) Bandwidth = 2	(2) Bandwidth = 3	(3) Bandwidth = 4
Net FDI inflows (% of GDP)	0.8329**	0.8329**	0.8329*
	(0.4060)	(0.4202)	(0.4339)
Net ODA received (% of GDP)	0.0078	0.0078	0.0078
	(0.2128)	(0.2176)	(0.2211)
Conflict dummy	-2.9285	-2.9285	-2.9285
	(6.1200)	(6.0494)	(5.9481)
Financial development (M2, % of GDP)	-0.0863***	-0.0863***	-0.0863***
	(0.0293)	(0.0299)	(0.0307)
Population growth (annual %)	-0.7394**	-0.7394*	-0.7394*
	(0.3736)	(0.3882)	(0.3956)
School enrollment, primary (% gross)	0.0016	0.0016	0.0016
	(0.0191)	(0.0198)	(0.0203)
Life expectancy at birth, total (years)	0.1271	0.1271	0.1271
	(0.0843)	(0.0866)	(0.0871)
Government consumption (% of GDP)	-0.1108*	-0.1108*	-0.1108*
	(0.0619)	(0.0641)	(0.0656)
Political Constraints Index	5.3458**	5.3458**	5.3458**
	(2.1630)	(2.2568)	(2.3220)
Disaster dummy	-0.1802	-0.1802	-0.1802
	(0.5542)	(0.5501)	(0.5551)
Observations	1002	1002	1002
F-test	3.0898	3.0686	3.1739
F-test p-value	0.0000	0.0000	0.0000
Weak Ident.	1.2649	1.2129	1.2011
Underident.	9.1579	8.6927	8.5055
Underident. p-value	0.1029	0.1220	0.1305
Hansen J stat.	3.4409	3.3092	3.2702
Hansen p-value	0.4869	0.5075	0.5137

Robust standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.010$

Table A.3: Robustness checks with GMM

	(1) 2SLS	(2) GMM2s	(3) CUE
Net FDI inflows (% of GDP)	0.8329**	0.8211**	1.0985***
	(0.3884)	(0.3740)	(0.4260)
Net ODA received (% of GDP)	0.0078	-0.0493	-0.0460
	(0.2049)	(0.1970)	(0.2192)
Conflict dummy	-2.9285	-1.2257	-1.7167
	(5.9281)	(5.8310)	(6.6679)
Financial development (M2, % of GDP)	-0.0863***	-0.0801***	-0.0811***
	(0.0285)	(0.0280)	(0.0304)
Population growth (annual %)	-0.7394**	-0.6978**	-0.7110**
	(0.3575)	(0.3496)	(0.3590)
School enrollment, primary (% gross)	0.0016	0.0058	0.0070
	(0.0178)	(0.0176)	(0.0200)
Life expectancy at birth, total (years)	0.1271	0.1312*	0.0985
	(0.0795)	(0.0790)	(0.0874)
Government consumption (% of GDP)	-0.1108*	-0.1073**	-0.1231*
	(0.0569)	(0.0546)	(0.0635)
Political Constraints Index	5.3458***	5.0776**	6.1383***
	(2.0694)	(2.0336)	(2.2792)
Disaster dummy	-0.1802	-0.1999	-0.1163
	(0.5629)	(0.5496)	(0.6340)
Observations	1002	1002	1002
F-test	3.2474	3.2396	2.8385
F-test p-value	0.0000	0.0000	0.0000
Weak Ident.	1.4259	1.4259	1.4259
Underident.	10.3936	10.3936	10.3936
Underident. p-value	0.0648	0.0648	0.0648
Hansen J stat.	3.7117	3.7117	3.7169
Hansen p-value	0.4464	0.4464	0.4457

Robust standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.010$

Table A.4: Robustness checks with different instrument sets

	(1) Minimum set	(2) Gov. party orientation	(3) Colony trends
Net FDI inflows (% of GDP)	0.7541**	0.7482**	0.8514**
	(0.3734)	(0.3670)	(0.3818)
Net ODA received (% of GDP)	-0.0444	0.0125	0.0131
	(0.2045)	(0.1697)	(0.2129)
Conflict dummy	-3.0627	-4.0161	-6.6951
	(7.2266)	(7.0093)	(5.5385)
Financial development (M2, % of GDP)	-0.0825***	-0.0873***	-0.0860***
	(0.0277)	(0.0269)	(0.0287)
Population growth (annual %)	-0.6865*	-0.7317**	-0.7279*
	(0.3552)	(0.3525)	(0.3944)
School enrollment, primary (% gross)	0.0016	0.0003	-0.0020
	(0.0174)	(0.0173)	(0.0173)
Life expectancy at birth, total (years)	0.1335	0.1312	0.1064
	(0.0820)	(0.0816)	(0.0830)
Government consumption (% of GDP)	-0.0983*	-0.1018*	-0.0980*
	(0.0562)	(0.0547)	(0.0536)
Political Constraints Index	5.3201***	5.1396***	5.8258***
	(2.0256)	(1.9690)	(2.1554)
Disaster dummy	-0.1220	-0.1974	-0.0901
	(0.5514)	(0.5196)	(0.5896)
Observations	1002	1002	1002
F-test	3.3040	3.2487	2.8018
F-test p-value	0.0000	0.0000	0.0000
Weak Ident.	1.3087	1.1524	1.6821
Underident.	8.2944	8.3380	12.2354
Underident. p-value	0.0403	0.0800	0.0317
Hansen J stat.	3.1992	3.5048	3.6907
Hansen p-value	0.2020	0.3201	0.4495
Excluded instruments	*Donors' arms exports, fractionalization, tax revenue, GDP, energy depletion*	*Donors' arms exports, fractionalization, tax revenue, GDP, energy depletion, largest government party orientation*	*Donors' arms exports, fractionalization, tax revenue, GDP, energy depletion, French and English colony trends*

Robust standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.010$

Table A.5: Robustness checks with a different weight in the instruments' computations

	(1) Normal set of instruments	(2) Without GDP
Net FDI inflows (% GDP)	0.7610**	1.2002***
	(0.3252)	(0.4655)
Net ODA received (% GDP)	-0.0150	0.1824
	(0.1683)	(0.2299)
Conflict dummy	4.8304	6.7458
	(4.5299)	(5.5873)
Financial development (M2, % of GDP)	-0.0861***	-0.0993***
	(0.0280)	(0.0353)
Population growth (annual %)	-0.7500**	-0.9678***
	(0.2939)	(0.3527)
School enrollment, primary (% gross)	0.0090	0.0105
	(0.0187)	(0.0231)
Life expectancy at birth, total (years)	0.1730***	0.1398*
	(0.0670)	(0.0829)
Government consumption (% of GDP)	-0.1336**	-0.1954***
	(0.0550)	(0.0745)
Political Constraints Index	4.2879**	4.7396**
	(1.8279)	(2.2591)
Disaster dummy	-0.3605	-0.5551
	(0.5063)	(0.6435)
Observations	1002	1002
F-test	3.2539	2.3838
F-test p-value	0.0000	0.0000
Weak Ident.	1.7423	1.7707
Underident.	12.3938	10.9305
Underident. p-value	0.0298	0.0274
Hansen J stat.	9.7813	0.4483
Hansen p-value	0.0443	0.9301
Excluded instruments	*Donors' arms exports, fractionalization, tax revenue, GDP, inequality, alternative and nuclear energy uses, energy depletion*	*Donors' arms exports, fractionalization, tax revenue, inequality, alternative and nuclear energy uses, energy depletion*

Robust standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.010$

Table A.6: Robustness checks with alternative specifications

	(1) Trade	(2) Inflation	(3) Remittances	(4) Natural resources	(5) Oil production
Net FDI received (% of GDP)	0.8343**	1.0587*	0.6789*	0.8371**	0.9238**
	(0.3402)	(0.5623)	(0.3612)	(0.3801)	(0.4301)
Net ODA received (% of GDP)	0.0114	-0.0455	0.2567	-0.0147	-0.0539
	(0.2101)	(0.2104)	(0.2534)	(0.2109)	(0.2072)
Conflict dummy	-3.0187	-0.0707	-1.4287	-3.3784	-3.0083
	(6.1853)	(6.5399)	(1.1327)	(6.0769)	(5.8800)
Financial development (M2, % of GDP)	-0.0866***	-0.0937**	-0.0979	-0.0821***	-0.0691**
	(0.0286)	(0.0437)	(0.0715)	(0.0290)	(0.0288)
Population growth (annual %)	-0.7408**	-0.8065**	-0.7150**	-0.7592**	-0.6607*
	(0.3495)	(0.3797)	(0.3588)	(0.3601)	(0.3614)
School enrollment, primary (% gross)	0.0013	0.0085	0.0127	0.0008	0.0115
	(0.0185)	(0.0219)	(0.0252)	(0.0181)	(0.0194)
Life expectancy at birth, total (years)	0.1267	0.0932	0.2343	0.1289	0.1056
	(0.0791)	(0.0837)	(0.1476)	(0.0803)	(0.0896)
Government consumption (% of GDP)	-0.1093**	-0.0736	-0.2441	-0.0999*	-0.1107*
	(0.0510)	(0.0578)	(0.1873)	(0.0606)	(0.0584)
Political Constraints Index	5.3726**	4.9113**	3.0987	5.6104***	5.2154**
	(2.1366)	(2.3782)	(2.0193)	(2.0878)	(2.0753)
Disaster dummy	-0.1831	0.2447	-0.2241	-0.1693	-0.1096
	(0.5640)	(0.6831)	(0.5314)	(0.5707)	(0.5946)
Trade (% of GDP)	-0.0026				
	(0.0333)				
Inflation, consumer prices (annual %)		-0.0002			
		(0.0002)			
Personal remittances, received (% of GDP)			-0.2500		
			(0.3126)		
Total natural resources rents (% of GDP)				0.0517	
				(0.0587)	
Oil production value (billions of 2009 dollars)					0.1281**
					(0.0647)
Observations	1002	860	812	1002	967
F	3.4511	2.5603	2.1352	3.0734	3.0769
Fp	0.0000	0.0000	0.0000	0.0000	0.0000
Weak Ident.	1.4989	0.6545	3.8100	1.5455	1.4841
Underident.	11.6242	4.7717	19.4022	11.9351	11.3645
Underident. p-value	0.0403	0.4444	0.0016	0.0357	0.0446
Hansen J stat.	3.6879	0.4994	5.0621	3.5210	2.9747
Hansen p-value	0.4499	0.9736	0.2810	0.4747	0.5621
Instrumented	*fdi, oda, conflicts*	*fdi, oda, conflicts*	*fdi, oda, remittances*	*fdi, oda, conflicts*	*fdi, oda, conflicts*

Robust standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.010$

Appendix B

The New Mercantilism

B.1 The cocoa and coffee supply chains in more details

B.1.1 The cocoa supply chain

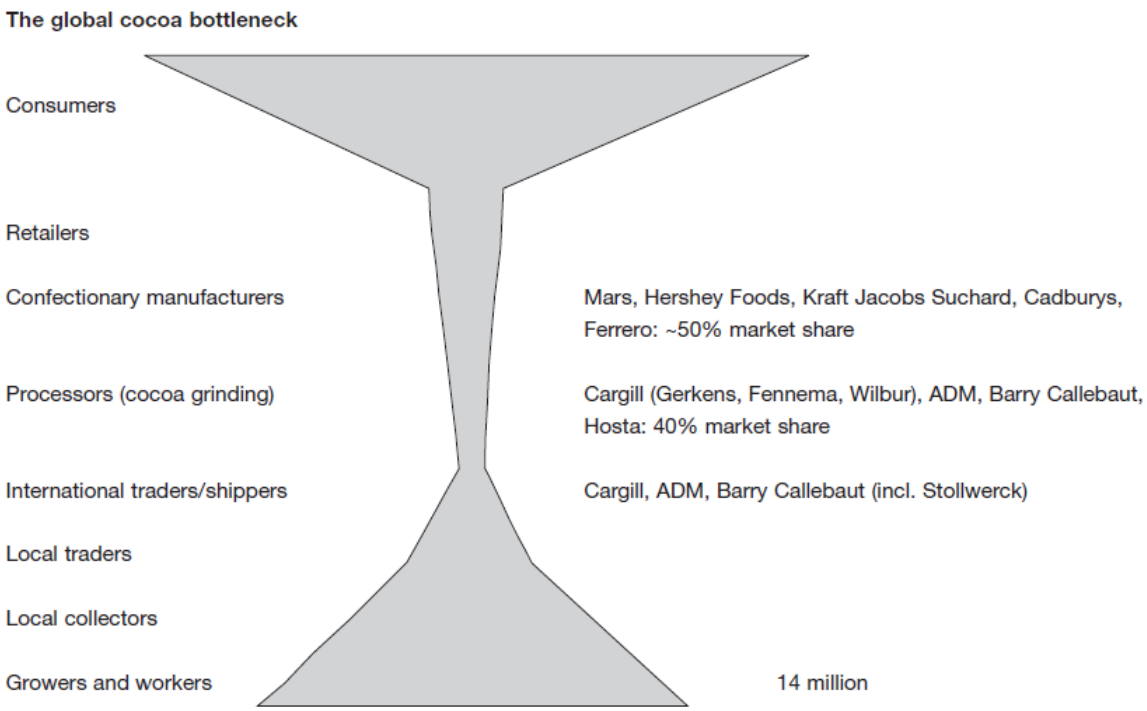


Figure B.1: The cocoa supply chain (Vorley, 2003)

Fair Labor Association (2016) also provides many details as to the workings of the supply chain of Nestlé and one of its tier-1 supplier (i.e. grinder) in Côte d'Ivoire. The reader can refer to it for more details, particularly p. 8-9 and 13-19.

B.1.2 The coffee supply chain

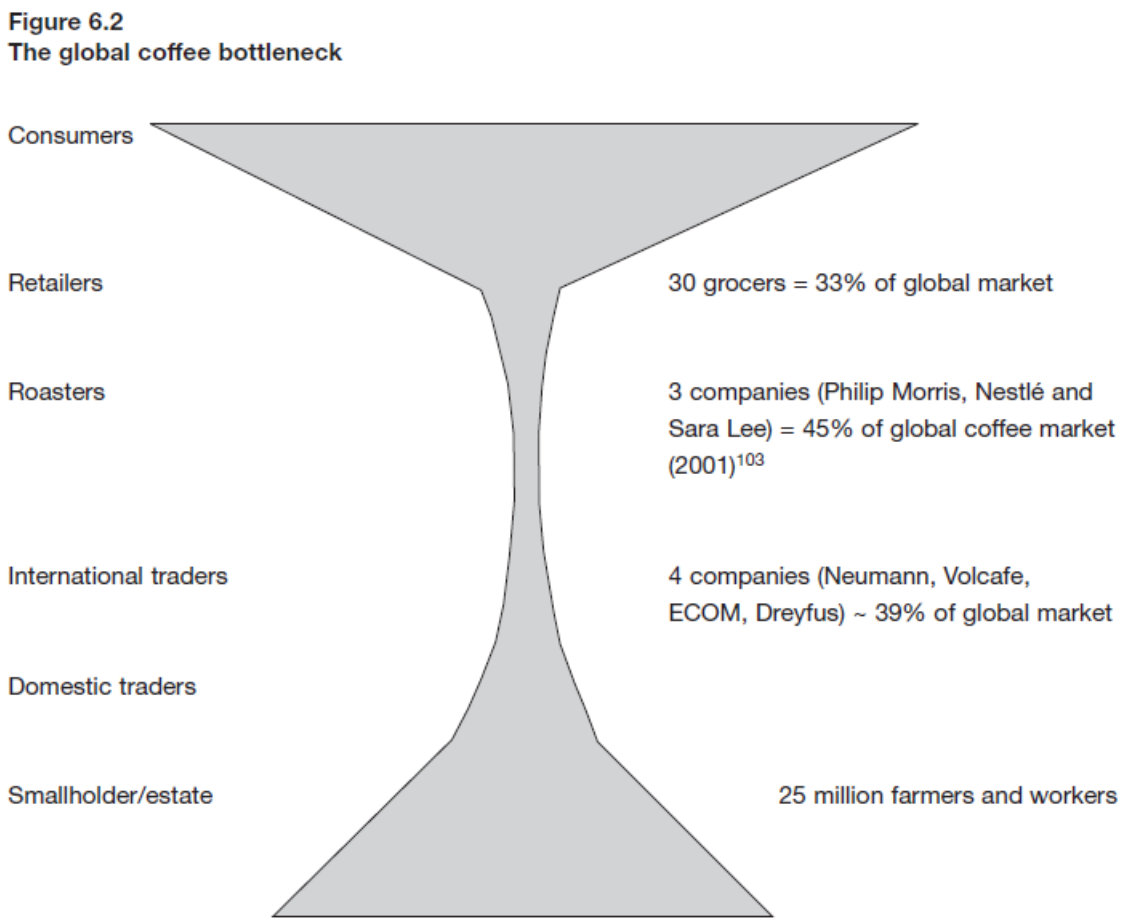


FIGURE B.2: The coffee supply chain (Vorley, 2003)

B.2 Locations of production and consumption

B.2.1 Cocoa

B.2.2 Coffee

A useful map is available in a Washington Post article, available from https://www.washingtonpost.com/news/wonk/wp/2015/06/17/19-maps-and-charts-that-explain-pretty-much-everything-about-coffee/?utm˙term=.3c060fd9d18d (last accessed on August 7, 2017).Note that this map has no consumption data for Ethiopia, even though nearly half of the country's production is locally consumed. In fact, even though it is of lower quality, the coffee sold locally is usually more expensive than the coffee exported (A. Tefera and T. Tefera, 2014).

B.2.3 Cocaine

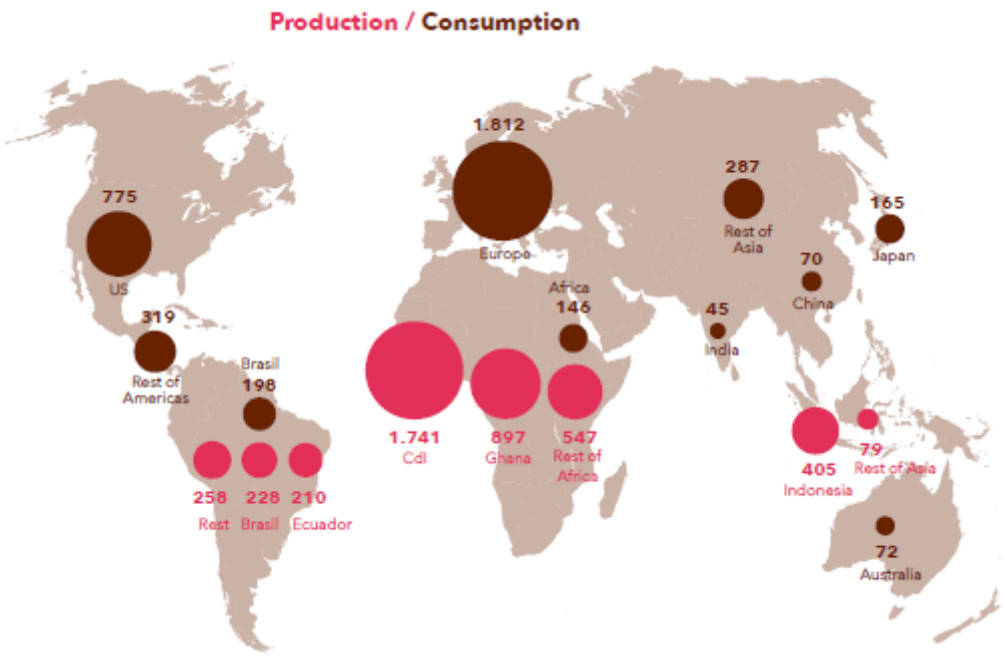


Figure B.3: World production and consumption of cocoa/chocolate (Fountain and Hütz-Adams, 2015)

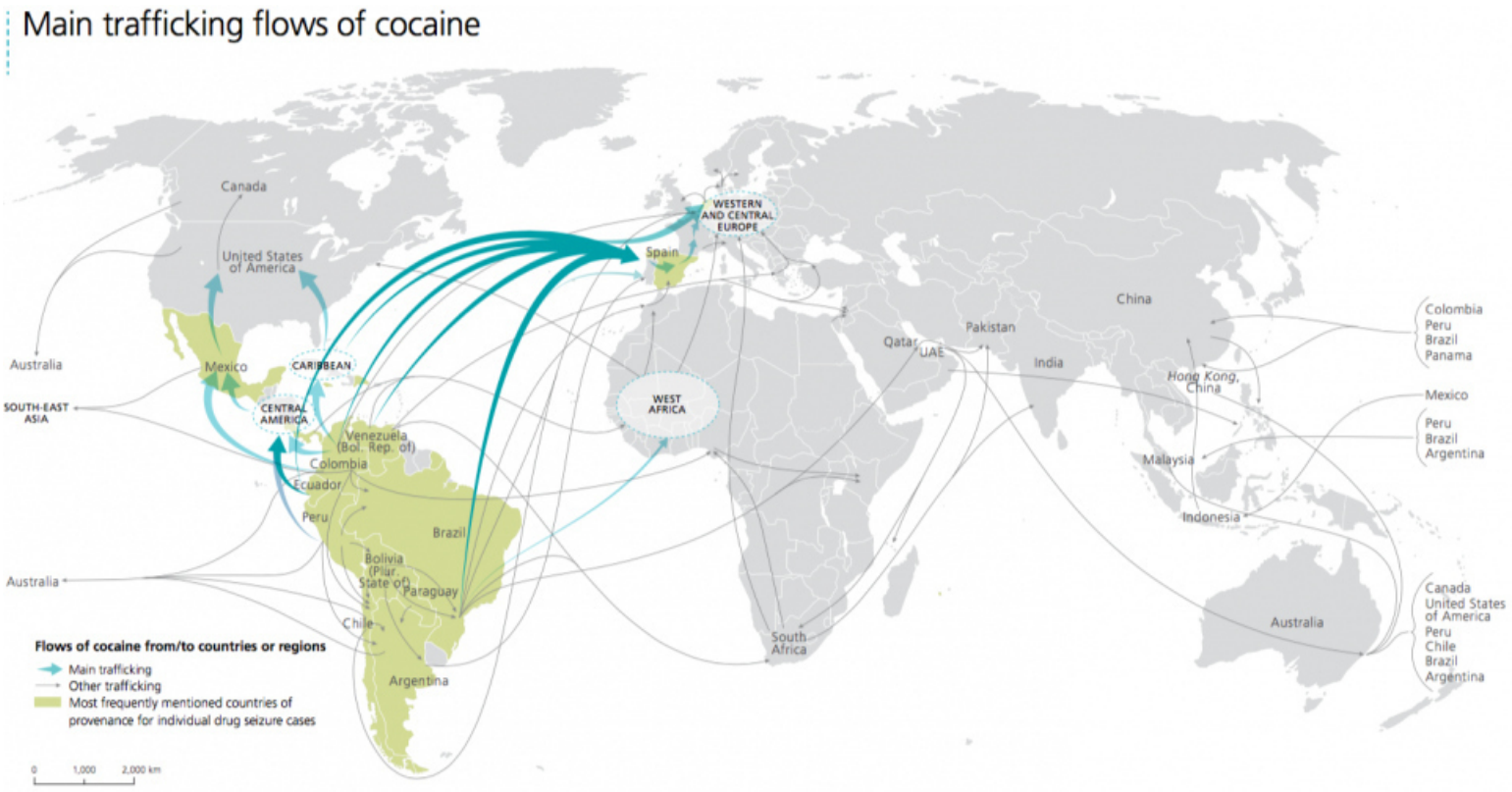


Figure B.4: Main cocaine trafficking flows, 2011-2015 (UNODC, 2016)

B.3 The competitive case

Assuming perfect competition, the intermediary firm faces the following maximization problem:

$$\max_{q_i^S} p^N f\left(q_i^S, \theta\right) - \left(p^S + \gamma\right) q_i^S \tag{B.1}$$

The equilibrium conditions are therefore

$$p^{N*} = \frac{p^{S*} + \gamma}{f'\left(q_i^{S*}\right)} \tag{B.2}$$

$$\sum_i q_i^{S*} = S\left(p^{S*}, \sigma\right) \tag{B.3}$$

$$\sum_i q_i^{N*} = \sum_i f\left(q_i^{S*}, \theta\right) = D\left(p^{N*}, \delta\right) \tag{B.4}$$

Equation B.2 is the first order condition of the maximization problem, and gives the equilibrium price of the finished product, which is equal to the marginal cost of the intermediary firm in the equilibrium. Equations B.3 and B.4 are the equilibrium conditions of supply equal demand in the North and South markets.

Since intermediaries are all identical by assumption, they will all buy and produce the same quantity. Hence in equilibrium, we can write the total quantity supplied and produced as $S\left(p^{S*}, \sigma\right) = Q^{S*} = nq^{S*}$ and $D\left(p^{N*}, \delta\right) = Q^{N*} = nq^{N*}$. Replacing in the first order condition yields:

Proposition 8 *The competitive first order condition or price pass-through is*

$$p^{N*} = \frac{p^{S*} + \gamma}{f'\left(\frac{Q^{S*}}{n}, \theta\right)} \tag{B.5}$$

The situation is represented in Figure B.5.

B.3.1 Properties of the price pass-through in the competitive case

In this section, we look into the conditions determining the curvature of the price pass-through (or first order condition) in the competitive case.

B.3.1.1 Top left quadrant

First order derivative

f' denotes the derivative of f with respect to the quantity, and S' the derivative with respect to the price.

$$\frac{dp^{N*}}{dp^S} = \frac{1}{f'\left(\frac{S(p^S,\sigma)}{n}, \theta\right)} - \frac{\left(p^S + \gamma\right) S'\left(p^S, \sigma\right) f''\left(\frac{S(p^S,\sigma)}{n}, \theta\right)}{n\left[f'\left(\frac{S(p^S,\sigma)}{n}, \theta\right)\right]^2} \tag{B.6}$$

This derivative is positive, since $f' > 0, S' > 0$ and $f'' < 0$.

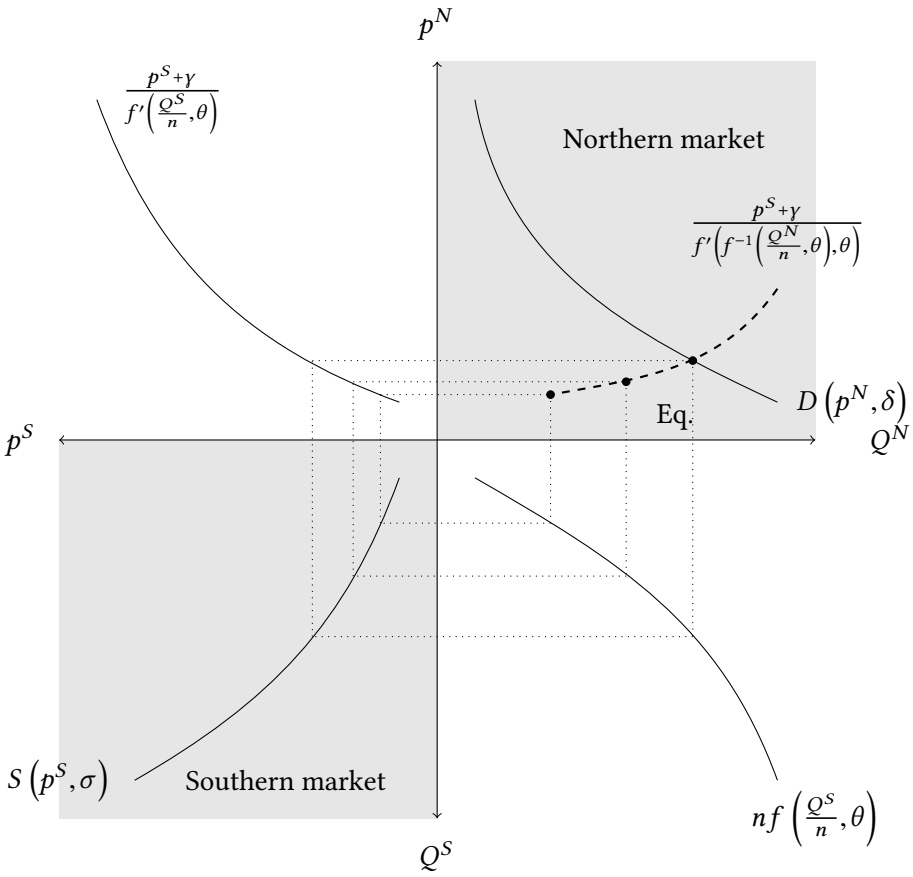


Figure B.5: The competitive equilibrium

Second order derivative

The arguments of f are $\frac{S(p^S)}{n}$ and θ and those of S are p^S and σ. They are omitted, for easier reading.

$$\frac{d^2p^{N*}}{dp^{S2}} = -\frac{f''(\bullet)S'(\bullet)}{n\left[f'(\bullet)\right]^2} - \frac{S'(\bullet)f''(\bullet) + \left(p^S+\gamma\right)S''(\bullet)f''(\bullet)}{n\left[f'(\bullet)\right]^2} + \frac{2\left(p^S+\gamma\right)\left[S'(\bullet)\right]^2\left[f''(\bullet)\right]^2 f'(\bullet)}{n^2\left[f'(\bullet)\right]^4} - \frac{\left(p^S+\gamma\right)\left[S'(\bullet)\right]^2 f'''(\bullet)}{n^2\left[f'(\bullet)\right]^2} \tag{B.7}$$

Until the third term, the derivative is positive. f''' is positive, making the last fraction positive. Because of the minus in front of it, the sign of the derivative is uncertain and will depend on the relative magnitude of the positive and negative terms. In the body of the paper, $\frac{d^2p^{N*}}{dp^{S2}}$ is assumed to be positive, so that the curve is convex.

B.3.1.2 Top right quadrant

First order derivative

$$p^{N*} = \frac{p^{S*}+\gamma}{f'\left(\frac{S(p^{S*},\sigma)}{n},\theta\right)} = \frac{p^{S*}+\gamma}{f'\left(f^{-1}\left(\frac{D(p^{N*},\delta)}{n},\theta\right),\theta\right)} \tag{B.8}$$

since $D\left(p^N,\delta\right) = nf\left(\frac{S(p^S,\sigma)}{n},\theta\right)$. Therefore:

$$\frac{\partial p^{N*}}{\partial D\left(p^N,\delta\right)} = -\frac{p^S+\gamma}{n\left[f'\left(f^{-1}\left(\frac{D(p^N,\delta)}{n},\theta\right),\theta\right)\right]^2}\left[\frac{f''\left(f^{-1}\left(\frac{D(p^N,\delta)}{n},\theta\right),\theta\right)}{f'\left(f^{-1}\left(\frac{D(p^N,\delta)}{n},\theta\right),\theta\right)}\right] \tag{B.9}$$

which is positive.

Second order derivative

The arguments of f^{-1} are $\frac{D(p^N)}{n}$ and θ.

$$\frac{\partial^2 p^{N*}}{\partial(D(p^N,\delta)^2} = \frac{\left(p^S+\gamma\right)}{n^2\left[f'\left(f^{-1}(\bullet)\right)\right]^5}\left(3\left[f''\left(\left(f^{-1}(\bullet)\right)\right]^2 - f'''\left(f^{-1}(\bullet)\right)f'\left(f^{-1}(\bullet)\right)\right) \tag{B.10}$$

Once again, because f''' is positive, the sign depends on the relative magnitude of $3\left[f''\left(\left(f^{-1}(\bullet)\right)\right]^2$ and $f'''\left(f^{-1}(\bullet)\right)f'\left(f^{-1}(\bullet)\right)$. Here, the marginal cost function is assumed to be convex.

B.4 The hourglass case

The intermediaries' maximization problem is now:

$$\max_{q_i^S} p^N f\left(q_i^S, \theta\right) - \left(p^S + \gamma\right) q_i^S \tag{B.11}$$

subject to $p^N = D^{-1}\left(f\left(q_i^S, \theta\right) + \sum_{j \neq i} f\left(q_j^S, \theta\right), \delta\right)$ and $p^S = S^{-1}\left(q_i^S + \sum_{j \neq i} q_j^S, \sigma\right)$.

This time, the first order condition is:

$$\frac{\partial p^N}{\partial q_i^S}\left(q_i^{S*}\right) \times f\left(q_i^{S*}, \theta\right) + p^{N*} f'\left(q_i^{S*}, \theta\right) - \frac{\partial p^S}{\partial q_i^S}\left(q_i^{S*}\right) \times q_i^{S*} - \left(p^{S*} + \gamma\right) = 0 \tag{B.12}$$

Since

$$\frac{\partial p^N}{\partial q_i^S} = \frac{1}{D'\left(p^N, \delta\right)} f'\left(q_i^S, \theta\right) \tag{B.13}$$

$$\frac{\partial p^S}{\partial q_i^S} = \frac{1}{S'\left(p^S, \sigma\right)} \tag{B.14}$$

we can re-write the first order condition as:

$$p^{S*} + \gamma = p^{N*} f'\left(q_i^{S*}, \theta\right) + \frac{f'\left(q_i^{S*}, \theta\right)}{D'\left(p^{N*}, \delta\right)} f\left(q_i^{S*}, \theta\right) - \frac{q_i^{S*}}{S'\left(p^{S*}, \sigma\right)} \tag{B.15}$$

To simplify the expression, we can use the absolute value of the demand and the supply elasticities, which are given by:

$$\eta^N = -\frac{p^N D'\left(p^N, \delta\right)}{D\left(p^N, \delta\right)} > 0 \tag{B.16}$$

$$\eta^S = \frac{p^S S'\left(p^S, \sigma\right)}{S\left(p^S, \sigma\right)} > 0 \tag{B.17}$$

respectively. Solving for D' and S' and replacing in the first order condition yields:

$$p^{S*} + \gamma = p^{N*} f'\left(q_i^{S*}, \theta\right) - \frac{p^{N*}}{D\left(p^{N*}, \delta\right) \eta^N} f'\left(q_i^{S*}, \theta\right) f\left(q_i^{S*}, \theta\right) - \frac{p^{S*}}{S\left(p^{S*}, \sigma\right) \eta^S} q_i^{S*} \tag{B.18}$$

Because all intermediaries are identical, we can replace $D\left(p^N, \delta\right)$ by nq^N and $S\left(p^S, \sigma\right)$ by nq^S. Re-arranging the equality, we obtain:

$$p^{S*}\left(1 + \frac{1}{\eta^S n}\right) + \gamma = p^{N*} f'\left(\frac{Q^S}{n}, \theta\right)\left(1 - \frac{1}{\eta^N n}\right) \tag{B.19}$$

B.4.1 Properties of the price pass-through in the hourglass case

The first order condition is

$$p^N = \frac{p^S\left(1+\frac{1}{\eta^S n}\right)+\gamma}{f'\left(\frac{S(p^S,\sigma)}{n},\theta\right)\left(1-\frac{1}{\eta^N n}\right)} \tag{B.20}$$

The numerator is positive. The denominator is positive if $\eta^N n > 1$. In other words, it is positive if n is large enough compared to the elasticity, or if the demand is at least unit elastic (since we are in an oligopoly setting, $n \geq 2$). However, the bracket that multiplies f' is lower than one, which would shift the price pass-through curve in the upper left quadrant upwards and clockwise, reinforcing the effect of the numerator. Then, overall, the effect of the oligopoly compared to the competition would be to shift upwards and anticlockwise the intermediary's supply curve in the top right quadrant. On the other hand, the denominator of the fraction is negative if $\eta^N n < 1$. In this case, the curve of the first order condition becomes downward sloping, causing the supply curve from the North East quadrant to be also downward sloping. In particular, this happens when the elasticity is close to zero and there are not enough firms to drive $\eta^N n$ over one. Then, there would not be enough firms to cover the inelastic demand. We assume away this case, as it does not resemble many (if any) real-life scenario. This reasoning is verified and completed by the computations below.

First, it is useful to consider that p^N in the oligopoly case is equal to p^N in perfect competition multiplied by a factor. We assume that this is the case and start from:

$$p^{No} = p^{Nc} \times x = \frac{p^S+\gamma}{f'\left(\frac{S(p^S,\sigma)}{n},\theta\right)} \times x = \frac{p^S\left(1+\frac{1}{\eta^S n}\right)+\gamma}{f'\left(\frac{S(p^S,\sigma)}{n},\theta\right)\left(1-\frac{1}{\eta^N n}\right)} \tag{B.21}$$

Solving for x, we find that

$$x = \frac{\eta^N n}{\eta^N n - 1}\left(1+\frac{p^S}{\eta^S n\left(p^S+\gamma\right)}\right) \tag{B.22}$$

This is positive, as long as $\eta^N n - 1 > 0$ and hence as long as $\eta^N n > 1$. This is the same assumption that ensured that p^{No} was upward sloping. Furthermore,

$$\frac{dx}{dp^S} = \frac{\eta^N n}{\eta^N n - 1} \times \frac{\eta^S n \gamma}{\left[\eta^S n\left(p^S+\gamma\right)\right]^2} > 0 \tag{B.23}$$

$$\frac{d^2x}{dp^{S2}} = -\frac{\gamma \eta^S \eta^N n^2}{\eta^N n - 1} \times \frac{2\left(\eta^{S2} n\right)^2\left(p^S+\gamma\right)}{\left[\eta^S n\left(p^S+\gamma\right)\right]^4} < 0 \tag{B.24}$$

B.4.1.1 Top left quadrant

x depends on p^S, therefore

$$\frac{dp^{No}}{dp^S} = \frac{d}{dp^S}\left(x(p^S)p^{Nc}(p^S)\right) = \frac{dx(p^S)}{dp^S}p^{Nc}(p^S) + x(p^S)\frac{dp^{Nc}}{dp^S} \tag{B.25}$$

which is positive (see equations B.23 and B.6) and bigger than $\frac{dp^{Nc}}{dp^S}$, so that the slope of the p^{No} curve will be steeper than that of the p^{Nc} curve. However, the sign of the second derivative is uncertain:

$$\frac{d^2p^{No}}{dp^{S2}} = \frac{d}{dp^S}\left(\frac{d}{dp^S}x(p^S)p^{Nc}(p^S)\right) = \frac{d^2x}{dp^{S2}}p^{Nc} + 2\frac{dx}{dp^S}\frac{dp^{Nc}}{dp^S} + x(p^S)\frac{d^2p^{Nc}}{dp^{S2}} \tag{B.26}$$

Indeed, every term is positive, except $\frac{d^2x}{dp^{S2}}$, which is negative, and $\frac{d^2p^{Nc}}{dp^{S2}}$, which has an uncertain sign but was assumed positive. Here again, convexity must be assumed.

B.4.1.2 Top right quadrant

We can deduce the shape of p^{No} without any further computations, since we already computed the derivatives of p^{Nc} to investigate its shape. Indeed, since x is positive,

$$\frac{dp^{No}}{dD(p^N,\delta)} = \frac{dxp^{Nc}}{dD(p^N,\delta)} = x\frac{dp^{Nc}}{dD(p^N,\delta)} \tag{B.27}$$

and

$$\frac{d^2p^{No}}{d(D(p^N.\delta))^2} = \frac{d}{d(D(p^N,\delta))^2}\left(x\frac{dp^{Nc}}{d(D(p^N,\delta))^2}\right) = x\frac{d^2p^{Nc}}{d(D(p^N,\delta))^2} \tag{B.28}$$

and the sign of the derivatives are the same and convexity (or concavity) is preserved.

Moreover,

$$\frac{dp^{No}}{dD(p^N,\delta)} > \frac{dp^{Nc}}{dD(p^N,\delta)} \tag{B.29}$$

meaning that the slope of the p^N curve in the graph will be larger in the oligopoly case than in the case of perfect competition.

B.5 Comparative statics

B.5.1 Complements to in-text comparative statics

n enters the industry production function and the price pass-through.

B.5.1.1 Increase in competition: n

Shift in the industry production function

$$\begin{aligned}\frac{\partial}{\partial n}\left(nf\left(\frac{Q^S}{n},\theta\right)\right) &= f\left(\frac{Q^S}{n},\theta\right) - n\times\frac{1}{n^2}Q^Sf'\left(\frac{Q^S}{n},\theta\right)\\ &= f\left(\frac{Q^S}{n},\theta\right) - \frac{Q^S}{n}f'\left(\frac{Q^S}{n},\theta\right)\end{aligned} \tag{B.30}$$

which is positive, because f is concave.

Shift in the price pass-through

From its equation, it is obvious that p^N decreases for any given p^S, and hence for Q^S (via $S\left(p^S,\sigma\right)$), given that f is concave.

An increase in n can have two different impacts, depending on how much f and the pass-through shift.

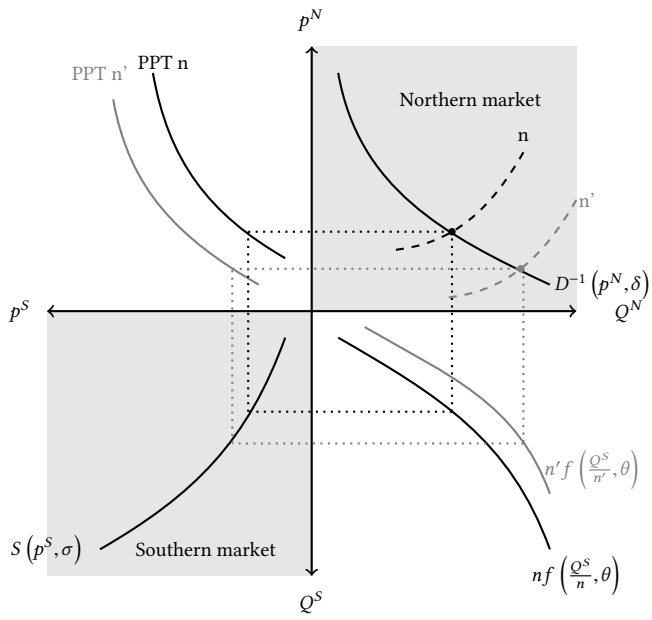


Figure B.6: The hourglass equilibrium and an increase in competition n: first case

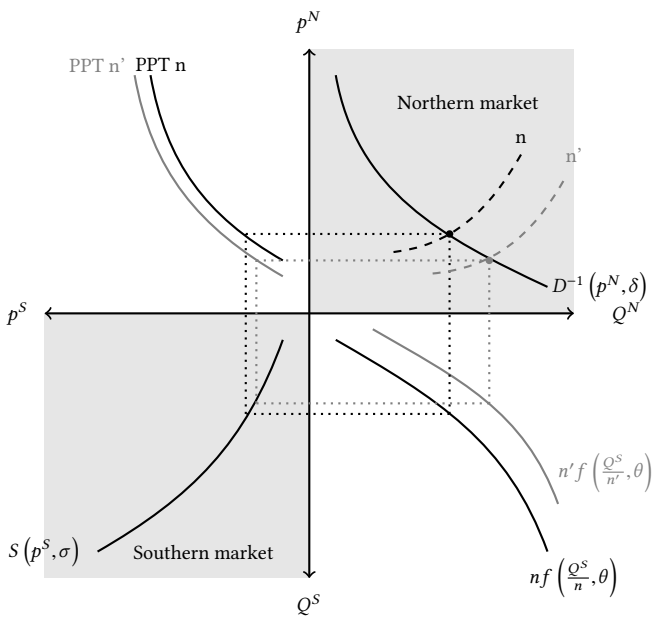


Figure B.7: The hourglass equilibrium and an increase in competition n: second case

An increase in n leads to:

- An increase in Q^N and a decrease in p^N
- Either an increase in Q^S and p^S

- Or a decrease in Q^S and p^S

Hence, the Northern consumers are unambiguously better off. The outcome for farmers is ambiguous, and depends on whether we are in the first or second case. They will be better off in the first scenario, and worst off in the second one. For the firms, the effect on profits will depend on the scenario, but also on the elasticity of demand, as shown in the tables below.

	$p^N q^N$	$-$	$(p^S + \gamma)q^S$	$=$	Π
$\eta^N < 1$	$\downarrow$		$\uparrow$		$\downarrow$
$\eta^N = 1$	$=$		$\uparrow$		$\downarrow$
$\eta^N > 1$	$\uparrow$		$\uparrow$		??

Figure B.8: Firms' profits in the first case

	$p^N q^N$	$-$	$(p^S + \gamma)q^S$	$=$	Π
$\eta^N < 1$	$\downarrow$		$\downarrow$		?
$\eta^N = 1$	$=$		$\downarrow$		$\uparrow$
$\eta^N > 1$	$\uparrow$		$\downarrow$		$\uparrow$

Figure B.9: Firms' profits in the second case

B.5.2 Increase in the exogenous productivity parameter in the South: σ

An increase in σ will affect the supply curve in the South (S), but also the price pass-through the North West quadrant. Indeed, with the shift in S, for each p^S the corresponding Q^S changes, and with it the associated marginal productivity of intermediaries, i.e. f'. To be specific, for each p^S, the marginal productivity will be lower. Hence, the price pass-through in the North West quadrant will shift upwards.

The impact of this change on the supply curve in the North East quadrant is ambiguous. Indeed, its equation is

$$\frac{p^S\left(1+\frac{1}{n\eta^S}\right)+\gamma}{f'\left(\frac{f^{-1}\left(\frac{Q^N}{n},\theta\right)}{n},\theta\right)\left(1-\frac{1}{n\eta^N}\right)} = \frac{S^{-1}\left(Q^S,\theta\right)\left(1+\frac{1}{n\eta^S}\right)+\gamma}{f'\left(\frac{f^{-1}\left(\frac{Q^N}{n},\theta\right)}{n},\theta\right)\left(1-\frac{1}{n\eta^N}\right)} \tag{B.31}$$

In the right hand-side, notice that both S^{-1} and f' will decrease. Hence, the overall impact on the curve is ambiguous. There are five possible scenarios. The supply curve in the North East quadrant will either

1. shift downwards
2. shift upwards
3. rotate so that the new equilibrium is below the old one
4. rotate so that the new equilibrium is above the old one
5. rotate so that the new equilibrium is the same as the old one

Which scenario prevails depend on the relative magnitude of the shifts in S^{-1} and f'. Scenarios 1 and 4 are illustrated below.

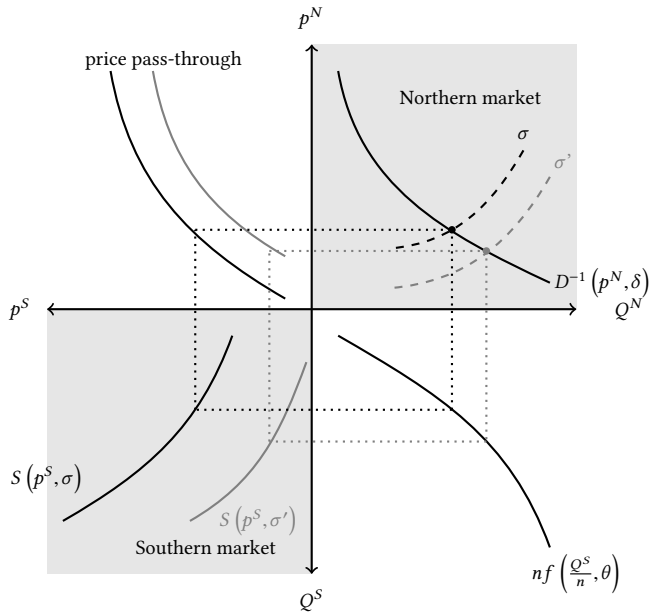


Figure B.10: The hourglass equilibrium and an increase in the exogenous productivity parameter in the South σ (scenario 1)

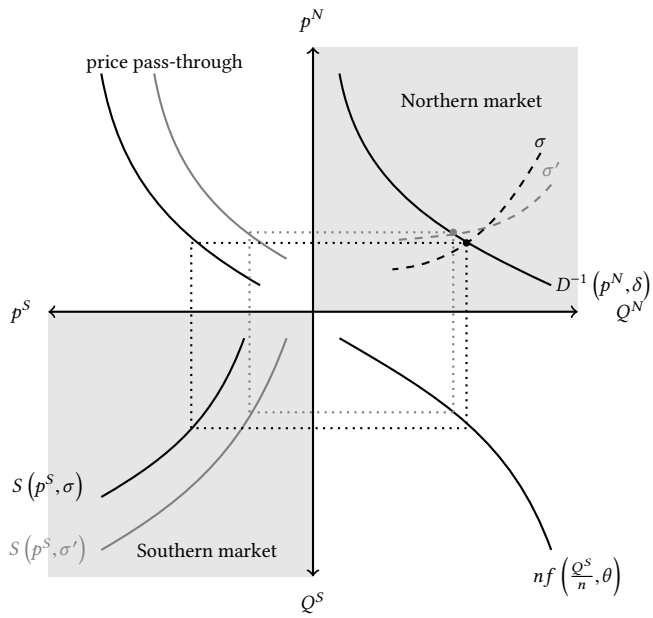


Figure B.11: The hourglass equilibrium and an increase in the exogenous productivity parameter in the South σ: scenario 4

However, note that while there are five scenarios, there are in total three equilibrium situations: either the new equilibrium is on the left, or on the right of the old one, or it is unchanged.

If the new equilibrium is on the left of the old one, an increase in σ leads to:

- A decrease in Q^N and Q^S
- A decrease in p^S
- An increase in p^N

The Northern consumers are unambiguously worse off. Southern producers see their income reduced, but whether their surplus is decreased depends on S. For the firms, the effect is ambiguous:

	$p^N q^N$	$-$	$(p^S + \gamma)q^S$	$=$	Π
$\eta^N < 1$	$\uparrow$		$\downarrow$		$\uparrow$
$\eta^N = 1$	$=$		$\downarrow$		$\uparrow$
$\eta^N > 1$	$\downarrow$		$\downarrow$		??

If the Northern equilibrium is unchanged, an increase in σ leads to:

- No change in Q^N, Q^S and p^N
- A decrease in p^S

Northern consumers are as well off as before, Southern producers see their income reduced again, and firms are better off.

If the new equilibrium is on the right of the old one, an increase in σ leads to:

- An increase in Q^N and Q^S
- A decrease in p^S
- A decrease in p^N

The Northern consumers are unambiguously better off. For the Southern producers, the outcome will depend on η^S. For the firms, the effect of an increase in σ is ambiguous:

		$p^N q^N$	$-$	$(p^S + \gamma)q^S$	$=$	Π
	$\eta^S < 1$			$\downarrow$		??
$\eta^N < 1$	$\eta^S = 1$	$\downarrow$		$=$		$\downarrow$
	$\eta^S > 1$			$\uparrow$		$\downarrow$
	$\eta^S < 1$			$\downarrow$		$\uparrow$
$\eta^N = 1$	$\eta^S = 1$	$=$		$=$		$=$
	$\eta^S > 1$			$\uparrow$		$\downarrow$
	$\eta^S < 1$			$\downarrow$		$\uparrow$
$\eta^N > 1$	$\eta^S = 1$	$\uparrow$		$=$		$\uparrow$
	$\eta^S > 1$			$\uparrow$		??

Proposition 9 *An increase in σ leads to one of three outcomes.*

1. *a decrease in Q^S, p^S and Q^N, and an increase in p^N*
2. *a decrease in p^S and no change in the other variables*

3. *an increase in Q^N and Q^S, and a decrease in p^S and p^N.*

A decrease causes the opposite effects.

The comparative statics for σ are examined in detail in Galez-Davis, 2018, and used to study the sustainability programs implemented in cocoa-producing countries by the big firms of the sector.

B.5.3 Increase in the trade cost: γ

An increase in the trade cost γ results in the change shown in the figure below.

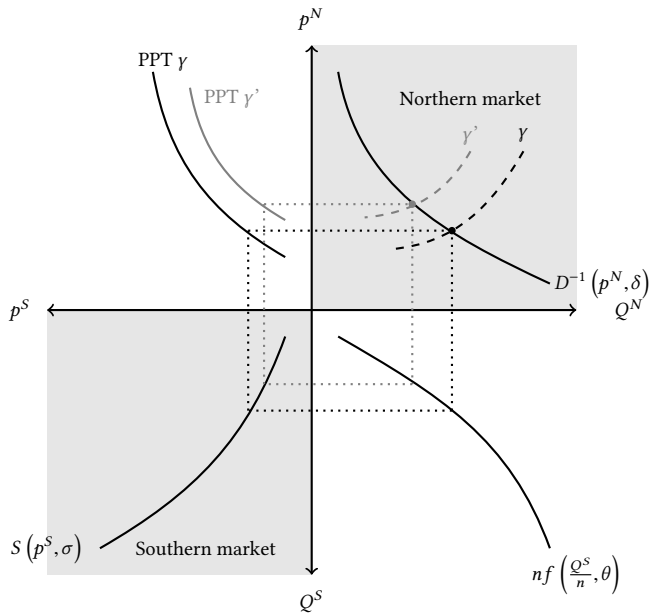


FIGURE B.12: The hourglass equilibrium and an increase in trade cost γ

An increase in γ leads to:

- A decrease in Q^N and Q^S
- A decrease in p^S
- An increase in p^N

Thus, the Southern producers and the Northern consumers are unambiguously worse off. For the firms, the outcome will depend on the elasticity of demand:

	$p^N q^N$	$-$	$(p^S+\gamma)q^S$	$=$	Π
$\eta^N < 1$	$\uparrow$		$\downarrow$ $\uparrow$		$\uparrow$??
$\eta^N = 1$	$=$		$\downarrow$ $\uparrow$		$\uparrow$ $\downarrow$
$\eta^N > 1$	$\downarrow$		$\downarrow$ $\uparrow$		?? $\downarrow$

Proposition 10 *An increase in γ leads to a decrease in Q^N, Q^S and p^S, and an increase in p^N. A decrease causes the opposite effects.*

Studying the comparative statics of γ could allow to look into export taxes or subsidies as in Deardorff and Rajaraman (2009) and Oladi and J. Gilbert (2012), the impact of the quality of infrastructure in the producer country, or even transport technology.

B.5.4 Increase in the exogenous productivity parameter in the North: θ

An increase in θ increases $f(\bullet)$, given Q^S and n, and increases $f'(\bullet)$ in most cases (we ignore instances when it reduces $f'(\bullet)$). Then, it can be represented as follows.

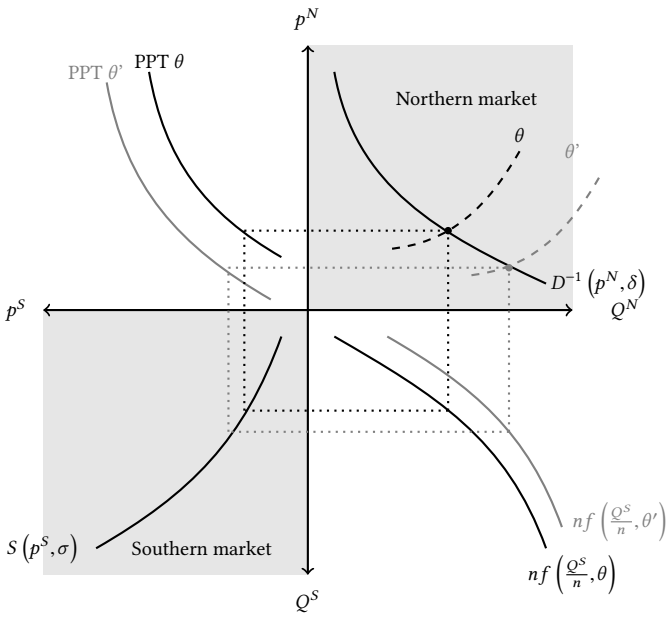


FIGURE B.13: The hourglass equilibrium and an increase in the Northern productivity parameter θ

An increase in θ leads to:

- An increase in Q^N and Q^S
- An increase in p^S
- A decrease in p^N

Thus, the Northern consumers and the Southern producers are unambiguously better off. For the firms, the outcome will depend on the elasticity of demand, as shown in the table below.

	$p^N q^N$	$-$	$(p^S + \gamma)q^S$	$=$	Π
$\eta^N < 1$	$\downarrow$		$\uparrow$		$\downarrow$
$\eta^N = 1$	$=$		$\uparrow$		$\downarrow$
$\eta^N > 1$	$\uparrow$		$\uparrow$		??

Proposition 11 *An increase in θ causes a rise in Q^N, Q^S and p^S, but a decrease in p^N. A decrease causes the opposite effects.*

θ could allow to incorporate many production-level factors into the model, including for instance standards of fabrication (e.g. the standards of Swiss chocolate, or the European Chocolate regulation which for a long time did not allow other fat than cocoa butter for a product to be called chocolate[1]) or changes in the price of other inputs.

B.5.5 Increase in the exogenous demand parameter in the North: δ

The effects of an increase in the exogenous demand parameter δ can be represented as follows.

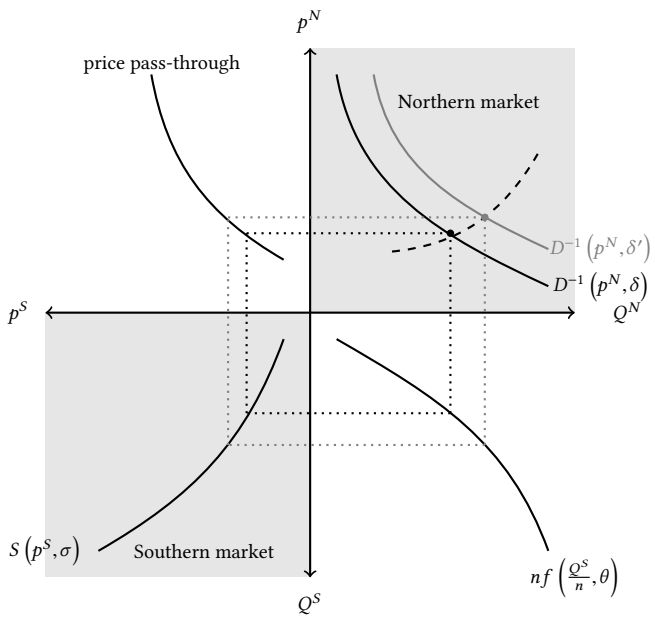


Figure B.14: The hourglass equilibrium and an increase in the exogenous demand parameter in the North δ

An increase in δ leads to:

- An increase in Q^N and Q^S
- An increase in p^S
- An increase in p^N

The Southern producers are unambiguously better off. For the Northern consumers and the firms, the outcome is uncertain.

Proposition 12 *An increase in δ leads to an increase in Q^N, Q^S, p^S and p^N. A decrease causes the opposite effect.*

A change in δ could be used to study changes in consumer preferences or income (e.g. the increasing demand for chocolate in China or India), or boycotts.

[1] See https://www.theguardian.com/uk/2003/jan/17/foodanddrink, accessed on August 11th, 2018.

B.6 Existence of the optimal minimum price

p^S_{min*} solves simultaneously

$$nf\left(\frac{Q^S}{n},\theta\right) = D\left(p^N,\delta\right) \qquad \text{(Northern market clearing)}$$

$$S\left(p^S_{min},\sigma\right) = Q^S \qquad \text{(Output ceiling)}$$

$$p^N = \frac{p^S_{min}+\gamma}{f'\left(\frac{Q^S}{n},\theta\right)\left(1-\frac{1}{\eta^N n}\right)} \qquad \text{(Pass-through floor)}$$

Substituting for p^{S*}_{min} and $S\left(p^{S*}_{min},\sigma\right)$ allows us to write the optimum p^{S*}_{min} as the fixed point of the following mapping:

$$p^{S*}_{min} = \underbrace{D^{-1}\left(nf\left(\frac{S\left(p^{S*}_{min},\sigma\right)}{n},\theta\right),\delta\right)f'\left(\frac{S\left(p^{S*}_{min},\sigma\right)}{n},\theta\right)\left(1-\frac{1}{\eta^N n}\right)-\gamma}_{RHS} \tag{B.32}$$

It can be easily checked that RHS is decreasing in p^{S*}_{min}. Indeed[2],

$$\frac{\partial RHS}{\partial p^{S*}_{min}} = \underbrace{\frac{\left[f'(\bullet)\right]^2\left(1-\frac{1}{\eta^N n}\right)}{D'(\bullet)}}_{(-)}\underbrace{\frac{\partial S(\bullet)}{\partial p^{S*}_{min}}}_{(+)} + \underbrace{\frac{D^{-1}(\bullet)}{n}}_{(+)}\underbrace{f''(\bullet)}_{(-)}\underbrace{\frac{\partial S(\bullet)}{\partial p^{S*}_{min}}}_{(+)} < 0 \tag{B.33}$$

Hence, the fixed point exists and is unique provided

$$\lim_{p^N\to\infty} D\left(p^N,\delta\right) > 0 \text{ and } \lim_{p^N\to 0} D\left(p^N,\delta\right) \to \infty \tag{B.34}$$

[2]The arguments of the functions are omitted for the sake of clarity. They follow from equation B.32.

Appendix C

In-House Sustainability Initiatives in the Chocolate Value Chain

C.1 An example of the cocoa supply chain: the producing-country segment

Once again Fair Labor Association (2016) provides many details as to the workings of the supply chain of Nestlé and one of its tier-1 supplier in Côte d'Ivoire. The structure described in the paper is summarised in more details in figure C.1. The reader can refer to Fair Labor Association (2016) for more information, particularly p. 8-9 and 13-19.

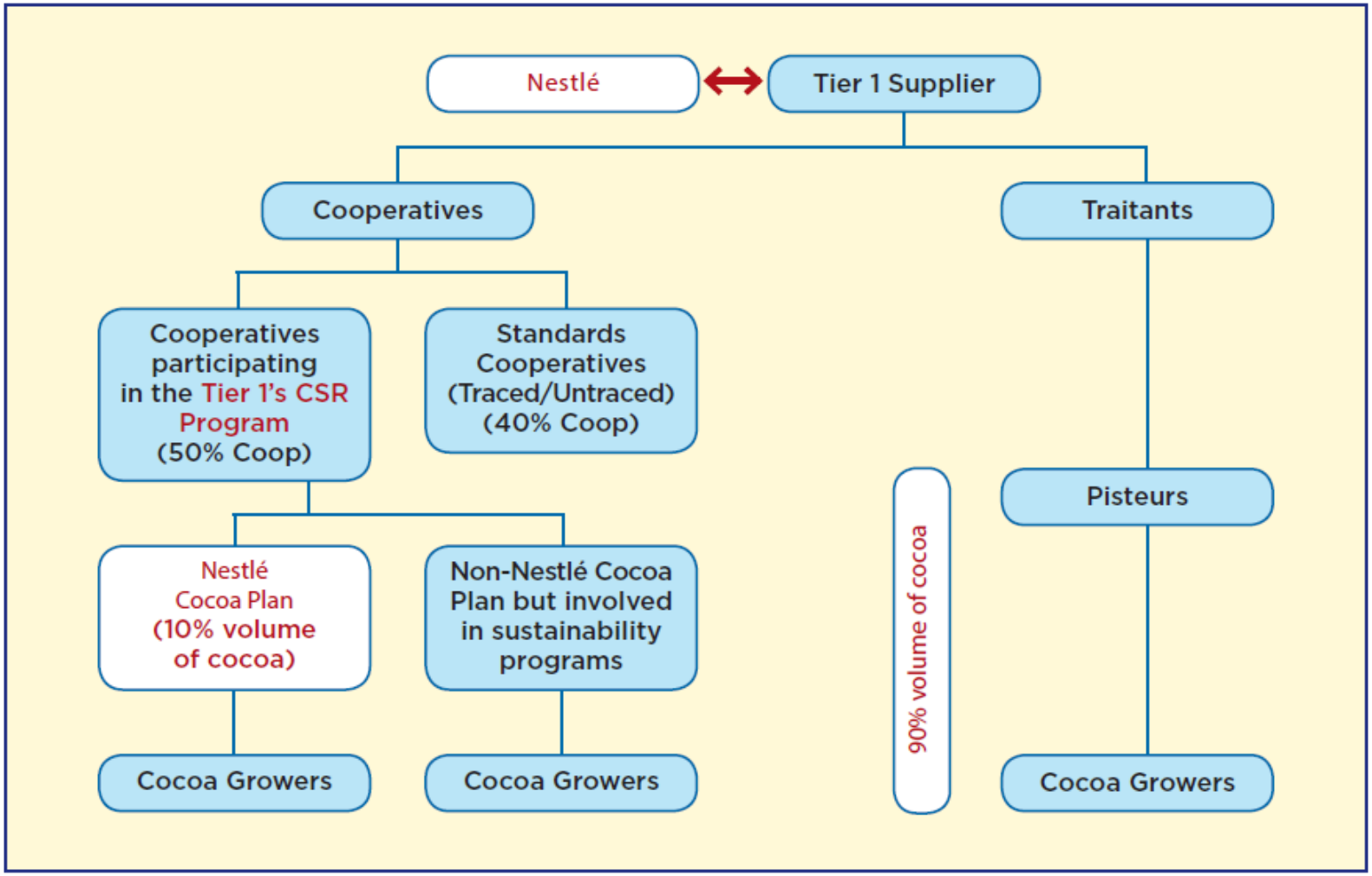


Figure 2: Cocoa Supply Chain of Assessed Tier 1 Supplier (estimated percentages)

FIGURE C.1: Cocoa Supply Chain of Assessed Tier 1 Supplier (estimated percentages) (Fair Labor Association, 2016)

C.2 Cocoa and chocolate industry websites

The information exposed in section 4.4.1 was taken from the following websites, in January-March 2017 and updated in January 2018:

- Cargill
  - General website:
    https://www.cargill.com/
  - Cocoa Promise:
    https://www.cargill.com/sustainability/cargill-cocoa-promise
  - Cocoa Promise 2016/2017 report (registration necessary):
    https://www.cargill.com/sustainability/cocoa/cocoa-promise-report-downloads
  - Cocoa Promise 2015/2016:
    https://www.cargill.com/sustainability/cocoa/previous-cocoa-promise-reports
  - External report: Ingram et al. (2013)
- Barry Callebaut
  - General website:
    https://www.barry-callebaut.com/
  - Cocoa sustainability:
    http://forever-chocolate.barry-callebaut.com/
  - Cocoa sustainability reports:
    https://www.barry-callebaut.com/sustainability/sustainability-reporting
  - Cocoa Horizon:
    https://www.cocoahorizons.org/
  - External report: Balineau, Bernath, and Pahuatini (2017)
- Mars Inc.
  - General website:
    http://www.mars.com/global
  - Cocoa sustainability:
    http://www.mars.com/global/sustainable-in-a-generation/our-approach-to-sustainability/raw-materials/cocoa
- Nestlé
  - General website:
    https://www.nestle.com/
  - CSV reports, 2015 and 2016:
    https://www.nestle.com/csv/downloads
  - Cocoa sustainability:
    https://www.nestle.com/csv/communities/nestle-cocoa-plan
  - Cocoa Plan:
    http://www.nestlecocoaplan.com/
  - External reports: Fair Labor Association (2015) and Fair Labor Association (2016)
- Mondelēz

- General website:
  http://www.mondelezinternational.com/en
- Sustainability:
  http://www.mondelezinternational.com/impact/sustainable-resources-and-agriculture
- Cocoa Life:
  https://www.cocoalife.org/
- Cocoa Life reports:
  https://www.cocoalife.org/library-search?SearchText=*&Filter=Library%20Item

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