

IMF Working Paper

Export Tax and Pricing Power: Two Hypotheses on the Cocoa Market in Côte d'Ivoire

Alexei Kireyev

IMF Working Paper

African Department

Export Tax and Pricing Power: Two Hypotheses on the Cocoa Market in Côte d'Ivoire

Prepared by Alexei Kireyev

Authorized for distribution by Doris C. Ross

November 2010

Abstract

This Working Paper should not be reported as representing the views of the IMF.

The views expressed in this Working Paper are those of the author and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the authors and are published to elicit comments and to further debate.

The paper models export taxation of a primary commodity in a large country under two hypotheses about the structure of its export market. The first is perfect competition among exporters, where there is an indefinite number of buyers of the local product and at least a partial pass-through of international prices to local producers. The second is an oligopsony, a market structure in some low-income countries where numerous scattered local producers face a few powerful exporters that can influence domestic prices. For both hypotheses, export taxation can be justified on efficiency grounds only for the country that adopts the tax. Designed correctly, a low export tax may be welfare-enhancing for that country but will always be welfare-reducing for its trading partners. The models of export taxation for both hypotheses are calibrated for the illustrative case of cocoa exports from Côte d'Ivoire.

JEL Classification Numbers: F22, F41,O15

Keywords: Low-income countries, imperfect competition, Côte d'Ivoire

Author's E-Mail Address: akireyev@imf.org

	Contents
	Page
I. Introduction	3
II. Cocoa Market Structure	4
A. Production	4
B. Prices	7
C. Taxes	9
D. Market Structure	10
III. Optimal Taxation	13
A. The Perfect Competition Hypothesis	13
B. The Oligopsony Hypothesis	18
C. Application to Côte d'Ivoire's Cocoa Exports	24
IV. Conclusions.....	29
V. References.....	31

Tables

1. World Production of Cocoa Beans	5
2. Cocoa Sector Price Structure	8
3. Cocoa Sector Tax Structure	10
4. Distribution of Cocoa Purchases by Exporter.....	12
5. Largest Cocoa Exporters From Côte d'Ivoire.....	13
6. Reference Matrix for Export Tax on Cocoa Under Perfect competition	26
7. Reference Matrix for Export Tax on Cocoa Under Oligopsony	29

Figures

1. Cocoa Pipeline	6
2. Characteristics of the Ivorian Cocoa Export Market	11
3. Export Tax Under Perfect Competition	14
4. Export Demand Elasticity and the Optimal Tax	16
5. Monopsony	19
6. Oligopsony	21
7. Specific Export Tax on an Oligopsonistic Buyer	22
8. Evolution of Average Farm-Gate Prices.....	27

*Sur les pistes ténébreuses du cacao,
un homme s'est égaré,
son stylo s'est volatilisé.
La liberté telle un oiseau géant
a pris du plomb dans l'aile
et s'est fourvoyée...*

An anonymous Ivorian poet,
Les Routes du Cacao, 2008

I. INTRODUCTION¹

This paper examines two hypotheses that may be used to assess an optimal export tax in a low-income country with enough market power to influence international prices of a certain commodity. The market structure for Côte d'Ivoire's cocoa exports is used as an illustration. The first hypothesis assumes the existence of almost perfect competition among producers and exporters in the domestic market. The second assumes an oligopsonistic domestic export market. Oligopsony is defined as a market structure in which the number of buyers is small but the number of sellers could in theory be large. Almost perfect competition and oligopsony are typical arrangements for agricultural production and exports in many low-income countries (LICs). Local producers, mainly small family farms, either compete with each other in selling their product directly to international buyers or are forced to sell their product to local branches of multinational corporations, which may either use the product themselves or export it.

Taxing exports is not an optimal policy because it distorts trade and reduces world welfare, although it may raise welfare for an individual country. An export tax improves the terms of trade of the exporter but can be welfare-enhancing only if the terms of trade gain outweighs the deadweight losses from inefficiencies in resource allocation that result from the tax. A country would have to be a major exporter of a commodity that lacks easy substitutes to realize the terms of trade gains, but even in this case the tax would be globally welfare-reducing. If a country that sees itself as "large" in the export of a specific commodity in the sense that it can impact its international price misinterprets its real market power and proves to be "small," or if a substitute for its export commodity becomes readily available, the positive terms of trade effect disappears totally and the export tax becomes unambiguously welfare-reducing.

Export taxes are used mainly by LICs, and mainly as a source of revenue. Although World Trade Organization rules do not prohibit export taxes, over two-thirds of its members have chosen not to apply them, recognizing that they distort trade and may lead to welfare losses. Only three OECD countries use export taxes, and many regional and bilateral trade agreements explicitly prohibit them. As most LICs are small, with little or no pricing power, they use export taxes only

¹ The author is grateful to T. Dorsey, D. Fanizza, P. English, A. Kouwenaar, B. McDonald, S. Nolan, D. Ross, I. Samake, and S. Tokarick for their helpful comments. All remaining errors are the author's responsibility.

as a source of revenue. However, for a country with substantial pricing power, export taxes may be welfare-improving and be viewed as a policy option—taken, however, at the expense of its trading partners.

The purpose of this paper is to illustrate ways to assess the level of an export tax for a large country. It reviews a broad range of market structures, from perfect competition to an oligopsony, and suggests simple methods for calculating a possible range for an optimal export tax, which differ depending on the selected hypothesis on the market structure. While perfect competition is seen as a generally superior market structure on efficiency grounds and government interventions can help skew the existing structure towards a more efficient structure, the discussion of these issues is outside the scope of the paper. Moreover, additional studies are needed to arrive at a definitive conclusion of the actual market structure of cocoa exports from Côte d'Ivoire. This market is used only as an illustration of the methodologies reviewed.

In what follows, Section II describes the structure of cocoa production, pricing, and taxation in Côte d'Ivoire. Section III presents two simple models of an export tax calculation based on alternative hypotheses about market structure and illustrates the calculations by applying the models to the case of cocoa export taxation in Côte d'Ivoire. Conclusions are presented in Section IV.

II. COCOA MARKET STRUCTURE

A. Production

In Côte d'Ivoire in recent years, cocoa has accounted for 25–30 percent of exports and 17–20 percent of revenue. The cocoa sector employs about 4 million people out of a population of 20 million. Accounting for over 36 percent of world production on average in 2007–09, Côte d'Ivoire is the world's dominant producer of cocoa. In 2006–09 its average production reached almost 1.3 million tons of cocoa beans a year, of which 97 percent was exported (Comité de Gestion de la Filière Café Cacao [CGFCC], 2009). Although Ghana and Indonesia are also increasingly large cocoa producers, their combined share in the world market is only about 32 percent. Other countries have much smaller shares of the cocoa market (Table 1).

World cocoa production is fragmented; there is no cartel-type association. The main international institutions involved in the industry are the Federation of Cocoa Commerce (FCC) and the International Cocoa Organization (ICO), both primarily consultative and informational bodies with no power to regulate the market or influence prices. The ICO, for example, has the mandate “to work towards a sustainable world cocoa economy,” but has no influence on prices, distribution channels, or market structure (ICO, 2008).

Table 1. World Production of Cocoa Beans

	2007/08		2008/09	
	Thousand tons	Percent	Thousand tons	Percent
Africa	2,687	72.0	2,484	70.7
Cameroon	185	5.0	210	6.0
Cote d'Ivoire	1,382	37.0	1,222	34.8
Ghana	729	19.5	662	18.8
Nigeria	220	5.9	240	6.8
Others	171	4.6	150	4.3
America	453	12.1	456	13.0
Brazil	171	4.6	157	4.5
Ecuador	111	3.0	112	3.2
Others	171	4.6	187	5.3
Asia and Oceania	591	15.8	575	16.4
Indonesia	485	13.0	475	13.5
Papua New Guinea	52	1.4	52	1.5
Others	54	1.4	48	1.4
World total	3,731	100	3,515	100

Source: ICCO, www.icco.org/statistics/production.aspx

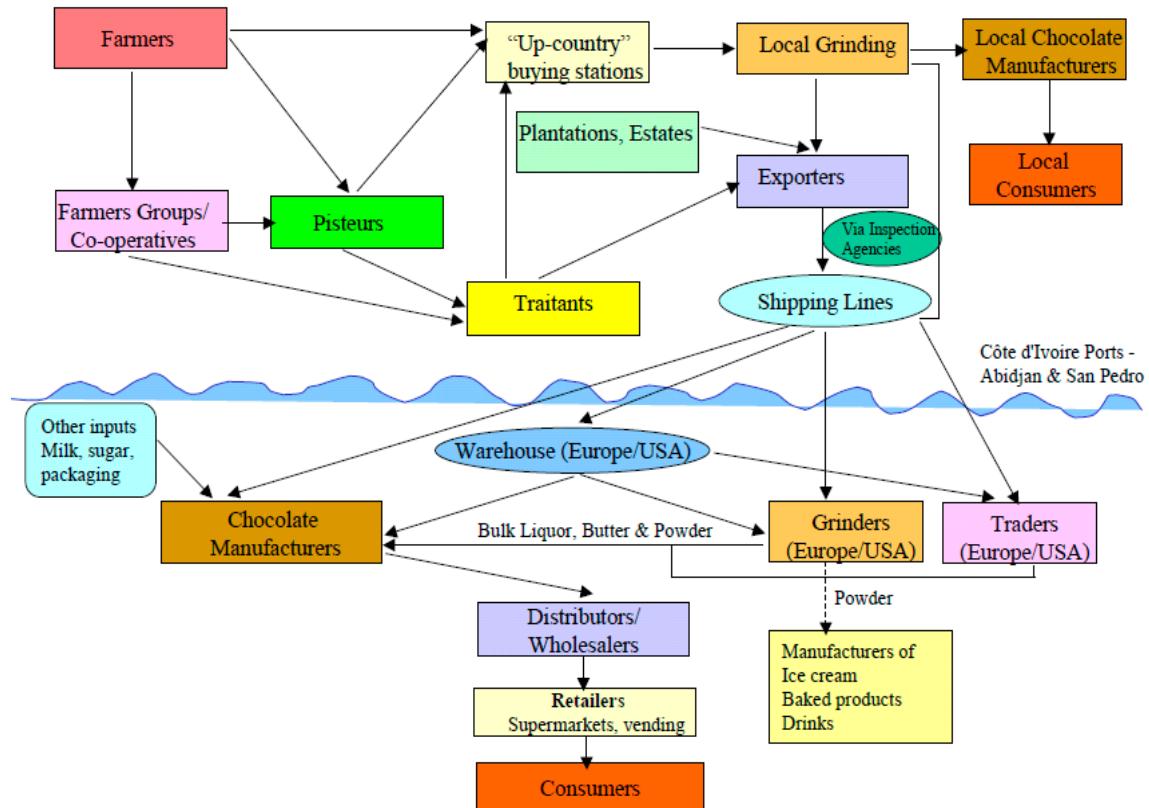
The cocoa market in Côte d'Ivoire is structured as an inverted pyramid. Production and primary collection are highly decentralized (see top of Figure 1), while exports and consumption are highly concentrated (base of Figure 1). Key players are:

- Producers (*planteurs*). Cocoa is produced by a vast number of small farmers and cooperatives. With no reliable census data available, the total number of smallholder families is estimated to be anywhere from 600,000 to 800,000. Côte d'Ivoire's cocoa crop season lasts from October to June, with about 70 percent of cocoa output collected and usually exported during October-December.
- Itinerant buyers. These *traitants* are local intermediaries, some supported by several *pisteurs* who travel among villages in a specific area to buy cocoa from the producers. The buyers pay in cash and deliver the cocoa to the collection center in the nearest large town. This activity requires a license. Based on the number of licenses issued, their total number is estimated at about 1,000, although only 188 individuals were listed as approved buyers (*acheteurs agréés*) for the 2006/07 campaign.²

² Bourse du Café et du Cacao (www.bcc.ci).

- Exporters. From the collection centers located in the larger towns of Côte d'Ivoire, the cocoa is transported to exporters' warehouses in the port areas of Abidjan or San Pedro. The warehouses mainly belong to companies formally registered with the government as cocoa exporters for each crop season. The total number each year does not exceed 50–60 (European Union [EU], 2006).

Figure 1. Cocoa Pipeline



Source: Federation of Cocoa Commerce (2008).

The paper focuses only on the domestic segment of the complex market structure of cocoa production and exports. Of the cocoa pipeline presented in Figure 1, the paper discusses only the domestic market structure in Côte d'Ivoire, i.e., local cocoa farmers, itinerant buyers, and exporters, and the impact of a particular market structure on the level of optimal export taxation. It does not cover the international market for the Ivorian cocoa where about 40 percent of the output is sold in the spot market, whereas the rest is sold through futures contracts.

B. Prices

In the export chain, economic agents in Côte d'Ivoire must deal with several types of prices for cocoa:

- Farm-gate prices. These are the domestic prices itinerant collectors pay farmers in cash. Statistics on these prices are partial because data are collected only for the six main cocoa-producing regions. Farm-gate prices are calculated as an average price for the six regions.
- Indicative price. For each crop season the government establishes an indicative farm-gate price, which is used only for general orientation of farmers and is not enforced. The indicative price for 2008–09 was set at CFAF 700 per kg, up from CFAF 450 per kg the previous season. On October 1, 2009, the authorities increased the indicative farm-gate price to CFAF 950 (US\$2.1).
- Export prices. These are discounted world prices set by exporters as a function of cocoa future prices on international markets. Depending on the quality of cocoa beans each season, the Ivoirian export price can be lower or higher than the world average.³

Information on farm-gate prices, which depend on location, is fragmented. Data are collected by the Comité de Gestion de la Filière Café-Cacao (CGFCC) and published by the Coffee and Cocoa Bourse (BCC). It appears that the average farm-gate price for cocoa reached CFAF 618 per kg in July 2009, a 30 percent increase over the CFAF 476 per kg a year earlier. By September 2009, it was CFAF 640, a percentage increase of 46 percent. However, location makes a difference. For example, in November 2008 beans sold for approximately CFAF 610 per kg in Abidjan but for CFAF 590 in San Pedro. When there is a difference of at least CFAF 75 or 100 in price in Côte d'Ivoire and neighboring Ghana, there is increased incentive for smuggling cocoa from one country to the other.

The world price for cocoa is based on trading in futures for cocoa beans. Cocoa futures contracts are mainly traded on the London Financial Futures Exchange (LIFFE) and the New York Board of Trade (NYBOT). A contract is a standardized agreement to purchase or sell cocoa beans for delivery in the future at a price determined when the contract is sold. Contracts are used to assume or shift price risk and may be satisfied by delivery or offset by an opposite transaction on the futures market (ICO, 2006).⁴

³ International Monetary Fund World Economic Outlook (IMF WEO) cocoa prices are based on the International Cocoa Organization's (ICO) quoted cash price. It is an average of the three nearest \$/Mt active futures trading months in the New York Cocoa Exchange at noon and the London Terminal market at closing, CIF U.S. and European ports (*The Financial Times*, London).

⁴ Cocoa futures contracts are highly standardized. They specify delivery months, trading units, daily price movement limits, quality of deliverables, and delivery specifications. For example, LIFFE contracts call for delivery of a lot size of 10 tons of beans in the months of March, May, July, September, and December. Futures contracts are priced

(continued)

Each agent involved in cocoa trading receives a share of the world price. From 2001 to 2009 the average world price for cocoa beans in U.S. dollars increased by over 160 percent, but because the dollar depreciated, the world price in CFAF increased by only 70 percent (Table 2). Because of quality differences, Ivorian cocoa is usually exported at a discount from the world price that varies substantially but generally does not exceed 10 percent. After exporters pay all fiscal and quasi-fiscal levies, the average price they retain is about 60–70 percent of the world price. No matter what the indicative producer price is, exporters usually pay farmers less, so the actual producer price is substantially below the indicative price. The margin between the export price after taxes and the farm-gate price is split between the exporter, who receives about 90 percent as profit, and local intermediaries, who get the other 10 percent.

Table 2. Cocoa Sector Price Structure
(CFAF per kg)

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Average world price	797.1	1,235.7	1,074.9	818.2	813.3	830.9	937	1,148.7	1,359
Average export price of CIV	719.1	1,222.1	1,063.0	801.5	785.0	803.5	855.3	1,008.2	1,218
Discount	78.0	13.5	11.9	16.7	28.3	27.4	81.8	140.5	141.0
<i>in percent of world price</i>	9.8	1.1	1.1	2.0	3.5	3.3	8.7	12.2	10.4
Fiscal and quasi-fiscal levies	284.8	393.5	372.6	313.3	312.5	313.4	310.2	301.4	308.3
<i>in percent of export prices</i>	39.6	32.2	35.1	39.1	39.8	39.0	36.3	29.9	25.3
Price retained by exporters	434.3	828.6	690.4	488.2	472.5	490.1	545.1	706.8	909.4
Indicative producer price	473.0	662.0	516.0	385.0	392.5	400.0	450.0	700.0	762.5
Farm-gate price	403.7	487.6	337.4	322.6	313.8	329.5	425.6	490.7	609.7
Export margin	27.6	306.9	317.7	149.0	142.9	144.5	107.5	194.5	269.7
Intermediaries' margin	3.1	34.1	35.3	16.6	15.9	16.1	11.9	21.6	30.0
Actual farm-gate price in percent of									
<i>world price</i>	50.6	39.5	31.4	39.4	38.6	39.7	45.4	42.7	44.9
<i>export price of CIV</i>	56.1	39.9	31.7	40.3	40.0	41.0	49.8	48.7	50.1
<i>indicative producer price</i>	85.3	73.7	65.4	83.8	79.9	82.4	94.6	70.1	80.0

Sources: Ivorian authorities, *IMF World Economic Outlook*, and IMF staff estimates

Thus in 2001–09 Ivoirian producers received on average no more than 41 percent of the world price for cocoa. This is the lowest share in the region, and probably in the world. By way of comparison, 2007–08 producer prices stood at 90 percent of international prices in Nigeria, 70 percent in Ghana, and 85 percent in Cameroon.

in British pounds with a minimum price movement of £1 per ton and no limit on daily price movements. LIFFE accepts delivery at licensed warehouses in Amsterdam, Antwerp, Bremen, Felixstowe, Hamburg, Humberside, Le Havre, Liverpool, London, Rotterdam, and Teesside.

C. Taxes

Taxation of the cocoa sector has been a complex combination of fiscal and quasi-fiscal levies. In Côte d'Ivoire export taxes are considered an important source of fiscal revenue and also an indirect way to tax the land used to generate profit. Fiscal levies form part of budget revenue; quasi-fiscal levies are collected to finance sector institutional structures and are not included in fiscal revenue.

Fiscal levies have been a combination of specific and ad valorem taxes:

- Export tax (*droit unique de sortie, or DUS*) is a specific tax set in CFAF per kg of cocoa beans is periodically revised. It was CFAF 220 per kg for the 2008–09 crop season. The government has reduced it to CFAF 210 for the 2009–10 crop season. Exporters pay the DUS when the cocoa cargo is loaded onto the vessel.
- Registration tax (*taxe d'enregistrement*) is an ad valorem tax set as a percentage of the price CIF and is periodically revised. Because international cocoa prices rose, the government in 2008 temporarily increased the tax from 5 to 10 percent but intends to reduce it to 5 percent starting with the 2009–10 crop. Exporters pay the registration tax first when they register with the government as an official cocoa exporter and annually thereafter.
- Other state levies: There is a CFAF 2 per kg tax on itinerant buyers, and the European Union has documented over 20 other implicit state charges (EU, 2005).

The government has committed itself to gradually reducing overall cocoa taxation to 22 percent of the CIF price in 2011 and to transforming all cocoa-related levies into a single ad valorem tax before the 2010–11 season.

The total amount of quasi-fiscal levies fluctuates from year to year. For the 2008–09 season, they totaled CFAF 31 per kg, a substantial reduction from CFAF 47 a year earlier. The amount is a function of a complex power balance between the central government and several public entities (ARCC, BCC, FRC, and FDPCC⁵, among others) involved in management and investment in the cocoa sector. The system is being reformed to improve its efficiency, transparency, and governance.

It is hard to establish with precision how much tax the cocoa sector pays. Because of the unstable tax structure, with the DUS and quasi fiscal levies changing regularly, and active use of specific taxes, the ad valorem equivalents depend on international cocoa prices, so they may change from

⁵ Autorité de Régulation du Café et du Cacao (ARCC), Bourse de Café et du Cacao (BCC), Fonds de Régulation et de Contrôle du Café-Cacao (FRC), Fonds de Développement et de Promotion des Activités des Cacao/café (FDPCC).

year to year. Rough estimates based on the October 2008 world price and the tax structure for the 2007–08 campaign suggest that the total of DUS, the registration tax, and the quasi-fiscal levies represented about 28 percent of the cocoa CIF price (Table 3).

**Table 3. Cocoa Sector Tax Structure
(FCFA per kg)**

	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fiscal and quasi-fiscal levies	284.8	393.5	372.6	313.3	312.5	313.4	310.2	301.4	308.3
<i>in percent of export prices</i>	39.6	32.2	35.1	39.1	39.8	39.0	36.3	29.9	25.3
Fiscal levies	218.0	270.9	273.2	260.1	259.3	260.2	262.8	270.4	280.9
<i>in percent of export prices</i>	30.3	22.2	25.7	32.4	33.0	32.4	30.7	26.8	23.1
DUS	201.5	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0
Registration tax	16.5	50.9	53.2	40.1	39.3	40.2	42.8	50.4	60.9
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Quasi-fiscal levies	66.8	122.6	99.5	53.3	53.3	53.3	47.4	31.0	27.5
<i>in percent of export prices</i>	9.3	10.0	9.4	6.6	6.8	6.6	5.5	3.1	2.3
ARCC	3.0	3.0	3.6	5.7	5.7	5.7	5.7	4.0	5.5
BCC	3.3	5.9	4.9	4.8	4.8	4.8	4.0	3.0	1.8
FRC	0.0	1.7	2.9	2.7	2.7	2.7	2.7	2.0	1.4
FDPCC	35.0	46.3	43.9	25.0	25.0	25.0	20.0	15.0	13.7
Reserve	22.0	62.3	40.0	10.0	10.0	10.0	10.0	5.0	1.4
"Sacherie"	3.5	3.5	4.2	5.0	5.0	5.0	5.0	2.0	3.7

Sources: Ivoirian authorities, *IMF World Economic Outlook*, and IMF staff estimates.

D. Market Structure

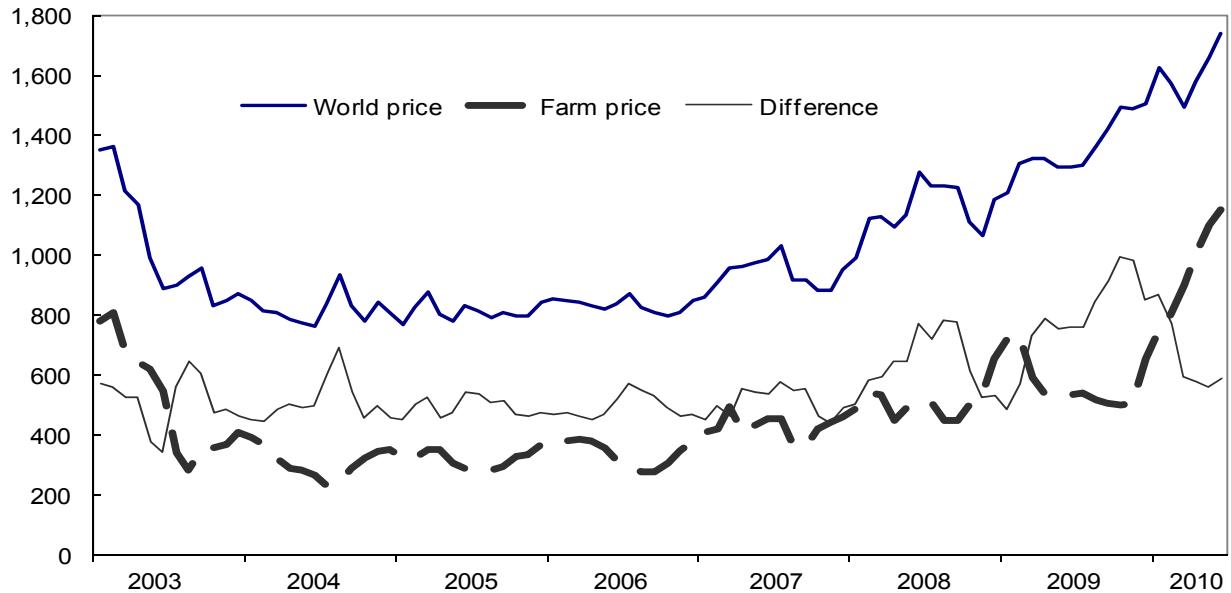
It is not possible for us to reach an unambiguous conclusion about the structure of the cocoa export market in Côte d'Ivoire. At a minimum, two possibilities need to be considered: the market is highly competitive, with many exporters competing for the output of an even larger number of producers; or the market is quite restricted, with a large number of domestic cocoa producers faced with a few large exporters. Other features that distinguish a perfectly competitive market from an imperfectly competitive one are shown in Figure 2. The shaded areas provide a broad overview of features of the Côte d'Ivoire's cocoa exports market. It is obvious that this market is neither perfectly competitive nor perfectly monopolistic. The theoretical approaches to an optimal export tariff for a near-perfect competition market structure and a near-oligopsony market structure obviously differ.

Figure 2. Characteristics of the Ivorian Cocoa Export Market

	Perfect competition	Imperfect competition		
		Monopoly	Monopolistic competition	Oligopsony
Number of firms	many	one	many	a few
Price control	none	full	partial	partial
Commodity	homogeneous	unique	differentiated	unique or differentiated
Barriers to entry	none	insurmountable	none	significant
Information	available to all	not available	limited	strongly limited
Economic profit	none in the long run	always positive	positive in the short run and zero in the long run	positive or none

The first hypothesis assumes that the cocoa export market in Côte d'Ivoire is highly, but not perfectly, competitive. Evidence of competition can be found in what seems to be a substantial degree of pass-through to domestic producers of international prices (Figure 3), which since 2003 have been trending in the same general direction. A simple correlation coefficient between world and domestic farm-gate prices for 2003–09 was 0.8. A correlation this high can be interpreted as demonstrating a fair degree of competition among exporters on the Côte d'Ivoire cocoa exports market. At the same time, the share of world prices received by producers has been very unstable as it declined from 51 percent in 2001 to 31 percent in 2003 and then increase again to 45 percent in 2009 (Table 2), which would suggest that such competition is not perfect.

Figure 3. World and Farm-Gate Cocoa Prices (CFAF per kg)



Sources: ICCO; La Bourse du Café et du; and IMF *World Economic Outlook*.

While fluctuations in domestic and international prices for cocoa have been generally synchronous, the difference between the two has been significant. For 2003–09 the difference averaged 56% of the export price, which suggests that although competition among exporters may be intense, less than half of the export price has actually been passed on to producers. Surprisingly, from January to July 2003 the difference between domestic and international prices was never more than 41 percent of the international price. With reforms of the sector, the wedge increased to 61 percent and fell below 60 percent only in 2007.

The second hypothesis assumes that the cocoa export market structure in Côte d'Ivoire represents an oligopsony. During the 2008–09 season, of a total of 97 registered exporters, only 62 actually exported cocoa, and only 42 exported amounts that exceeded 10,000 tons. On the other hand, the nine largest entities exported over 70 percent of the country's cocoa, with the top six firms accounting for over 50 percent (Table 4). However, the oligopsonistic situation may not be particularly strong as there is a “competitive fringe” that includes dozens of buyers and accounts for nearly half of all purchases.

Table 4. Distribution of Cocoa Purchases by Exporter
July 2009

Cocoa purchases		Exporters	
Tons	(%)	Exporters	(%)
0	0.0	35	36.1
69,117	6.2	42	43.3
79,311	7.1	5	5.2
101,967	9.1	4	4.1
38,497	3.5	1	1.0
45,852	4.1	1	1.0
113,224	10.1	2	2.1
67,271	6.0	1	1.0
77,481	6.9	1	1.0
263,614	23.6	3	3.1
259,487	23.3	2	2.1
1,115,821	100.0	97	100.0

Source: CGFCC (2009-1), p.4.

Most Ivoirian exporters are either subsidiaries of or otherwise linked to large multinational corporations. This is not surprising. Three major cocoa processing companies—Archer Daniels Midland (ADM), Barry Callebaut, and Cargill⁶—buy over 40 percent of the cocoa beans

⁶ In 2005, Cargill, one of the biggest purchasers of cocoa in the world, was sued by a United States labor rights law firm accusing it of forced child labor. Although Cargill does not own cocoa plantations or directly employ child workers but instead buys through agents, the plaintiff argued that exporters and manufacturers bear ultimate responsibility for conditions on the farms because they exert considerable control over world cocoa markets, essentially setting the farm-gate price.

produced in the world (Table 5) and the top 10 chocolate manufacturers (including Nestlé, Ferrero, Cadbury Schweppes, Mars, and Hershey) account for over 40 percent of global chocolate sales.

**Table 5. Largest Cocoa Exporters from Côte d'Ivoire
March 2008**

	Share in percent
Cargill (US)	16.0
SAF Cacao (Cote d'Ivoire)	12.5
ADM Cocoa (US)	9.0
Barry Callebaut (Switzerland)	7.7
Outspan Ivoire-Olam (Singapore)	6.8
CIPEXI-Continaf (The Netherlands)	4.7
Tropical – ED&F Man (UK)	4.1
TOTAL	60.8

Source: Oxfam (2009), p.9.

Thus, Côte d'Ivoire's exports market consists of some 800,000 small producers facing, through several hundred local intermediaries, three to ten large buyers, mainly subsidiaries of local exporters controlled by ADM, Barry Callebaut, and Cargill. On this hypothesis, a very few buyers control the majority of Ivoirian cocoa exports and the world cocoa market, and therefore export taxation of cocoa from Côte d'Ivoire can be analyzed on the assumption that the cocoa market is oligopsonistic.

III. OPTIMAL TAXATION

A. The Perfect Competition Hypothesis

The impact of a country on the international price for a commodity depends on its export market share. Côte d'Ivoire produces about 36 percent of world cocoa output. International prices for cocoa thus largely depend on the quantity and quality of cocoa exported from Côte d'Ivoire. Bad weather, plant diseases, and delays in the harvesting season immediately translate into higher international prices. Since cocoa is mainly sold through forward contracts, expectations of a good or bad crop in Côte d'Ivoire affect declines or increases in international prices. For example, concerns about swollen shoot disease⁷ in some areas of Côte d'Ivoire have been a major cause of high world prices for cocoa in 2009, irrespective of how good the crop is.

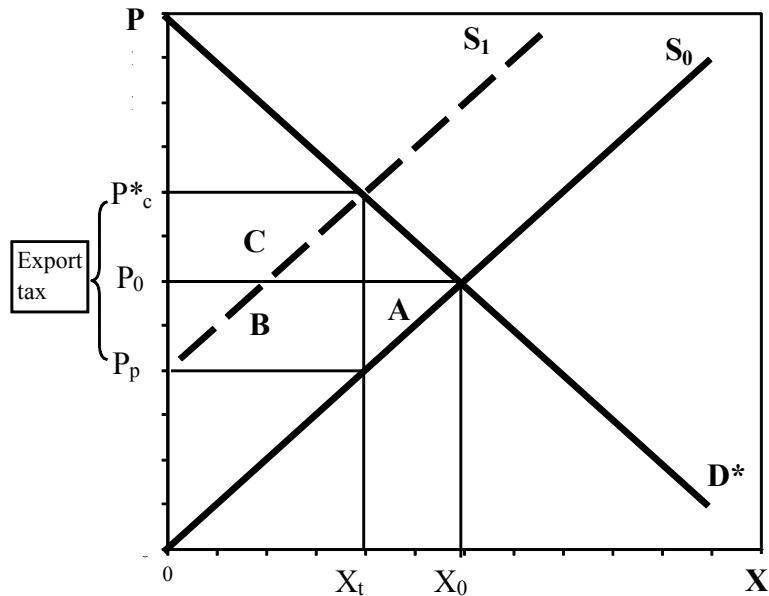
A country with pricing power can, in principle, improve its terms of trade by imposing an export tax on its main exportable commodity. Imposed by a large country, such a tax affects export supply and international demand and has substantial distributional and welfare implications. Like

⁷ Swollen shoot is a viral plant disease that attacks cocoa leaves and shoots and can kill trees within two years. There are few treatments except ripping out infected trees and replanting.

firms, which under imperfect competition face a downward sloping demand curve and can increase profits by suppressing output below the level where their marginal revenue equals marginal costs, the government can restrict the exports of cocoa by way of an export tax. This can maximize national welfare if the resulting positive effect on the terms of trade exceeds the deadweight welfare losses from distortions introduced by the tax. In any case, the net welfare improvement will be at the expense of the country's trading partners.

An export tax restricts supply and leads to redistribution of income and to inefficiency. Local producers receive less for their output because part is appropriated by the government in the form of the export tax (Figure 3). From the point of competitive equilibrium, P_0Q_0 , where S_0 is home supply curve and D^* is foreign import demand curve, a specific export tax will shift the supply curve to the left from S_0 to S_1 , and an ad valorem tax will make its slope steeper. The economic impact of both kinds of the tax is roughly the same. In the case of a large country, prices for international consumers rise from P_0 to P_c^* and for domestic producers fall from P_0 to P_p . Exports declines from X_0 to X_t . The sum of the consumer and producer surpluses is reduced by areas $A + B$, the government of the exporting country gets revenue represented by areas $B + C$. To measure the net welfare impact, the terms of trade gain shown by area C needs to be compared with the deadweight loss area A . Therefore, it can be seen that $C > A$, if the export tax is relatively small and does not shift the supply curve too far to the left. In this case, an export tariff will be welfare enhancing for the exporting country.

Figure 3. Export Tax Under Perfect Competition



The optimal tax rate can be set by raising the rate to the point where the gain from improved terms of trade is just offset by the loss from distortions caused by the tax. To achieve that, the

marginal cost of exports as measured by the export supply curve should be equal to the marginal return from exports as measured by marginal export revenue. The optimal tax would reduce the domestic price for exports to the marginal revenue from exports. If the inverse demand is given by $p^*(Q)$, where p^* is a world price, the country's export revenue would amount to $Qp^*(Q)$, and its marginal revenue from exports would be

$$MR = p^*(Q) + Q \left[\frac{dp^*(Q)}{dQ} \right] = p^*(Q) \left[1 + \frac{Q}{p^*(Q)} \frac{dp^*(Q)}{dQ} \right] = p^*(Q) \left[1 - \frac{1}{\eta_x} \right]$$

where $\eta_x = \frac{p^*(Q)}{Q} \frac{dQ}{dp^*(Q)}$ is the elasticity of export demand (Krugman and Helpman, 1989).

To set an ad valorem tax at rate t_x so that $p = MR$, where $p = \frac{p^*}{1+t_x}$ is the domestic price, would

mean that $p^* \left[1 - \frac{1}{\eta_x} \right] = \frac{p^*}{1+t_x}$. Therefore, the optimal export tax would be $t_x = \frac{1}{\eta_x - 1}$.⁸

The application of this optimal export tax formula is complicated by several factors. The formula rests on numerous assumptions: trade is always balanced, the foreign demand curve is given as if other countries do not alter their trade policies in retaliation for the export tariff, there is perfect competition within the country, there are no domestic divergences so the supply curve shows the marginal social cost of exports, and the revenue raised by the government from the export tax is spent on imports and therefore does not affect domestic demand and the supply curve.

The optimal rate of an export tax rate critically depends on the price elasticity of demand for cocoa exports. Where a small country would see a horizontal and perfectly elastic demand curve, for the exports of a large country, like cocoa from Côte d'Ivoire, the demand curve is less than perfectly elastic. In this case any slight deviation of the demand curve from a horizontal line is a sufficient precondition for applying an export tax. Neither a full monopoly nor an inelastic demand curve is required to achieve a favorable impact on the country's welfare.

However, by far the largest problem is that the elasticity of the demand curve at each point is different and is generally not known. All the formula for the optimal export tariff says is that at

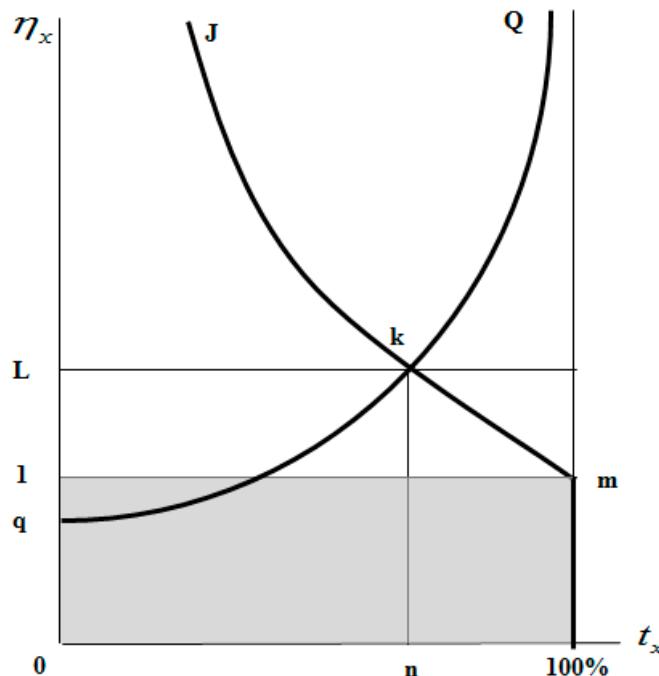
⁸ Since $\eta_x - \varepsilon_m = 1$, where ε_m is import supply elasticity and $t_x = \frac{1}{\eta_x}$ and $t_m = \frac{1}{\varepsilon_m}$, the optimal export tax can

be also expressed in terms of the elasticity of import demand, $t_x = \frac{1}{1 + \varepsilon_m}$, and the optimal import duty can be

expressed in terms of export demand elasticity as $t_m = \frac{1}{\eta_x}$ (Corden, 1974, p.167).

the optimum point on the demand curve, wherever it is, the optimal tariff can be calculated using the formula—it tells nothing about where the optimal point actually is. Therefore, with elasticity changing along the demand curve, any inferences about the optimum level of the export tax should be derived only in terms of ranges within the obvious constraints. This suggests that if $\eta_x = 1$, the optimum tax rate is 100 percent; if $\eta_x = \infty$, the optimal rate is zero. Note that if $\eta_x < 1$, the tax should be greater than 100 percent, which is clearly not feasible. The elasticity of the demand is larger at higher prices than at lower prices, and declines as the price falls.⁹ The shaded area in Figure 4 shows demand elasticity below 1 and the applicable range of a possible export tax from 0 to 100 percent. The Q curve shows that export demand elasticity, η_x , increases as the tax rate t increases, because increasing export prices and reducing the volume of trade by increasing the tax rate is likely to raise elasticity.

Figure 4. Export Demand Elasticity and the Optimal Tax



The J curve shows the tax rate at different elasticities. When $\eta_x < 1$, for example at q , the tax is zero, as it cannot be negative; when $\eta_x = 1$, the tax rate is 100 percent; when $\eta_x > 1$, the tax rate is

⁹ By definition, the demand elasticity $\varepsilon = \frac{\partial q}{\partial p} \frac{p}{q}$, where $\frac{\partial p}{\partial q}$ is the slope of the demand curve. For $\frac{\partial p}{\partial q} = \text{const}$,

$\frac{p}{q}$ declines as p falls and q rises. In addition, the slope is likely to decline as p falls.

between zero and 100 percent. Starting with a point such as q on the Q curve, where the elasticity of the demand curve is less than unity, as the tax rate rises, elasticity also rises, but the optimal tax remains at 100 percent until the J curve reaches point m . After that, once the elasticity is higher than unity, the tax starts to decline from the extreme 100 percent to zero. On the assumption of perfect competition, point k at the intersection between the Q and the J curves establishes the optimal tax rate n for a given elasticity of the export demand curve, L . Therefore, when the elasticity of export demand is less than unity, the export tax is always suboptimal and should be raised until the elasticity exceeds unity. Conversely, if the export tax is optimal, than the elasticity of export demand must exceed unity.

With any deviation from perfect competition, the optimal rate depends not only on the elasticity of export demand but also on the number of competing firms. Unless the exporters behave like a monopoly, the optimal export tax is positive but is lower than on the assumption of perfect competition. An export tax may be welfare-improving when the domestic export market is competitive. The larger the number of exporters or the closer the market is to perfect competition, the lower is the optimal export tax.¹⁰

The price elasticity of export demand for cocoa seems to be relatively high but cannot be known with any degree of certainty. Based on indirect indications, arguably it is not perfectly elastic and is fairly high because Côte d'Ivoire can sell all its cocoa output in the international market. At international prices of about US\$3,000 per ton (as in mid-2009) as well as below US\$1,500 (as in 2005), Côte d'Ivoire could export virtually all the cocoa it produces. Even during the financial crisis in mid-2009 when prices for cocoa spiked, international demand for beans remained robust. Therefore, Côte d'Ivoire's demand curve should clearly be downward-sloping but elastic. Indirect estimates for LICs yield an average export demand elasticity of 3.5 for agricultural commodities and 4.0 for food (IMF, 2009). Estimates in a general equilibrium framework of export demand elasticity for other primary commodities in a big country framework (e.g., exports of rice from Thailand) yielded a range of elasticities from 2 to 5 (Warr, 2001). These elasticities are not constant and fluctuate substantially depending on market conditions.

The price elasticity of the export supply is equally hard to identify but seems low.¹¹ Even if additional supply were required, there is no way to increase output once the cocoa crop is harvested. Cocoa stocks are limited and—absent a buffer price agreement—are used mainly to regulate intra-seasonal fluctuations of supply. Although the availability of substitutes, like tea and coffee, would suggest higher supply elasticity in the long run, consumer preferences for

¹⁰ See Corden (1974, p. 171–72) and Krugman and Helpman (1989, pp. 84–87).

¹¹ Although the optimal tax depends only on export demand elasticity, the relationship between the tax rate and the demand elasticity (the Q curve on Figure 5) depends also on the domestic supply curve as it establishes the point where the supply curve intersects the marginal revenue curve (see Corden, 1975, pp.160—167 for details).

cocoa-based drinks and chocolate are strong, suggesting that short-term elasticity is low. Finally, because key factors of cocoa production—land, vines, and climate—are fixed and cannot be easily displaced or used for other purposes, there can be no price equalization for these factors, which also supports the argument that cocoa supply has low elasticity.

The rate of an optimal export tax depends on the degree of market competition. If local exporters are perfectly competitive, the optimal rate is a function of the inverse elasticity of demand for cocoa. This may not be the case for Côte d'Ivoire's export market. If local firms are not perfectly competitive, the optimal rate may still be positive but lower than rates created with perfect competition. In both cases, the welfare and distribution effects are as outlined above but their magnitude will depend on the elasticities of supply and demand as well as on the tax rate. The optimality of export taxation, i.e., its impact on the maximization of national welfare, can be fully evaluated only within a general equilibrium framework.

B. The Oligopsony Hypothesis

The literature on monopolistic behaviors of buyers is remarkably scarce. Most texts on advanced microeconomics (Varian, 2008; Jehle, 2007) and industrial organization (Tirole, 1988; Shepherd, 1999; Scherer & Ross, 1992) focus on imperfect competition among sellers. On the buyers' side, they tend to analyze only vertical pricing relationships. Among several market structures involving power on the buyers' side,¹² standard texts explore only bilateral monopoly, which is rarely encountered in the real world. But partial equilibrium models of buyer behavior and taxes under imperfect competition with application to Côte d'Ivoire can be found in papers by Deardorff and Rajaraman (2005), McIntire and Vatangis (1999), Burger (2008), and EU (2005).

Oligopsony can be modeled in a partial equilibrium framework as an inverse of oligopoly.¹³ Starting from monopsony (one buyer), which can easily be presented as an inverse of monopoly (one seller), one can build a model of oligopsony (few buyers) as an inverse of an oligopoly (few sellers). If a monopolist faces a linear demand function, $p(y) = a - by$, then the revenue function

is $r(y) = p(y)y = ay - by^2$ and the marginal revenue function is $MR(y) = \frac{dR}{dy} = a - 2by$ —i.e.,

the MR function has the same vertical intercept a as the demand function but is twice as steep; its slope is $-2b$ compared with $-b$ for the demand function. Symmetrically, if a monopsonist faces a linear supply function $p(x) = a + bx$, then its total cost function is

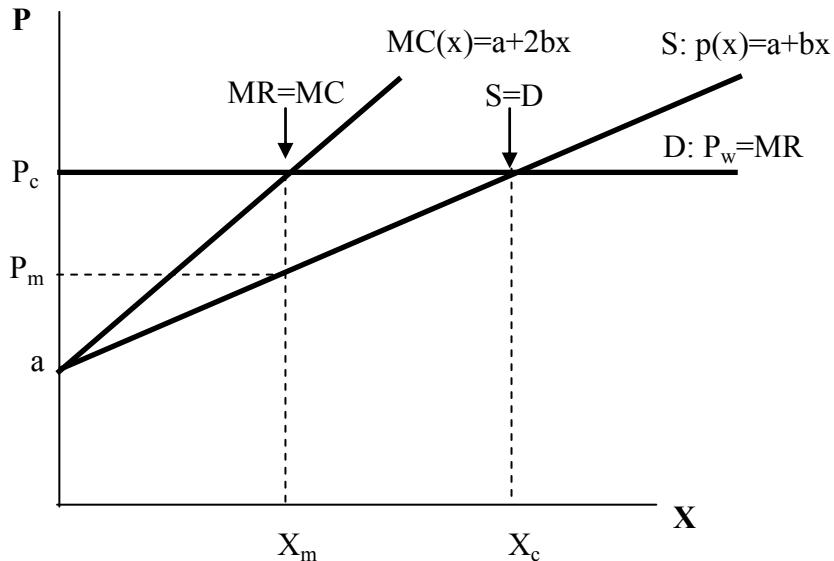
$C(x) = p(x)x = ax + bx^2$ and the marginal cost function is $MC(x) = \frac{dC}{dx} = a + 2bx$ —i.e., the

¹² Bilateral monopoly (a single buyer facing a single seller); pure monopsony (a single buyer facing many competitive sellers); bilateral oligopoly (a few buyers facing a few sellers); and oligopsony (a few buyers facing many sellers), etc.

¹³ The model presented here generally follows Deardford and Rajaraman (2005), Varian (2003), and Krugman (2005).

MC function has the same vertical intercept a as the supply function but is twice the slope, which is $2b$ compared with b for the supply function (Figure 5).

Figure 5. Monopsony



The monopsonist purchases goods and has market power domestically but sells the goods internationally. Therefore, unlike a monopolist, a monopsonist faces a perfectly elastic demand function, D , and its marginal and average revenue would equal the world price, which is the price under perfect competition, P_c . At the same time, a monopsonist faces an upward-sloping supply curve, S . The larger the quantity it wants to buy, the higher the price it must offer.

In the international market the monopsonist is a price-taker, but in the domestic market it is a price-maker. The condition for maximizing profits for a monopsonist is that the marginal revenue from purchasing an additional kilo of cocoa beans should equal its marginal cost. The monopsonist maximizes its total revenue function and finds a position where $MR = MC$, which will determine the quantity of beans, X_m , that the monopsonist will buy and the price, P_m , it will pay producers. First, if the marginal cost of purchasing an extra kilo of beans exceeds its price, the P_m that the monopsonist will pay the producer will be lower than P_c , the price in a competitive market. As both equilibrium quantity and the equilibrium price will be lower than the competitive market outcome, the monopsonist's operations are Pareto-inefficient, and the source of the inefficiency is in the domestic market.

A monopsonist's behavior demonstrates two important features. First, the prices paid and the quantities purchased by the monopsonist will always be lower than in a competitive market. Second, unlike the monopoly situation, government minimum prices, if set correctly, may correct for the inefficiency created by the monopsony. If the government sets the minimum price at or

close to the competitive market level, P_c , the monopsonist will behave as if it purchases the beans at a constant price, which does not depend on the amount of kilos it buys. Therefore, the monopsonist will buy until the value of the marginal product equals P_c , which is X_c , i.e., equal to a competitive market outcome.

As the next step, an oligopsony can be modeled as a group of a few monopsonists engaged in a Cournot-type competition for domestic suppliers.¹⁴ A Cournot-type competition seems a reasonable approach for modeling Côte d'Ivoire's cocoa market as it describes a market structure in which companies compete on the amount of output they produce and exports, set independently and at the same time. All key features of a Cournot-type model seem satisfied by the Côte d'Ivoire's cocoa market:

- there is more than one exporter and all of them export a homogeneous product, i.e. there is no product differentiation;
- exporters do not cooperate, i.e. there is no collusion;
- large exporters have market power, i.e. each firm's decision affects the good's price;
- the number of exporters is fixed for each crop year;
- exporters compete in quantities and choose quantities simultaneously;
- the exporters are economically rational and act strategically, usually seeking to maximize profit given their competitors' decisions.
- finally, the Cournot conjecture seems to hold as each exporter aims to maximize profits based on the expectation that its decision regarding the quantity exported will not have an effect on the decisions of its rivals.

At the same time, weaknesses of a Cournot-based approach are also obvious:

- Cournot assumptions are best suited to circumstances where quantity decisions have to be made in advance. While this might seem plausible for cocoa growers who need to make planting decisions ahead of price discovery, it seems less plausible for cocoa exporters, who presumably are in a position to buy as much or as little as they like, provided they can find willing sellers;
- even if Cournot behavior is appropriate for modeling the market power and optimal export tax in a single crop year, it may not hold up over the medium term when other large producers or all other producers together could adjust their production to undercut Côte d'Ivoire;

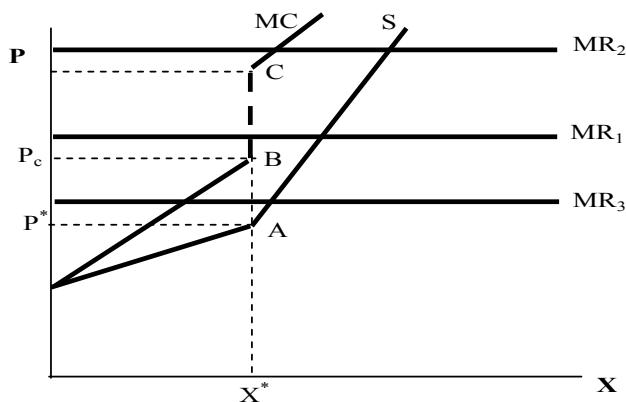
¹⁴ An assumption of a Bertrand-type competition in prices and price discrimination can also be used as possible alternative approaches to modeling the market stricture.

- given the seemingly low entrance costs to becoming an exporter, international exporters than those currently in the market (e.g., from Japan, China, or India) may be in a position to enter Côte d'Ivoire's market if the current incumbents attempt to use their market share to push prices.

Oligopsonists expect to compete for an extended period and therefore engage in tacit collusion. In a market with very few buyers, each oligopsonist is prompted to behave in a way that is helpful to the others. Each buyer sets purchasing prices and quantities so as to maximize its own profits but without undermining the profits of the other buyers, expecting that competitors will return the favor. With this informal market balance, known as tacit collusion, in principle no buyer has an incentive to take steps to change its market share, because if one firm decides to change either purchasing prices or quantities, other firms may interpret this as non-cooperative, and the tacit collusion will erupt into a rough rivalry, to the detriment of all.

Quantities purchased by an oligopsonist may not be responsive to changes in marginal revenue. At the tacit collusion point A , the monopsonist who purchased quantity X^* pays the suppliers price P^* . To the right of A , the supply curve is steep because the oligopsonist thinks that if it tries to purchase more than Q^* or sets prices higher than P^* , its competitors will retaliate. As a result, it will gain very little, if at all. Similarly, every other firm faces a supply curve that is less elastic above the price P^* than below it. To the left of A , the supply curve is flat because the oligopsonist thinks that if it tries to purchase less than Q^* or offers a price lower than P^* , its competitors will not follow its example because there is no incentive, and the oligopsonist will just lose market share. Therefore, the oligopsonist faces a supply curve, S , which may be kinked at the tacit collusion point A (Figure 6).

Figure 6. Oligopsony

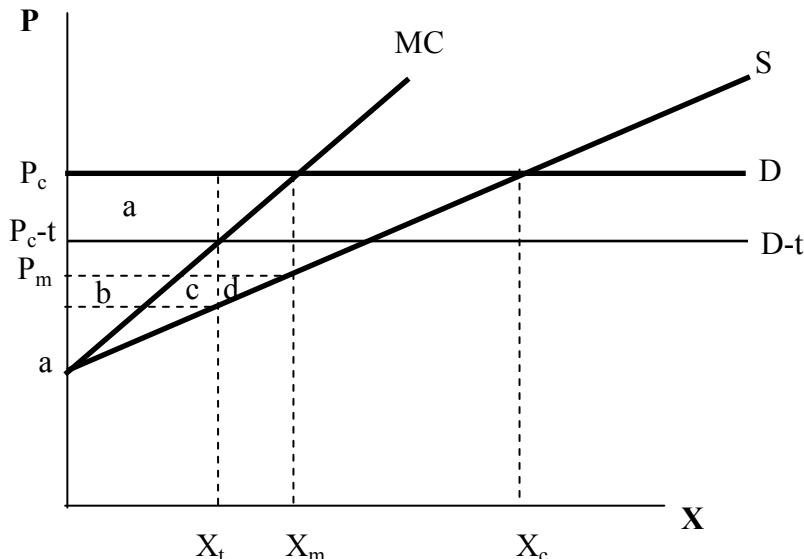


The kink in the supply curve leads to a break in the oligopsonist's marginal cost curve. Several marginal revenue curves can pass through the break between points B and C . One of them, MR_1 , is shown in Figure 7. With the profit maximization condition ($MR = MC$), any marginal revenue curve that falls between A and B will indicate the same profit-maximizing quantity, X^* . Thus, within a certain range the quantity of output an oligopsonist would be willing to buy is not sensitive to changes in its marginal revenue. The monopsonist will be willing to withdraw from the tacit collusion and increase its purchases only if MR promises to surge. This is the case with the MR_2 curve, which cuts the MC curve above C . If MR promises to plunge, the monopsonist will be willing to break the tacit collusion and reduce its purchases. This is the case with the MR_3 curve, which cuts the MC curve below B .

There is a case for the use of export taxes on the hypothesis of an oligopsony. Export taxes are justified not on the grounds of shifting the country's terms of trade in its favor but rather on the need to appropriate part of the oligopsonists' surplus and redistribute it to local producers and consumers.

The government has an option to impose either a specific or an ad valorem tax on the oligopsony. If the government imposes a specific export tax, marginal revenue, equal to the world price, will be reduced by the amount of the tax, t , and the oligopsony will be forced to buy less domestically by the difference between X_m and X_t (Figure 7). The government gets revenue in the amount of the area a , but at the same time domestic producers will lose areas $(b + c + d)$. Assuming that $a > b + c + d$, the country as a whole should gain from the export tax.

Figure 7. Specific Export Tax on an Oligopsonistic Buyer



Suppose a specific tax is levied on the oligopsonist. For this case Deardorff and Rajaraman (2005) provide the following derivation of the optimal export tax: An oligopsonist faces a linear

supply function $p(x) = a + bx$. There is a total of n oligopsonists, each purchasing quantities x and taking into account quantities purchased by other firms, x_{-1} , such that $x_{-1} = (n-1)x$. The oligopsonists carry the cost of $(a + b(x_{-1} + x))x$ from purchasing the product domestically and get revenue $(P_c - t)x$ from selling the product to the world market. Therefore, their challenge is to maximize profit, $\pi = [(P_c - t) - (a + b((n-1)x + x))]x$.

Maximization allows for calculation of the equilibrium quantity and price under oligopsony.

Differentiating the profit function gives $x_0 = \frac{P_c - t - a}{(n+1)b}$. Since there are n oligopsonistic firms,

and taking into account that $X = \frac{P_c - a}{b}$, an oligopsonist will purchase quantity

$X_o = nx_o = \frac{n}{n+1} \left(X_c - \frac{t}{b} \right)$ at the price $P_0 = a + bX_0 = \frac{1}{n+1}a + \frac{n}{n+1}(P_c - t)$. As a result of the tax, the country's welfare will change. The change is a sum of government revenue raised and producer surplus lost. The change in the country's welfare, ΔW , as a result of changing the tax, t , is $\frac{d\Delta W}{dt} = \frac{n}{(n+1)^2} \left[X_c - \frac{(n+2)t}{b} \right]$.

In this model, the specific tax rate depends on the number of buyers and the world price. Setting $\frac{d\Delta W}{dt} = 0$ yields the optimal tax, $t^* = \frac{P_c - a}{n+2}$. The tax approaches zero as the number of oligopsonists approaches infinity. The more competition between buyers, the lower the tax. The world price for the product in the model coincides with its price with perfect competition. The domestic price should be interpreted as the marginal price at which the producers will be ready to supply the first unit of the product.

An ad valorem tax will change the slope of the demand curve and make it less than perfectly elastic. Facing a less than perfectly elastic demand curve is all a country needs to justify an export tax in the oligopsony context. Devarajan et al. (1996) show that there is a strong analytical and practical case for a country with power in a specific export market to use an export tax, based on the presumption that a country with market power faces a less than perfectly elastic demand curve. In this case the optimal welfare-maximizing tax is the inverse of the elasticity of demand. By imposing an export tax a country with market power can improve its terms of trade and overall welfare.

The optimal balance between specific and ad valorem export taxes depends on the specific market. Specific taxes are more appropriate when preserving product quality is of concern and there are negative externalities associated with consumption of the product. Keen (1998) shows that a predominantly ad valorem taxation does more to improve consumer welfare and raise revenue in markets with monopolistic output restrictions and little product heterogeneity. In the

Cournot oligopoly case, however, there appears to be a conflict of preferences: while consumers of taxed goods prefer ad valorem taxation, producers prefer specific taxation because it increases their profits. Inverting the argument, under an oligopsony, buyers should prefer ad valorem taxes and producers should prefer specific taxes. Therefore, both types of taxes may be equally applicable; their optimal combination under oligopsony requires further study.

C. Application to Côte d'Ivoire's Cocoa Exports

The government of Côte d'Ivoire is undertaking comprehensive reform of the cocoa sector. It is streamlining its complex institutional structure, improving governance and transparency, and auditing financial flows through the sector. The goals of these reforms are to define the government's responsibilities for management of the sector, build a viable inter-professional network of stakeholders, increase competition among buyers and the share of world prices obtained by farmers, introduce market-based instruments for risk management, and further promote cocoa transformation and export of finished products.

Tax reform is the critical element of cocoa sector reform. The authorities intend to reduce all taxes to no more than 22 percent of the CIF price, possibly for the 2010 crop season, from the current 30 percent or so. This would help align export taxation in Côte d'Ivoire with international practice. The authorities are drafting the details of these reforms, in close cooperation with their development partners. The exact modalities of the new tax structure will require detailed study and additional information on the cocoa market and price structure.

Meanwhile, the present model allows for a ballpark assessment of the desirable rate of export tax. The model requires three pieces of information: the world price for cocoa, the number of oligopsonistic buyers, and the marginal price at which Ivoirian producers would be willing to supply the first kilo of cocoa beans rather than switch to some other crop. Of the three components, only the world price is known with certainty (in 2001 to 2008, the range was CFAF 800–1,200 per kg). Therefore, the model has to be calibrated to establish the desirable tax range based on various assumptions about the marginal price and the number of oligopsonistic competitors.

Assuming perfect competition, the export tax rate becomes just the inverse of the elasticity of demand. As was shown by the model of perfect competition (paragraphs 28), the optimal export tax depends on the elasticity of the demand curve for exports at each point, which is generally not known. The reasonable span of demand elasticities for primary agricultural commodities is 1 to 5 or even higher (Warr, 2001), which allows for calibrating the model on the hypothesis of perfect competition (Table 6).

For calibration of the model of an oligopsony, marginal prices are needed. Farm-gate prices actually paid can help in assessing the marginal price. Since 2001 the minimum average price paid to farmers per kilo of cocoa beans was CFAF 228, in July 2004; the maximum was

Table 6. Reference Matrix for Export Tax on Cocoa under Perfect Competition

	Elasticity of export demand												
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
Tax rate (percent)	100.0	66.7	50.0	40.0	33.3	28.6	25.0	22.2	20.0	18.2	16.7	15.4	14.3
Export price													
	In FCFA												
800	800	533	400	320	267	229	200	178	160	145	133	123	114
840	840	560	420	336	280	240	210	187	168	153	140	129	120
880	880	587	440	352	293	251	220	196	176	160	147	135	126
920	920	613	460	368	307	263	230	204	184	167	153	142	131
960	960	640	480	384	320	274	240	213	192	175	160	148	137
1,000	1,000	667	500	400	333	286	250	222	200	182	167	154	143
1,040	1,040	693	520	416	347	297	260	231	208	189	173	160	149
1,080	1,080	720	540	432	360	309	270	240	216	196	180	166	154
1,120	1,120	747	560	448	373	320	280	249	224	204	187	172	160
1,160	1,160	773	580	464	387	331	290	258	232	211	193	178	166
1,200	1,200	800	600	480	400	343	300	267	240	218	200	185	171
1,240	1,240	827	620	496	413	354	310	276	248	225	207	191	177
1,280	1,280	853	640	512	427	366	320	284	256	233	213	197	183
1,320	1,320	880	660	528	440	377	330	293	264	240	220	203	189
1,360	1,360	907	680	544	453	389	340	302	272	247	227	209	194
1,400	1,400	933	700	560	467	400	350	311	280	255	233	215	200

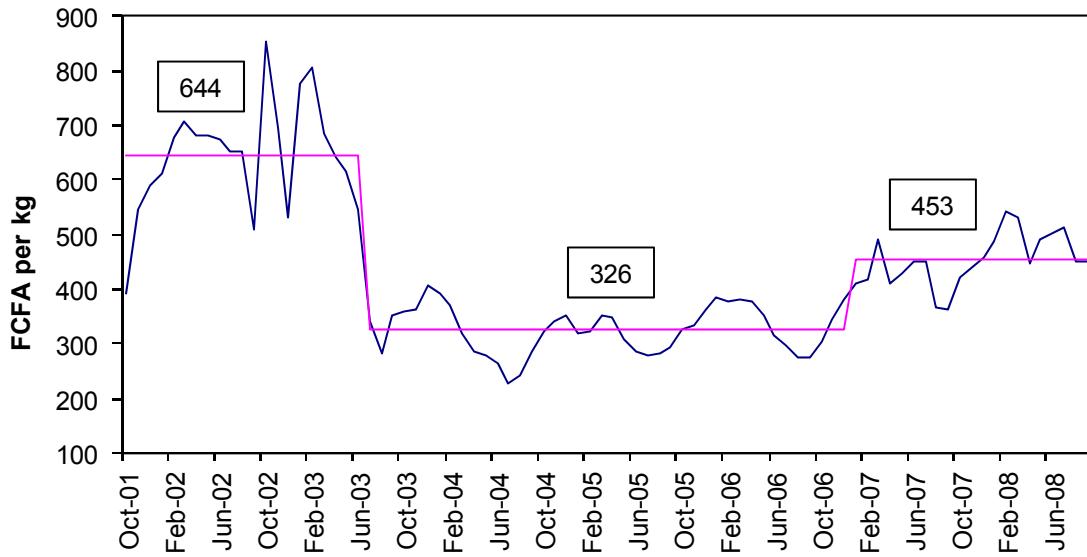
Source: IMF staff estimates.

CFAF 852, in October 2002. In recent history, there have been three clear periods of high, low, and average prices (see Figure 8). It is possible to assume that the minimum marginal price could be somewhat lower than the lowest actual farm-gate price in recent history. Depending on the region of the country and other conditions, it would be in the range of CFAF 150–250 per kg.

The number of oligopsonists depends on their relative market power. There is no conclusive evidence of how many out of some 50 exporters actually control exports of cocoa and Côte d'Ivoire may not fit this model at all. Based on indirect evidence, the number should not exceed 10, and it is likely that only a few largest have real market power. Also, as it was shown in the model of an oligopsony (paragraphs 37–49), the optimal tax rate depends on the number of oligopsonistic buyers. Therefore, the model was calibrated for a number of oligopsonistic buyers between 1 and 10 (Table 7).

Using this model, the optimal tax on cocoa exports should be somewhat lower than the 22 percent targeted by the authorities. Assuming three oligopsonistic buyers, total fiscal and quasi-fiscal levies should be in the range of CFAF 130–190 per kg, or about 16 percent of the world price. In general, the larger the number of buyers, and therefore the closer the market is to perfect competition, the lower the export tax. In the extreme case of a pure monopsony with just one buyer, the tax could be on the order of CFAF 200–300, or 26–27 percent of the world price.

Figure 8. Evolution of Average Farm-Gate Prices



Sources: Bourse du Café et du Cacao, MEMEF/DGE/ DCPE

The numerical results produced by the model are only a crude approximation. First, the model does not incorporate information about the elasticity of export demand for Ivoirian cocoa, the supply elasticities of cocoa from the rest of the world, and the share of Côte d'Ivoire in world cocoa production. This information is usually critical for calculation of the optimal export tax.¹⁵ Second, neither the farmers' marginal prices nor the buyers' power-sharing arrangements can be measured with precision. This would require a detailed market survey, which the Ivoirian authorities intend to prepare in cooperation with development partners. Third, calibration of the model using Côte d'Ivoire's export prices yields slightly different results depending on whether the world price in each season is higher or lower than the Ivoirian export price. Finally, the model does not allow evaluation of the "optimal" export tax or the appropriate combination of ad valorem and specific taxes. It suggests only that, in conditions of oligopsony, the export tax should be positive and proportionate to the strength of the oligopsonistic power.

The simulations do not allow establishing, under which of the two assumptions on the market structure the tax rate should be higher.

- First, the simulations of an optimal tax under both assumptions point in the same direction. The closer the market structure is to perfect competition, the lower the optimal export tax should be. As the number of oligopsonists and the elasticity of export demand approach infinity, the optimal tax under both assumptions approaches zero.

¹⁵ See EU (2005) and Burger (2008) for the derivation of an optimal export tax.

- Second, export demand elasticity for cocoa, as for any primary commodity, can vary greatly from year to year depending on market conditions. In any case, the demand curve should be highly elastic, as the world market can absorb virtually any volume of cocoa produced in Côte d'Ivoire.
- Third, an oligopsonistic market structure may require the use of taxes in addition to the taxes mandated by the optimal tax calculations. Such additional taxation would drive the tax rate above the implicit tax rate under the competitive market assumption. Fourth, the cocoa markets may be highly, but still not perfectly, competitive. The higher the existing market frictions are, the higher the optimal export tax would be.
- Finally, the pricing/purchase decisions of an oligopsonist do not necessarily lead to lower purchases and higher prices, as an oligopsony maximizes its profit, not prices. In the optimum, the welfare maximizing outcome for an oligopsony may find it more profitable to set lower prices and therefore pay lower taxes, so that to achieve a profit-maximizing outcome.

Table 7. Reference Matrix for Export Tax on Cocoa under Oligopsony

World price in FCFA per kg	Marginal price	Number of buyers/exporters									
		1	2	3	4	5	6	7	8	9	10
800	100	233	175	140	117	100	88	78	70	64	58
840	120	240	180	144	120	103	90	80	72	65	60
880	140	247	185	148	123	106	93	82	74	67	62
920	160	253	190	152	127	109	95	84	76	69	63
960	180	260	195	156	130	111	98	87	78	71	65
1,000	200	267	200	160	133	114	100	89	80	73	67
1,040	220	273	205	164	137	117	103	91	82	75	68
1,080	240	280	210	168	140	120	105	93	84	76	70
1,120	260	287	215	172	143	123	108	96	86	78	72
1,160	280	293	220	176	147	126	110	98	88	80	73
1,200	300	300	225	180	150	129	113	100	90	82	75

World price in FCFA per kg	Marginal price	In percent of world price									
		1	2	3	4	5	6	7	8	9	10
800	100	29.2	21.9	17.5	14.6	12.5	10.9	9.7	8.8	8.0	7.3
840	120	28.6	21.4	17.1	14.3	12.2	10.7	9.5	8.6	7.8	7.1
880	140	28.0	21.0	16.8	14.0	12.0	10.5	9.3	8.4	7.6	7.0
920	160	27.5	20.7	16.5	13.8	11.8	10.3	9.2	8.3	7.5	6.9
960	180	27.1	20.3	16.3	13.5	11.6	10.2	9.0	8.1	7.4	6.8
1,000	200	26.7	20.0	16.0	13.3	11.4	10.0	8.9	8.0	7.3	6.7
1,040	220	26.3	19.7	15.8	13.1	11.3	9.9	8.8	7.9	7.2	6.6
1,080	240	25.9	19.4	15.6	13.0	11.1	9.7	8.6	7.8	7.1	6.5
1,120	260	25.6	19.2	15.4	12.8	11.0	9.6	8.5	7.7	7.0	6.4
1,160	280	25.3	19.0	15.2	12.6	10.8	9.5	8.4	7.6	6.9	6.3
1,200	300	25.0	18.8	15.0	12.5	10.7	9.4	8.3	7.5	6.8	6.3

Source: IMF staff estimates.

IV. CONCLUSIONS

This paper attempted to sketch possible approaches to modeling the export tariff for a large country on the hypotheses of perfectly competitive and oligopsonistic market structures. It did not attempt to draw any conclusion on the actual market structure in Côte d'Ivoire and used the Ivoirian cocoa sector only as an illustration of application of the methodologies for calculating the export tax. More research is needed to reach a conclusion on the existence of either a perfectly competitive or oligopsonistic cocoa market structure. Moreover, the actual market structure probably represents a complex combination of both.

Whatever the hypothesis about market structure, there is a case for the use of an export tax by the exporter only if its welfare gains exceed welfare losses, whereas its trading partners will always suffer losses. A large country that is in a position to exercise power on the world market for a particular commodity and influence its international price can use an export tax to alter the terms

of trade in its favor. With exports restricted by an export tax, international prices will rise, which would benefit the producers of the commodity in the exporting country and increase government revenue, but would have a cost for consumers and create market inefficiency. In addition, the administration of an export tax would have an additional cost, which would have to be deducted from additional government revenue generated by the exports tax and the improved terms of trade. The ultimate impact on the country's welfare depends on whether the positive impact on producers and the government can offset the losses of consumers. That is clearly true for cocoa exports from Côte d'Ivoire, where only 3 percent of the cocoa it produces is consumed domestically.

From the perspective of global welfare, an export tax is inferior to a free trade policy. It can be expected to bring net benefits to an exporting country that enjoys substantial market pricing power in a commodity that has no direct substitutes and if the resulting welfares losses do not exceed the benefits brought by improvement in its terms of trade. But even if a large country gets a net welfare gain, it will be achieved at the expense of its trading partners, so an export tax will be globally welfare-reducing. In a multilateral context, it might be argued that large countries are generally expected to conduct trade policies that do not harm their partners.

The rate of an export tax depends not only on the actual market structure but on other parameters that are largely unknown. Where competition is perfect, the optimal export tax is an inverse of the elasticity of export demand for the commodity. In the case of Côte d'Ivoire this ratio can fluctuate from year to year, making it hard to establish with any precision. Where there is an oligopsony, the optimal tax rate depends on the number of oligopsonistic exporters, which also cannot be established with any degree of certainty because the degree of buyers' market concentration changes each year, with the number of significant exporters changing every crop season.

Within the partial equilibrium framework used in this paper, the optimal tax rate can be estimated only as a reasonable range. The tax rate depends on the estimated export demand elasticity and the number of exporters. Obviously, the higher the competition in the export sector, the lower the tax rate should be. It would virtually converge to zero as the elasticity of export demand and the number of exporters approach infinity.

In either case a low ad valorem export tax seems preferable. As a general principle, for society at large an export tax creates deadweight losses, whose distribution among producers, consumers, and the government depends heavily on supply and demand elasticities, which are unknown, and the tax rate. The challenge for the government is twofold: (a) set an export tax at a rate that would allow local producers to receive a larger proportion of international prices, and therefore invest and produce more, while preserving the viability of public finance and government revenue; (b) set the tax in a way that would allow for full pass-through of trends in international prices to local producers. A relatively low single ad valorem tax would address both challenges.

V. REFERENCES

- Bandyopadhyay, Subhayu, 1996. "Growth, Welfare and Optimal Trade Taxes: A Fallacy of Composition," *Journal of Development Economics*, Vol. 50, No. 2, pp. 369–80.
- Bourse du Café et du Cacao, *Structure des coûts dans la formation du prix bord champ*. Available via the Internet: http://www.bcc.ci/cout_ind.asp.
- Burger, Kees, 2008, "Optimal Export Taxes – The Case of Cocoa in Côte d'Ivoire," paper prepared for presentation at the European Association of Agricultural Economists Seminar "Modeling of Agricultural and Rural Development Policies," Seville, Spain.
- Clarkson, K. W., and R. L. Miller, 1982, *Industrial Organization* (New York: McGraw Hill).
- International Cocoa Organization, 2007, *Cocoa Resources in Consuming Countries*, MC/10/6. Available via the Internet : <http://www.icco.org/Attachment.aspx?id=vq346062>.
- Comité de Gestion de la Filière Café Cacao (CGFCC). Reports:
- Analyse de la commercialisation du cacao et du café au 31 juillet 2009 (1)
 - Suivi de la commercialisation du cacao et du café au 27 aout 2009 (2)
 - Mémorandum parafiscalité campagne 2009/10 (3)
- Corden, W. Max, 1974, *Trade Policy and Economic Welfare* (Oxford: Clarendon Press).
- Deardorff, Alan V., and Indira Rajaraman, 2005, "Can Export Taxation Counter Monopsony Power? Research Seminar in International Economics," Discussion Paper No. 541 (Ann Arbor: University of Michigan Press).
- Denicolo, Vincenzo, and Massimo Matteuzzi, 2000, "Specific and Ad Valorem Taxation in Asymmetric Cournot Oligopolies," *Journal of International Tax and Public Finance*, Vol. 7, No. 3, pp. 335–42.
- Devarajan, Shantayanan , Delfin S. Go, Maurice Schiff, and Sethaput Suthiwart-Narueput, 1996, "The Whys and Why Nots of Export Taxation," World Bank Policy Research Working Paper No. 1684 (Washington: World Bank).
- Edwards, Geoff W., and Jan P. Voon, 1997, "The Calculation of Research Benefits with Linear and Nonlinear Specifications of Demand and Supply," *American Journal of Agricultural Economics*, Vol. 79, No. 4, pp. 1368–71.
- European Union, 2005, "Etude des Prélèvements sur la Filière Café et Cacao en Côte d'Ivoire Contrat Cadre MS/451 – LOT N° 11 N° Nagel-3/2003-ACP-DCE en Côte d'Ivoire (Amsterdam: Nederlands).
- Federation of Cocoa Commerce, "An Overview of Cocoa Production in Côte d'Ivoire and Ghana." Available via the Internet: <http://www.cocoafederation.com>

- Gilbert, Christopher and Eric Tollens, 2003, "Does Market Liberalization Jeopardize Export Quality? Cameroonian Cocoa, 1988–2000," *Journal of African Economies*, Vol. 12, No. 3, pp. 303–42.
- ICCO, 1993, *The world cocoa market: An analysis of recent trends and of prospects to the year 2000* (London: ICCO).
- International Cocoa Organization, 2006, "Study on the Impact of the Terminal Markets on Cocoa Bean Prices," MC/7/5/Rev.1.
- Kerr, William A, and James D. Gaisford, 2007, *Handbook on International Trade Policy* (NY: Edward Elgar Publishing).
- Jehle, Geoffrey A., and Philip J. Reny, 2000, *Advanced Microeconomic Theory* (NY: Addison Wesley).
- Keen, Michael, 1998, "The Balance between Specific and Ad Valorem Taxation," *Fiscal Studies*, Vol. 19, No. 1, pp. 1–37.
- Krugman, P., and E. Helpman, 1989, *Trade Policy and Market Structure* (Cambridge: MIT Press).
- Krugman, P., and R. Well, 2005, *Microeconomics* (New York: Worth Publishers).
- LMC Commodity Bulletins, December 2008–February 2009.
- McIntire, John, and Panos Varangis, 1999, "Reforming Côte d'Ivoire's Cocoa Marketing and Pricing System," World Bank Policy Research Working Paper 2081 (Washington: World Bank).
- Melhado Oscar, 2007, "Optimal Taxation in the Forestry Sector in the Congo Basin: The Case of Gabon," IMF Working Paper 07/253 (Washington: International Monetary Fund).
- Piermartini, Roberta, 2004, "The Role of Export Taxes in the Field of Primary Commodities," WTO Discussion Paper (Geneva: World Trade Organization).
- Scherer, Frederic, and David Ross, 1992, *Industrial Market Structure and Economic Performance* (Chicago: Rand McNally).
- Shepherd, William G., and Joanna Mehlhop Shepherd, 1989, *The Economics of Industrial Organization* (Long Grove: Waveland Press).
- Syropoulos, C., 2002, "Optimum Tariffs and Retaliation Revisited: How Country Size Matters," *Review of Economic Studies*, Vol. 69, No. 3, pp. 707–27.

Tirole, Jean, 1988, *The Theory of Industrial Organization* (Cambridge: MIT Press).

Oxfam International, 2009, *Towards a Sustainable Cocoa Chain*. Available via the Internet:
http://www.oxfam.org.uk/resources/policy/trade/downloads/research_sustainable_cocoa_chain.pdf

Trivedi Pravin K., and Takamasa Akiyama, 1992, “A Framework for Evaluating the Impact of Pricing Policies for Cocoa and Coffee in Côte d'Ivoire,” *World Bank Economic Review* Volume 6, Number 2, pp. 307–30.

Varian, Hal, 2003, *Intermediate Microeconomics: A Modern Approach* (NY: W.W.Norton)

Yilmaz, K., 1999, “Optimal Export Taxes in a Multicountry Framework,” *Development Economics*, Vol. 60, pp. 439–65.

Warr, P., 2003, “Welfare effects of an export tax: Thailand’s rice premium,” *American Journal of Agricultural Economics*, Vol. 83(4), pp. 903–20.