Future Agricultures

Not Ready for Analysis? A Critical Review of NRA Estimations for Cotton and other Export Cash Crops in Africa

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1. Introduction

The "Distortions to Agricultural Incentives" (DAI) project is a major study undertaken for the World Bank to track trends in taxation of, or support to, the agriculture sector across countries and regions over the past few decades. It thus updates earlier work by Krueger et.al. (1988), who had reported widespread and heavy taxation of agriculture in developing countries. The DAI project shows that, in the intervening period, taxation of agriculture has given way to subsidy in much of Asia and Latin America, whilst in Africa average levels of agricultural taxation fell during the structural adjustment period.

In much the same way as Bates (1981) sought to explain prevailing high taxation of African agriculture in terms of domestic political economy factors, attention is now switching to understanding the political economy determinants of more recent taxation patterns (see, for example, Bates and Block 2009). This is a very worthwhile endeavour, as is the entire DAI project. However, before political economy theorising proceeds too far, this paper provides a salutary check on some of the underlying numbers that have been presented for explanation.

This paper discusses the estimation methods used in Anderson and Masters (2009) to calculate nominal rates of assistance (NRAs) for cotton and other traditional export cash crops in sub-Saharan Africa (SSA) and offers alternative estimates for cotton for a sub-set of countries, on the basis of a standardised approach, alternative data sources and correcting some basic but important errors concerning processing ratios.

Traditional export cash crops are interesting for two reasons. Firstly, according to Anderson and Masters (2009, p21) agricultural NRAs in Africa are now (still) "most negative for tropical cash crops such as coffee, cotton, cocoa, and tobacco." Secondly, from a political economy perspective, traditional export cash crops are often associated with particular production regions and ethnic groups. Thus, taxation of these crops may provide insights into how decision-makers behave towards members of their and other ethnic groups (Bates and Block 2009, Kasara 2007): what do they have to offer to whom in order to obtain and retain power?

Sixteen African country studies were undertaken for the DAI project, in addition to which one paper by John Baffes calculates NRA estimates for eight cotton sectors of West and Central Africa (WCA), five of which are countries that do not otherwise feature in the DAI database. This paper draws on the country data spreadsheets and background papers that are downloadable from the project website: http://go.worldbank.org/5XY7A7LH40. It focuses exclusively on direct agricultural distortions and abstracts from indirect agricultural assistance/taxation via non-agricultural distortions, except through distortions to the exchange rate.

Our calculations reaffirm the basic finding of Anderson and Masters (2009) that the extent of agricultural taxation has fallen significantly since structural adjustment. However, our estimates suggest much lower levels of taxation than those displayed in Anderson and Masters (2009) both pre-reform in some countries and post-reform in most of them. As a result, we both 1) argue that the detailed pattern of NRAs for export cash crops that political economy analysis needs to explain is rather different from that currently presented by the DAI project and 2) question the general assertion that such crops are taxed more heavily than average in Africa.

The DAI project is hugely ambitious both in its coverage of countries and crops and in the time period for which it seeks to generate estimates. The construction of reliable NRA estimates for a period of several decades requires

not just detailed data, but also in depth knowledge of the relevant sectors over that period. In the African context, where data is often missing or of poor quality, generating reliable estimates requires a critical assessment of available data and/or the estimation of a number of parameters, for which the information is not readily available in the literature. This paper suggests that more work is required to validate NRA estimates for traditional export cash crops in Africa before detailed work is undertaken to explain variations in observed taxation.

The remainder of this paper is organized as follows. In section two, we outline the objective of the NRA estimates. In section three, we illustrate what NRA attempt to capture – or not – looking at the cotton sector. In section four, we describe how NRA estimates proceed in practice and contrast the different estimation approaches and underlying principles. In sections five and six, we outline issues with current cotton NRA estimation in the DAI project and discuss alternative estimates for a sub-set of countries. In section seven, we investigate whether the issues identified with NRA estimates for cotton also apply to other cash-crops. Section eight concludes on the implications of this critical review of NRAs for African cash-crops.

2. Objective of the NRA estimates
The purpose of the DAI project is to estimate the extent to which governments have distorted incentives for farmers to produce different agricultural products. Thus:

"The nominal rate of assistance is defined as the percentage by which government policies have raised gross returns to *farmers* above what they would have been without the government's intervention" (Anderson and Masters eds 2009, p11; emphasis added).

"The focus is on those border and domestic measures that arise exclusively from government actions, that, as such, may be altered by a political decision, and that have an immediate effect on consumer choices, producer resource allocations, and net farm incomes" (Anderson and Masters eds 2009, p507)

State intervention can impact a farmer's gross returns through three broad channels: (i) direct taxes and subsidies at various levels, e.g. export or import tax/subsidy on the processed product or local tax/subsidy on the primary product; (ii) indirect taxes or subsidies resulting from administrative pricing and/or excessive post-harvest margins, where these are due to the inefficiency of state enterprises and (iii) exchange rate distortions. NRAs aim to capture all three, when relevant.

3. The cotton story
In the case of cotton, the three state intervention channels listed above have all mattered historically. All African producing countries have, at some point in time since the 1960s, administratively fixed prices and intervened directly in ginning, that is, the transformation of seed cotton into cotton lint (Delpeuch and Leblois, 2011). In addition, in a number of countries, particularly in Eastern and Southern Africa (ESA), exchange rates have been significantly distorted.

In ex-French WCA colonies, indirect distortions still affect markets as single-channel marketing systems have at most been marginally/gradually reformed: some national monopolies remain (either state-controlled or privatised), some have been turned into concession systems (regional monopolies), and in those sectors where multiple players have been allowed, heavy regulation still prevents direct

competition for seed cotton purchase or pricing (Delpeuch and Leblois, 2011).

Elsewhere, in contrast, direct state control was largely eliminated by the mid-1990s. Reforms have however led to wide variation in industry structures (Tschirley et al., 2009). Distinctive features of cotton sectors in Africa - chiefly the interlocking of input and output markets resulting from the need for costly inputs and the lack of both contract enforcement institutions and rural credit access - mean that the performance of the sector is affected by a competition-coordination trade-off (Poulton et al., 2004; Tschirley et al., 2009). This trade-off results mainly from the fact that the greater competition is, the more difficult it becomes to enforce input-credit contracts and thus the more the sustainability of input-credit schemes is likely to be challenged.

The different sector structures observed post-liberalisation represent different responses to this trade-off, mixed with elements of historical path dependence. Thus, even post-reform, it can be state policy or public/private regulatory bodies that maintain monopolistic or oligopolistic sector structures, with both direct and indirect consequences for seed cotton pricing (e.g., lack of competition in purchase price for primary products from farmers and X-inefficiency in marketing margins respectively).

Two modest but worthwhile reflections on NRAs flow from this brief outline of the cotton case. Firstly, Anderson and Masters (2008 p3) emphasise that "getting markets right requires a focus not only on incentives but also on institutions and infrastructure" and the cotton case neatly illustrates this. Indeed, both Poulton et al. (2004) and Tschirley et al. (2009) find that concentrated and/or monopoly cotton systems generally outperform competitive ones in terms of farmer returns, as the higher yields that can be achieved when input credit and extension advice are readily available commonly outweigh the loss in pricing performance that comes from reduced competition in a sector.

Secondly, the distinction between state intervention that impacts farmer returns through depressed seed cotton pricing and private monopoly that has the same effect is not always clear cut. In Mozambique, for example, ginners operate in a local monopsony system by law. In addition, state representatives are party to the annual negotiations regarding seed cotton price setting. Poulton et.al. (2004) and Tschirley et.al. (2009) both find farmer returns in Mozambique to be the lowest amongst their sampled countries and attribute this poor performance to the weak regulation of the chosen concession model. Is this a case of private monopoly power depressing farmer returns or a policy choice that could be "altered by a political decision"? We return to this issue below.

4. Operationalisation of NRAs in the DAI project
General approach
The key idea behind NRAs is to compare the actual price of a good, which reflects the impact of policy "distortions", with an estimated "undistorted" price for the same product. NRAs can thus be calculated at different levels of the supply chain and may vary along the chain depending on how and where policy "distortions" exert their influence. Ultimately, however, the primary interest of both this paper and the DAI project is to estimate the overall effect of policy distortions on farmers. In practice the African background papers and data spreadsheets of the DAI project achieve this in at least three different ways, depending on data availability and the nature of the product in question. Each approach has its advantages, but also important disadvantages that need to be recognised.

The conventional place to look for a reference price for a product that is "undistorted" by domestic (including border) policy measures is the international market[1]. As products traded at this level generally embody a degree of processing, the central comparison in NRA calculations is thus between the so-called "undistorted international price – processed product" (P_{ip}), derived from the world market, and the so-called "wholesale price for the processed goods" (P_{up}) pertaining in the domestic market.

The estimation of P_{ip} is not specific to any of the approaches below, but rather depends on data availability. Thus, we discuss it briefly here. We focus on export commodities, as these are the main focus of the paper, although in some of the specific examples discussed below the good in question has only irregularly been exported. When an f.o.b. export price series, denominated in foreign currency terms and reflecting the prices actually received by exporters, was available to DAI researchers, the P_{ip} that they use is this f.o.b. price converted to domestic currency using the so-called estimated "equilibrium exchange rate which would prevail in an undistorted market" (E). When compared to the exchange rate actually used by exporters, E aims to capture the impact of foreign currency restrictions, generally imposed to sustain an artificially overvalued exchange rate, on the profitability of domestic producers of tradable goods[2]. When the actual f.o.b. prices received were not available, the P_{ip} is estimated on the basis of an international reference price (for example, the Cotlook A index for cotton lint), adjusted as best as possible for both quality differences and for "international trading costs for exports" (i.e. a c.i.f. to f.o.b. margin), where appropriate. As before, the resulting figure is converted to local currency using E.

We now turn to the three approaches used in practice to estimate the overall effect of policy distortions on farmers. These differ in how P_{up} is derived and how this is linked to the price received by farmers.

Approach 1: Work backwards from the actual price for the processed good

The first approach is to calculate the rate of distortion at the processed-good level and then to adjust for additional sources of distortion as one moves backward along the supply chain to farm-level. This requires the availability of a price series that directly captures the price that processors could obtain for their products in local currency terms, i.e. P_{up}. Logically, such series are more likely to be available for import-competing products, or for products for which there is a strong local market as well as export opportunities[3], than for products that are largely or exclusively exported. However, some examples are found amongst traditional export commodities in the African studies in the DAI database. For example, in cotton this could be the price at which ginners sell their lint to a local spinning industry.

The NRA for the processed good (NRA_p) is then calculated as follows:
$$NRA_p = (1 + s_p) * P_{up}/P_{ip} - 1$$
Where s_p = "taxes or subsidies on the processed good ($s_p < 0$ if a tax)".

Anderson et.al. (2008) argue that this already captures the impact of what are, from a global perspective, the main distortions ultimately affecting farmgate prices, i.e. border measures (tariffs, export taxes) and exchange rate distortions. However, some work is still required to translate this into an NRA at farm level.

To obtain farm-level distortions, several additional factors are considered:

• Firstly, analysts have to assess the extent to which distortions at processing level are

passed back to farmers through pricing processes within the supply chain. In the DAI database this is captured by two 'transmission factors', one (θ) capturing transmission of distortions from processed product level to primary product level and another (θ_f) capturing transmission from primary product level to farm-gate level;

- Secondly, any local-level taxes (s_f, where $s_f < 0$ if a tax) and consumer subsidies (c_c) on the primary good have to be taken into account. Local-level taxes have increased in Africa as decentralised local government authorities have sought to broaden their revenue base. By contrast, we are not aware of any consumer subsidies on primary products in the sectors discussed in this paper. Once again, the full burden of such taxes (or subsidies) may not be passed onto producers by the traders on whom they are first levied, so analysts also have to consider a coefficient for the "proportion of distortions in primary sector accruing to farmers" (λ_f)[4].

The NRA at farm-gate level (NRA_f) is thus calculated as follows:

$NRA_f = (1 + \lambda_f * ((1 + s_f) * (1 - c_c) - 1)) * (1 + \theta_f * NRA_{primary}) - 1$

In which $NRA_{primary} = \theta * NRA_p$

Data permitting, this is the preferred approach for calculating farm level NRAs within the DAI project (Anderson et.al. 2008). It captures the effects of direct taxation/subsidization as well as exchange rate distortions, whilst the impact of private market imperfections is strictly limited to the extent to which policy distortions that bear on downstream actors in the supply chain are passed upstream to farmers.

On the other hand, for the purposes of this paper, it suffers from two significant disadvantages:

- The first, as already noted, is that suitable price series for P_{up} are often not available for traditional export crops in Africa. The majority of these products are exported, often in semi-processed form, with the domestic market remaining small. Since liberalisation, many have been processed and exported by vertically integrated agribusinesses, such that price data immediately after initial processing within the country of origin are not known.

- The second is the issue of transmission coefficients. The basis for choosing these coefficients is not clear. Anderson and Masters (2009, p17) admit that, "To estimate the NRA for a typical farmer, authors of the country studies *estimated or guessed* the extent of pass-through back to the farmgate" (emphasis added). In practice, for the cotton cases, these coefficients are often set to 1. However, where more precise estimates are used, varying across time in some cases, the basis for these estimates is not provided[5]. In addition, pre-liberalisation, a transmission coefficient cannot adequately capture effects of indirect taxation/subsidisation due to either administrative farm-gate pricing[6] or excessive post-harvest margins due to inefficiency of state enterprises. The basis for choosing the coefficient for the proportion of distortions in primary sector accruing to farmers is similarly unclear.

Approach 2: Estimate P_{up} based on farmgate prices

The second approach, which is carefully explained and illustrated by Baffes (2007), starts from the producer price for the primary good and uses available data on technical parameters and costs within the marketing chain to estimate P_{up}, as follows:

$P_{up} = (P_f * (1 + m_1))/GoR * (1 + m_2)$

where:

P_f = farm-gate selling price for the primary good (i.e. producer price)

m_1 = "efficient" margin for transportation and handling to move primary good from point of purchase to processing facility (expressed as share of producer price)

GoR = processing conversion factor – in the case of cotton, the ginning out-turn ratio

m_2 = "efficient" margin for processing plus transportation to port and associated port charges (expressed as share of "into factory" price of one processed unit equivalent of primary product). Then, as P_{up} is directly derived from the producer price, $NRA_f = P_{up}/P_{ip}-1$

Within this approach, the level of taxation is effectively a residual figure ($P_{ip} - P_{up}$). Under different circumstances, this is both a strength and a weakness.

Pre-liberalisation, this approach neatly captures the impacts of indirect taxation/subsidisation resulting from both administrative farm-gate pricing and excessive post-harvest margins. As only "efficient" margins are incorporated into P_{up}, if margins have in practice exceeded these, depressing producer prices in the process[7], then this will show up in a lowered NRA. Additional advantages of the approach include the fact that:

- It eliminates the need to estimate transmission coefficients or the proportion of distortions in primary sector accruing to farmers;
- Seed cotton prices and ginning out-turn ratio data are readily available;
- Data on actual amounts of local-level taxes paid are not required, as their impact is observed indirectly through seed cotton pricing.

On the other hand, the disadvantages are that:

- This approach requires the estimation of "efficient" margins for both processing and transportation functions, stripped of X-inefficiency. This requires plenty of secondary data and insight into processing operations. Moreover,

as Appendix 1 shows, even within a given country, "efficient" margins can vary over time with changes in capacity utilisation driven by factors (such as rainfall) beyond the control of individual companies.

- Post-liberalisation, in a monopolistic or oligopolistic sector, the NRA calculation will incorporate both effects of government policy and impacts of private market imperfections on producer pricing[8].

How serious this latter issue is is open to debate. If the objective of NRA analysis is to compare the impact of the "whole package" of state policy on farmers over time, then including the impacts of post-liberalisation private monopoly alongside pre-liberalisation state monopoly is entirely reasonable. We have already noted, in the Cotton Story section, that state regulatory policy may accept a degree of private monopoly or oligopoly and, therefore, that the burden imposed on farmers will depend at least in part on the effectiveness of the regulator in counter-acting the impact of that power on pricing. We may also note that several of the export cash crops discussed in this paper require significant processing investment, which may make producers more susceptible to agribusiness market power than is the case in, for example, most staple food crop systems in Africa. A policy of market liberalisation cannot simply wish such realities away. On the other hand, if NRA estimates are used as indicators for policy economy analysis into the drivers of agricultural policy, then it is important to distinguish taxation as a direct result of state policy from price distortions due to private monopoly. However, from a political economy perspective, it may be equally important to distinguish taxation as a result of exchange rate overvaluation from taxation that is specific to a particular sector, so again the argument for singling out

private monopoly as a problem for NRA estimates can be overdone.

Overall, comparing across approaches 1 and 2, we note that approach 1 may underestimate distortions pre-liberalisation, due to the difficulties of capturing the impacts of administrative pricing through a transmission factor. By contrast, approach 2 may overestimate post-liberalisation distortions that are attributable directly to state policy by also incorporating impacts of private market imperfections. In other words, both could be argued to underestimate the impact of liberalisation reforms on price incentives to farmers.

Approach 3: Primary products
Approaches 1 and 2 both grapple with the challenges posed by agricultural goods that are bought from farmers as an unprocessed (primary) product but traded as processed products. By contrast, a number of goods are classed by DAI authors as being traded essentially as primary products. In such cases, the NRA at farmgate can be calculated as follows:

$$NRA_f = (1 + s_f) * (1 + \theta_f * (P_u / P_i - 1)) - 1$$

where P_u is the "wholesale price for the primary good" and P_i the "undistorted international price – primary product".

As can be seen, this is essentially a simplified version of Approach 1, hence raising the same issues concerning transmission factors (albeit just one in this case) and local taxes.

Above we argued that a major constraint to the application of Approach 1 to traditional export crops is the availability of suitable price series for P_{up}. The same constraint – lack of available price series for P_u – also applies to goods being traded as primary products. In practice, therefore, DAI authors often have to construct such series from available data on producer (farmgate) prices. In other words, a primary products version of Approach 2 is used.

Tobacco in Zimbabwe is a case where relatively few costs have to be incurred to get from producer price to P_u. Historically, in Zimbabwe, commercial farmers delivered their own tobacco leaf to national auctions floors, where it was purchased directly by exporters. Thus, a more or less direct comparison between the domestic currency prices received by producers at auction and the observed foreign currency prices for Zimbabwean tobacco (converted using the "equilibrium exchange rate which would prevail in an undistorted market") might be expected to give the NRA. Yet, even in an apparently simple case such as this, value addition along the supply chain may incur additional costs. For example:

- Even in the absence of "processing", the product as purchased from producers may have a higher moisture content (i.e. weigh more) than that which is eventually exported;
- Even where producers deliver directly to the point of sale to exporters, there will be transport and port costs associated with moving it from there to the ship. Where products are instead sourced from smallholders (by exporters or their agents), these costs become much larger still;
- Exporters may perform additional sorting and other value adding quality control measures before shipping the products that they have purchased. Thus, Poulton et.al. (2007, p5) report that quality control by international tobacco buyers in Malawi has involved "the construction of warehouse facilities at which tobacco leaf may be subjected to further grading after purchase and is then trimmed (removing stems and tips) so that cigarette manufacturers can feed it straight into their machines when they receive it".

The danger then is that the designation "primary" product may lull analysts into complacency, causing them to overlook costs that should be included in P_u. The consequence of this is that NRAs may be over-estimated.

5. Critique of NRA Estimates for Cotton

NRAs for cotton are estimated for 13 SSA countries: Benin, Burkina, Chad, Cote d'Ivoire, Mali, Mozambique, Nigeria, Sudan, Tanzania, Togo, Uganda, Zambia and Zimbabwe. We have two main concerns with the NRA figures reported for cotton. The first is that the calculations include a mix of the approaches described above, with Egypt, Mozambique, Nigeria and Uganda using approach 1, whilst the remainder using approach 2. As mentioned above, the choice of approach influences the nature of distortions captured in NRAs. In a comparative perspective, using a mix of approaches is thus problematic.

The second, and more important, is that in some cases[9] either NRAs are based on unreliable data or key parameters are left out of the formulae. Some of the more striking examples are listed below. (Others are illustrated in detail in Appendix 1).

- For some countries the f.o.b. export price figures used for estimating the P_{ip} fluctuate considerably over time when compared with the A-index (the f.o.b. price for Zimbabwe for example varies between 66 and 173% of the A-index). This is implausible.

- In some countries the quoted ginning out-turn ratios vary considerably from year to year, too. This is also implausible, as the ginning out-turn ratio is a technical parameter that, for a given seed cotton variety[10] and ginning technology, varies by at most 2% points over time as a result of climatic and management factors.

- Most critically, the estimation of P_{up} based on the producer price (i.e. approach 2) is flawed for three countries (Tanzania, Zambia and Zimbabwe) as a result of the non-inclusion of the GoR and/or problems with the assumed processing margin.

- There are also problems with the data for P_{up} in calculations using approach 1. Indeed, in estimates for Nigeria and Egypt, the farm-gate price for seed cotton divided by the GoR is found to be smaller than the supposed P_{up}. This implies either that the data is flawed or that processors were being subsidized so as to deliver cheap lint to domestic spinning industries. Either way, it results in an over-estimate – at times a major one! - of taxation at farm-gate level.

Finally, we also note that cotton lint is only one product (albeit by far the most important in terms of value) that is derived from the ginning process. The other is cottonseed, which is commonly sold to local oil companies for crushing to produce cooking oil (with cake for livestock feed a further by-product of the milling process). In practice, the level of development of the domestic cottonseed market varies from country to country (Tschirley et.al. 2009), with Zimbabwe being the only African country for which a cottonseed price series is available on FAOSTAT. Furthermore, biofuel-related increases in the international prices of edible oils post-date the most recent period (2000-04) for which NRAs have so far been calculated. Nevertheless, it should still be noted that, by ignoring the revenues from cottonseed sales, all the cotton NRAs tend to underestimate taxation to some degree.

6. Alternative NRA Estimates

With the above findings in mind, we calculated alternative NRA estimates for cotton for five ESA countries for which we had the necessary expertise and data[11]. We use approach 2 for all five countries. For Uganda, this requires that we update the producer price series (identified as flawed by the authors and thus disregarded in the calculations using approach 1). In addition:

- We re-estimate P_{up} for all countries using the GoR and post-farm gate margins (m) estimated using data from Tschirley et.al. (2009). In the case of Tanzania, the farm-gate price is also corrected (see Appendix 1). These estimates are based on data collected for Tschirley et al. (2009).
- We also re-estimate P_{ip} using the A-index price (c.i.f. North Europe)[12], an estimated c.i.f. to f.o.b. margin of 6 percent of the c.i.f. price and country-specific quality premia reported in Tschirley et al. (2009). The rationale for having a constant c.i.f. to f.o.b. margin in percentage terms is that the decline in the A-index has been of a similar magnitude to that of international shipping costs over recent decades.
- For Zimbabwe, we incorporate the value of cottonseed as well as lint into P_{ip}.

To illustrate our approach and provide an idea of the magnitude of the changes brought about by the different corrections operated, Appendix 1 provides a detailed step-by-step illustration of our re-estimation of NRA figures for Tanzania[13].

Table 1 displays both the original NRA figures reported in Anderson and Masters (2009) and our alternative estimates. For Tanzania, Zambia and Zimbabwe the estimated rates of taxation

Table 1. Original and Revised NRA figures:							
Tanzania		1976-79	1980-84	1985-89	1990-94	1995-99	2000-04
Original NRA		-0.83	-0.87	-0.84	-0.85	-0.73	-0.70
Our estimation		-0.56	-0.59	-0.50	-0.51	-0.22	-0.13
Zimbabwe	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Original NRA	-0.35	-0.45	-0.42	-0.38	-0.46	-0.36	-0.63
Our estimation	-0.28	-0.39	-0.22	-0.18	-0.25	-0.02	-0.27
Zambia		1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Original NRA		-0.40	-0.38	-0.77	-0.35	-0.27	-0.51
Our estimation		-0.16	-0.09	-0.70	-0.20	-0.01	-0.21
Mozambique		1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Original NRA		-0.64	-0.64	-0.65	-0.01	-0.03	-0.02
Our estimation		-0.84	-0.69	-0.82	-0.53	-0.24	-0.36
Uganda	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	2000-04
Original NRA	-0.42	-0.80	-0.52	-0.59	-0.07	0.00	0.00
Our estimation	-0.40	-0.69	-0.39	-0.37	-0.08	0.13	0.06

Sources: Authors' calculations and spreadsheets available on the DAI project website (http://go.worldbank.org/5XY7A7LH40)

are significantly reduced, with incorporation of the ginning outturn ratio and what we think are plausible margins accounting for the bulk of this reduction[14]. The reductions affect both pre- and post-liberalisation periods, but are most dramatic post-liberalisation, as (with the exception of Zimbabwe in 2000-04) exchange rate distortions are removed.

The new estimates are consistent with what is known about the sectors in question (Tschirley et.al. 2009). Exchange rate distortions prior to structural adjustment were more severe in Tanzania and Zambia than in Zimbabwe, peaking in the mid-1980s in Tanzania and the late 1980s in Zambia. However, some effort was made to relaunch a flagging cotton sector in Tanzania in 1985, which may help explain why the average NRA for 1985-89 is lower than for the previous periods. Post-liberalisation (1994-95) the cotton market in Tanzania has been amongst the most competitive in Africa, so, even though approach 2 is used, the NRA figures incorporate little, if any, monopoly profit. However, commentators on the sector noted a proliferation of taxes and levies imposed on primary marketing activities in the first decade or so after liberalisation. These were reduced after 2004, so the NRA figure today would be lower than that reported for 200-04 in Table 1.

Whilst Zimbabwe has suffered from a degree of exchange rate overvaluation for most of the period under study, taxation of agriculture was moderated by the influence of the commercial farm lobby over administered pricing decisions (Rukuni 1994, Jenkins 1997). Efforts to encourage smallholder households to enter cotton production were stepped up after 1980. However, in the latter 1980s, the cotton sector came under increasing pressure to supply lint to the domestic textile industry at heavily subsidised prices. Initially this translated in part into losses for the Cotton Marketing Board, but, as the Board was "commercialised" in preparation for privatisation in the early 1990s, lower lint prices had to be more fully passed onto producers of seed cotton. Following sector liberalisation in 1994-95, the two dominant companies, Cottco and Cargill, made major efforts to expand small-holder production, including through the payment of very attractive seed cotton prices. However, in the early 2000s they chose not to pass the full benefit of available exchange rate devaluation (see footnote 2) onto producers – a decision that contributed to rapid new entry into the sector. The NRA estimates for 2000-04 thus capture both exchange rate overvaluation and the impact of private oligopsony on pricing.

In Zambia, the impact of extreme exchange rate overvaluation in the late 1980s can be seen in the NRA estimates. Otherwise, cotton has not been seriously taxed in the country, where the main focus of agricultural policy is maize. As in Zimbabwe a post-liberalisation duopoly made major efforts to expand smallholder production in the latter 1990s, but then chose not to pass the full benefit of the country's dramatically improving quality reputation onto producers in the early 2000s. Thus, the NRA estimates for 2000-04 primarily reflect the impact of private oligopsony on pricing.

In contrast to the three countries just discussed, the revised NRA estimates in Mozambique indicate greater taxation of the cotton sector than the originals had done. Changing to approach 2 enables us to fully capture the impact of administrative pricing on producers in the 1975-79 to 1985-89 period. In Mozambique privatisation of the sector occurred in 1989, when three joint venture companies were given the right to re-establish cotton production in defined zones. As the country's civil war was still raging at this point, it is possible that the margins used in our calculations under-estimate the true costs of doing business at this point (e.g. hiring of private militias to protect ginneries and vehicles) and hence over-estimate taxation of the sector. However, in the two most recent periods, increased NRA estimates reflect

the very low seed cotton prices paid to producers within the concession system. As already noted, this reflects regulatory failing as well as lack of competition in the privatised market, as the state participates in the annual price setting negotiations. The original NRA estimates for the post-privatisation period reflect the tax levied on lint exports from the country to fund the national cotton research institute, which is the only explicit taxation of the sector.

In Uganda, despite the fact that we use approach 2 instead of approach 1 and use alternative data sources for a number of parameters; the NRAs are not significantly modified. The estimated rate of taxation is slightly reduced in the pre-liberalisation period, but not to the extent where it would change the interpretation of trends. The absence of price distortion since the reform is also confirmed. This suggests that the figures are very reliable (non-sensitive to methodological and data choices).

Across the five countries, our estimates suggest generally modest levels of taxation in the post-liberalisation period. Observed "taxation" comes from

- Local-level taxation plus sector levies in Tanzania (subsequently reduced)
- Exchange rate distortions in Zimbabwe post-2001 (not a cotton, or even an export crop, phenomenon)
- Oligopsony pricing of seed cotton in Mozambique, plus both Zimbabwe and Zambia in 2000-04 (picked up due to use of approach 2 methodology).

This is a very different picture from that painted by the initial estimates. It is also rather closer to the WCA estimates presented by Baffes (2007). Across eight WCA countries, Baffes calculates an average NRA for cotton in 2000-05 of -0.04, ranging from -0.13 in Togo to +0.03 in Mali and Cameroon. The next question to ask, then, is whether the methodological issues affecting ESA cotton NRAs also affect other export crops and, hence, whether our finding that existing

NRA figures tend to over-estimate taxation holds more generally? We briefly look into this question in what follows.

7. The bigger picture: NRAs for other export crops in Africa

Anderson and Masters' (2009, p21) claim that agricultural NRAs in Africa are now "most negative for tropical cash crops such as coffee, cotton, cocoa, and tobacco" is supported by a figure (Figure 1.2, p25-26) showing average NRAs by crop for their sample of African countries. Table 2 summarises which crops are most heavily taxed according to this figure.

	Table 2. Most Heavily Taxed Crops in Africa, 2000-04	
	Unweighted Average NRA	Weighted Average NRA (by National Production)
1	Tobacco	Tobacco
2	Soybean	Soybean
3	Sesame	Cotton
4	Tea	Groundnut
5	Groundnut	Sesame
6	Cocoa	Cocoa
7	Cotton	Beef
8	Beef	"bean"
9	Coffee	Sheep meat
10	Vanilla	Tea

Sources: Anderson and Masters (2009, p25-26)

Table 3 uses FAOSTAT data to list all countries which produced over 5% of Africa total production of the six most heavily taxed cash crops (weighted average NRAs) according to Anderson and Masters (2009). For each of those countries, the table shows whether an NRA was estimated and, if so, how.

An immediate observation is that, in a number of cases, NRAs are not calculated even when the country is included in the DAI study.

Table 3. Farm-level NRAs for key African cash crops at a glance

	Production share in Africa (2000-04 average), %	Country included in the DAI project	NRA (2000-04 average)*	Methodological approach
Tobacco			**-0.64**	
Zimbabwe	33	Yes	-0.66	Primary
Malawi	20	No	n.a.	n.a.
South Africa	7	Yes	Not calculated	n.a.
Uganda	6	Yes	Not calculated	n.a.
Tanzania	6	Yes	-0.55	Approach 2
Mozambique	6	Yes	0	Primary
Soybean			**-0.58**	
Nigeria	44	Yes	Not calculated	n.a.
South Africa	18	Yes	Not calculated	n.a.
Uganda	14	Yes	Not calculated	n.a.
Zimbabwe	11	Yes	-0.68	Primary
Cotton			**-0.5**	
Egypt	15	Yes	-0.34	Approach 1
Mali	11	Yes	0.01	Approach 2
Nigeria	9	Yes	-0.82	Approach 1
Benin	9	Yes	-0.07	Approach 2
Burkina Faso	9	Yes	-0.02	Approach 2
Côte d'Ivoire	7	Yes	-0.14	Approach 2
Zimbabwe	6	Yes	-0.63 / -0.27 (our estimation)	Approach 2
Groundnut			**-0.4**	
Nigeria	34	Yes	-0.58 (primary)	Primary
Sudan	11	Yes	-0.29 (primary)	Primary
Senegal	7	Yes	-0.21	Primary
Chad	5	Yes	Not calculated	n.a.

Table 3. (Continuation)				
	Production share in Africa (2000-04 average), %	Country included in the DAI project	NRA (2000-04 average)*	Methodological approach
Sesame			**-0.39**	
Sudan	22	Yes	-0.38	Primary
Uganda	8	Yes	Not calculated	n.a.
Nigeria	6	Yes	Not calculated	n.a.
Cocoa			**-0.38**	
Côte d'Ivoire	56	Yes	-0.48	Primary
Ghana	20	Yes	-0.21	Primary
Nigeria	16	Yes	-0.17	Primary
Cameroon	6	Yes	0.01	Approach 1

Sources: FAOstat for production shares, DAI Project 'national spreadsheets' for NRAs (crop averages are guesstimates of those displayed in Anderson and Masters 2009, figure 1.2b)
Note: We have listed countries which produce over 5% of Africa total on average between 2000 and 2004.

This means that the average levels of taxation displayed in Anderson and Masters (2009) Figure 1.2b sometimes reflects the estimated level of taxation in a single country (e.g. Zimbabwe for soybean or Sudan for sesame) or perhaps only two-three. This makes the "average" figures highly susceptible to idiosyncratic features or even errors in a single country. We would thus argue that the "average" figure for both tobacco and soybean owes much more to the macro-economic crisis in Zimbabwe during 2001-04 than to any generalized "tropical cash crop" effect.

We also observe that some of the issues identified in relation to cotton also apply for other crops. As noted in footnote 8 above, the high level of taxation for Tanzanian tobacco reflects in part the impact of private monopsony on pricing. Three agribusiness firms set out competing for the business of smallholder tobacco producers by providing an input package on credit, then discovered that they

could not control side-selling at harvest time, so amalgamated their contract farming operations into a single, jointly-owned venture that divided the resulting leaf amongst the shareholders on a quota basis.

The NRAs for Tanzanian tea, which features in Table 2 though not Table 3, do not include the processing conversion factor, estimated to range between 0.17 and 0.36 over the study period. This suggests that the level of taxation (NRA = -0.91 for 2000-04) is over-estimated by at least as much as the figure for Tanzanian cotton.

A notable feature of Table 3 is that most of the products are treated as being traded as primary products. We suspect that one reason for some of the substantial negative NRAs is that real marketing costs have been overlooked in the calculations of P_u. Thus, for example, cocoa beans are sourced from smallholders in both Côte d'Ivoire and Ghana, then transported and stored until the time for export. However, whilst

in Ghana a plausible average margin of 49% is added to the farmgate price in 2000-04 to cover these marketing costs[15], in Côte d'Ivoire the margin added is only 9%. There may even be a few cases of overlooked out-turn ratios, for example in groundnuts where purchases from farmers may be unshelled nuts but subsequent trade may be in shelled nuts (out-turn ratio = 0.7).

Cocoa in Côte d'Ivoire and Ghana do, however, represent a case where one might expect a fair degree of taxation and a genuine "tropical cash crop" effect. This is because the two countries combine to dominate the world supply of cocoa. Hence, restricting supply through taxation can help keep the "world" price of cocoa up. According to Faki and Taha (2007), the same logic held for sesame exports from Sudan, at least until 2000. Thus, whilst in general we are not convinced that "tropical cash crops" are more heavily taxed than other crops in Africa, we do recognize these potential exceptions.

8. Conclusion

In this paper we have critically examined the NRA estimates for cotton in a number of African countries. This exploration is made possible by the decision of the DAI project to make its background data freely available on its website, for which the project should be commended. It reaffirms the basic finding of Anderson and Masters (2009) that the extent of agricultural taxation in Africa has fallen significantly since structural adjustment, but suggest that the levels of taxation reported in Anderson and Masters (2009) are unduly high both pre-reform in some countries and post-reform in most of them. A preliminary look at other export crops suggests that some of the problems that affect the NRA estimates for cotton also affect the estimates for these other crops. This leads us to question the assertion that agricultural NRAs in Africa are now "most negative for tropical cash crops such as coffee, cotton, cocoa, and tobacco" (Anderson and Masters 2009, p21).

Insofar as such crops are still systematically "taxed", the two main reasons would seem to be:
- Moderating supply so as to sustain prices, where one or two countries have pricing power in the international market
- The impact of private oligopsony on producer prices post-liberalisation.

Inclusion of this latter effect in NRA estimates is controversial, but is a consequence of one approach to calculating NRAs (used by some of the DAI project authors for fully justifiable reasons of data availability, although not preferred by the project as a whole). In this paper we have argued that including the impacts of post-liberalisation private monopoly alongside pre-liberalisation state monopoly is entirely reasonable if the objective of NRA analysis is to compare the impact of the "whole package" of state policy on farmers over time. In the case of cotton we noted that post-liberalisation state regulatory policy may accept a degree of private monopoly or oligopoly and, therefore, that the burden imposed on farmers will depend at least in part on the effectiveness of the regulator in counter-acting the impact of that power on pricing. On the other hand, if NRA estimates are used as indicators for policy economy analysis into the drivers of agricultural policy, then it is important to distinguish taxation as a direct result of state policy from price distortions due to private monopoly. However, from a political economy perspective, it may be equally important to distinguish taxation as a result of exchange rate overvaluation from taxation that is specific to a particular sector.

We also note that several of the export cash crops discussed in this paper require significant processing investment, which may make producers more susceptible to agribusiness market power than is the case in, for example, most staple food crop systems in Africa. This, as

much as any conscious state taxation policy, may explain observed levels of taxation on "tropical cash crops".

Looking at the causes of flawed NRA estimates, we are inclined to emphasise rather mundane resourcing issues, rather than any ideological drive to generate a particular result. The most that the DAI project might be accused of is an undue willingness to accept continuing high estimates of agricultural taxation in Africa – because African states have been known to tax their farmers heavily in the past. In terms of resourcing, Anderson and Masters (2008, p15) recognise that: "Estimating the NRA or the CTE for an individual industry requires specialist knowledge of that sector, particularly in countries where trade costs are high, pass-through along the value chain is affected by imperfect competition, and markets for foreign currency have been distorted at various times and to varying degrees in the past. Specialist knowledge is also needed to assess how policy is actually implemented." This paper has uncovered cases where such "specialist knowledge" was clearly lacking. When secondary data sources and historical information on policy are limited – as in much of Africa – then expecting one or two consultants to construct NRA series for multiple commodities over several decades is perhaps too ambitious.

In our view, more of the NRA estimates would benefit from a thorough checking by people with specialist knowledge of the sectors concerned, in order that those who use the figures as the basis for subsequent political economy analysis can be confident that they are trying to explain real effects. However, the implication of the foregoing argument is that such checking will itself be a fairly substantial and costly exercise.

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Appendix 1. Detailed re-estimation of NRAs for Tanzania

According to Tschirley et.al. (2009), during the decade that followed the liberalisation of the Tanzanian cotton sector in 1994, producers in Tanzania received the highest average share of the ex-ginnery price of lint of producers in all nine surveyed African countries, despite significant village and district level taxes on cotton marketing (only reduced around 2004). Changes in world prices are passed onto producers through fierce competition between 30-40 ginners, notwithstanding the fact that competitive pressure can vary across seasons, with competition for seed cotton in drought seasons sometimes leading to losses amongst ginneries that have contracts to fulfil, whilst competition is less intense in years of bumper harvest.

The competitive nature of the sector post-liberalisation means that calculating NRAs by starting with the farmgate price of seed cotton and adding an "efficient" margin for seed cotton purchase, ginning and for transportation of the resulting lint to the port is an appropriate approach in the Tanzanian case. Nevertheless, this approach is not without its challenges. Specifically:

- Seed cotton prices vary considerably within a given buying season. Whether or not Tanzania Cotton Board issues an indicative price at the start of the buying season (policy on this has varied over time), it is common for the close of season seed cotton price to be double the indicative price. Occasionally, in a year of bumper harvest (and especially if the Tanzanian buying season coincides with a fall in the world market price), buying prices can peak part-way through the season, then fall once buyers have fulfilled their major orders. This happened in 2004, for example. These variations mean that analysts have to "guesstimate" an average producer price for each season, as data on how much seed cotton is bought at different buying prices is not readily available[16].

- The sector is subject to major climate-induced fluctuations in production (much more so than WCA, for example). As well as its effect on the strength of competition noted above, this means that: 1) capacity utilisation at ginneries can vary considerably from season to season; 2) the "efficient" ginnery margin, therefore, varies from season to season.

The NRA calculations for Tanzanian cotton have already been identified as problematic, but unfortunately not for the reasons given above. As is explained in Morrissey and Leyaro (2007, p31 and Appendix Table 9), the original NRA calculations that appear in Anderson and Masters (eds, 2009) and which still feature in the online Excel database, did not incorporate the ginning out-turn ratio when comparing farmgate price of seed cotton with export price of lint, thus dramatically overstating the degree of taxation on cotton throughout the study period (1976-2004). Whilst Morrissey and Leyaro (2007, p31 and Appendix Table 9) report efforts to correct for this, these are also unsatisfactory, as will be shown below. This note, therefore, elaborates the process of deriving our preferred estimates for NRAs in Tanzanian cotton.

Table T1 presents the results of a number of adjustments to the original NRA calculations for Tanzanian cotton, which, all combined, led to our preferred estimate reported in Table 1. The figures in row 1 are those presented in Anderson and Masters (2009) and which still feature in the online Excel database. The change in row 2 is the most important: (correctly) incorporating the ginning out-turn ratio dramatically lowers the estimated rate of taxation on Tanzanian cotton throughout the study period. Note that this is what "revision 1" in Morrissey and Leyaro (2007, Appendix Table 9) should have done.

Table A1: Revising the NRA Calculations for Tanzanian Cotton

	1976-79	1980-84	1985-89	1990-94	1995-99	2000-04
1. Original	-83.1	-87.4	-84.2	-85.4	-72.8	-70.2
2. Ginning Out-turn	-48.4	-61.8	-49.4	-58.6	-19.6	-10.8
3. A Index reference price + adjusted seed cotton price	-50.4	-54.7	-44.1	-45.3	-13.1	-3.3
4. Adjusted margins	-55.6	-59.5	-50.0	-51.1	-22.3	-13.4

In rows 3 and 4 we introduce information from the study by Tschirley et.al. (2009) that is not available in the online spreadsheet. These modifications have less of an impact and the impacts in part counterbalance each other. In row 3 we do two things. Firstly, we re-estimate the f.o.b. export price, against which the producer price (adjusted for ginning out-turn, plus processing and marketing margins) should be compared. The new reference price is the A index price (c.i.f. North Europe, average for the year beginning August 1st), adjusted for estimated premium or discount received by Tanzanian lint and a c.i.f. to f.o.b. margin of 6 percent. We know little about the export price figures used by Morrissey and Leyaro, but we note that their f.o.b. prices vary significantly with respect to the A-index - ranging from 63% to 103% of the latter - which we find implausible. Secondly, we observe that the seed cotton prices used by Morrissey and Leyaro are all out by one year, e.g. the price that they give for 2004 is actually the price paid to farmers in 2003[17]. We thus correct for this. The combined effect of these changes is to reduce the estimated NRA for all periods except 1976-79.

Finally, in row 4 we adjust the marketing and processing margins used by Morrissey and Leyaro in the light of data collected by Tschirley et.al. (2009). The original NRA calculations include two margins when building up from seed cotton price to f.o.b. export equivalent price:

- A 20% margin on the seed cotton price to cover seed cotton purchase costs and transportation to the ginnery;
- A 35% margin from the ginnery gate to the port, which includes both ginning costs and post-ginnery transportation.

As noted above, the big challenge with such estimates is the impact of climate fluctuations and hence variations in capacity utilisation. In addition, as these margins are cost-based, *ceteris paribus* they tend to fall in percentage terms when seed cotton prices rise (for example, in response to higher international prices).

Table T2 uses ginnery budget data from 2006, collected by Tschirley et.al. (2009), to illustrate the impacts of different seed cotton prices and levels of capacity utilisation on the two margins. Seed cotton prices are expressed as a percentage of f.o.b. lint equivalent for 2006, whilst capacity utilisation is expressed in terms of days of ginnery operation during the season. We note that:

- Seed cotton prices have been higher as a percentage of f.o.b. lint equivalent post-liberalisation than they were pre-liberalisation, thanks to competition between buyers. On average during the 1995-2005 period, Tanzanian cotton farmers received around 60% of the f.o.b. lint equivalent price;

Table A2: "Efficient" Marketing Margins under Varying Assumptions

		Seed Cotton Price as % of f.o.b. Lint Equivalent			
		40%	50%	60%	70%
Primary Marketing Margin		0.23	0.18	0.16	0.14
Ginnery + Post-Ginnery Margin at Capacity Utilisation of:	30 days	0.49	0.4	0.35	0.3
	60 days	0.39	0.32	0.28	0.24
	90 days	0.36	0.29	0.25	0.22
	150 days	0.33	0.27	0.23	0.2

- Post-liberalisation, there is a negative correlation between the share of the f.o.b. lint equivalent price received by producers and average capacity utilisation at ginneries, as climate-induced fluctuations in available seed cotton harvest drive both.

Our assessment of Table T2 suggests that an "efficient" primary marketing margin of 16% might be more appropriate than 20%. Choosing an appropriate "efficient" ginning and post-ginnery margin is more difficult. Thus, in 2000-04 ginning capacity utilisation perhaps only averaged 60 days per season in four of the years, but was closer to 150 days in the bumper harvest year of 2004. In earlier periods average capacity utilisation was perhaps somewhat higher, albeit still with major fluctuations year-on-year. In row 4 of Table T1 we, therefore, assume a processing margin of 0.25, instead of the 0.35 assumed by Morrissey and Leyaro.

If we take row 4 of Table T1 as our preferred NRA calculations for Tanzanian cotton, we note that there was still a noteworthy degree of taxation of the sector in the first decade after liberalisation – although much less than in the original estimates by Morrissey and Leyaro. Most of this was local-level taxation, levied on cotton marketing activity by village and district authorities. According to a 1999 report by the Ministry of Agriculture and Cooperatives, total taxes and levies on marketed seed cotton amounted to TShs 24 per kg when the seed cotton price was TShs 185 per kg (i.e. 13%). Over the next five years central government moved to control the level of local taxation on cotton marketing, but the effect on observed taxation of seed cotton prices is obscured by the introduction of levies for input purchase. Between 2000 and 2002 these amounted to a new tax on producers, as few producers benefited from the inputs that were procured as a result. However, from 2003 these did function more or less as an individual input entitlement (i.e. a forced saving mechanism for producers), so observed seed cotton prices should really be adjusted upwards accordingly (but have not been).

This discussion suggests that the NRA estimates in row 4 of Table T1 are reasonable, at least for the post-liberalisation periods. However, it is also clear that there is some margin of error in any NRA estimates calculated for Tanzanian cotton, given available data and the volatility of production conditions in the sector.

Appendix 2: Alternative estimates – Specific data and calculation modifications

Mozambique

- We calculate P_{up} with approach 2 using the producer price data in the spreadsheet and:

- A constant GoR of 0.37 (instead of the values in the spreadsheet which vary between 0.23 and 1.2)
- A margin (m) of 62% (which was derived from an estimated farm-gate to ginnery cost of 20% and a ginnery to f.o.b. cost of 35%).
• We re-calculate the f.o.b. price by discounting the A index by 4cts/kg

Tanzania
• We re-calculate the P_{up} using:
  - A margin of 0.45 (which was derived from an estimated farm-gate to ginnery cost of 18% and a ginnery to FOB cost of 25%).
  - A GoR of 0.35 (instead of the spreadsheet data which varies between 0.27 and 0.71)
  - the producer price figure reported for year t as the price for year t-1.

Uganda
• We calculate the P_{up} with approach 2 using
  - The producer price data in the spreadsheet until 1991 and then data from the Uganda Cotton Development Organisation (http://cdouga.org) as from 1995. Because CDO data is not available before 1995, between 1991 and 1995, we use data from the FAO. The FAO data is in line with both the spreadsheet data pre-1991 and the CDO data post-1995,
  - A GoR of 0.35 instead of 0.33
  - A margin of 75%. The large size of this margin is attributable to a low utilisation rate of ginneries and to high transportation costs from ginneries to port.
• We re-calculate the f.o.b. price by adding a quality premium to the A-index, which declines linearly from 4cts/kg at the beginning of the study period to 2 cts/kg by 2005.

Zambia
• We recalculate the P_{up} using
  - A margin of 0.66.
  - A GoR of 0.36 instead of 0.4.
• We re-calculate the f.o.b. price by include a quality premium which rises linearly from zero until the reform (1994) to 9cts/kg in 2004.

Zimbabwe
• We recalculate the P_{up} we using
  - A margin which reflects the proportion of commercial and smallholder farmers. Because commercial farmers did not receive extension services and delivered their cotton to ginneries, we estimate the margin to 0.44. When the cotton has to be collected from smallholders and extension services are provided we estimate the margin to 0.66 as in Zambia. The margin is thus a weighted average of the above two, based on a proportion of commercial farmers of 100% until 1970, which linearly decreases to 80% in 1980, 50% in 1990 and 0% in 2000.
  - A GoR of 0.36 instead of 0.4.
• We re-calculate the FOB price by applying a quality premium of 11cts/kg until 2003 and 6.4cts/kg in 2004 and adding the cotton seed price (FAOstat in local currency)

End Notes

[1] There are a few commodities for which domestic policies in major producing and consuming countries have been so distorting that this cannot be said to be true. Rather, the world market has been reduced to little more than a residual market where domestic surpluses (supported by subsidy policy) are dumped. As a result, it becomes the norm for any country producing the good in question to resort to subsidy, as the world market price is below the true cost of production in almost all countries. Sugar has been the classic example of this (Tyler 2008). Anderson and Masters (2009, p21) note that, "As in other regions of the world, the rice pudding ingredients of sugar, rice, and milk are among the products receiving the highest assistance" in Africa. However, this may in part be because the assumption that the world price represents an "undistorted" price does not hold for these commodities.

[2] The case of Zimbabwe post-2001 may be instructive here. When the fast track land redistribution programme began in 2001, there was a sudden and dramatic shortage of foreign exchange in the country due to 1) the collapse of tobacco exports (previously around 60% of all merchandise exports); 2) a withdrawal of foreign direct investment, and 3) reduced aid flows. The government attempted to maintain an official exchange rate that was woefully out of line with new demand and supply realities for foreign exchange, but was soon forced to allow exporters to retain a significant proportion of their foreign currency earnings, which could then be traded on the parallel market. The actual exchange rate obtained by exporters was thus a blend (weighted average) of official and parallel market rates. As inflation did not kick in for a couple of years after the foreign exchange shock, for a while this represented a real depreciation in the exchange rate, compared with 2001 and before. However, compared to the rate required to balance demand and supply for foreign exchange in post-2001 conditions, even this blend rate was too high. Had exporters been able to exchange foreign currency at a lower "equilibrium exchange rate", they could have paid domestic producers more for their produce in local currency terms out of the same hard currency receipts than they were actually able to do.

[3] As will be argued below, the analyst should check that the local price is not administratively set below that available to exporters of the same product.

[4] As documented by Poulton (1998) for cashew in Tanzania and widely reported for cotton in the same country, evasion of local-level taxes may also be high. Using stated rates may thus over-state the burden of taxation on the supply chain.

[5] A good example is Ethiopian coffee, where the transmission coefficient from $NRA_{primary}$ to NRA_f varies from year to year (average over the period 1981-2004 = 0.75) and is calculated to multiple decimal places.

[6] A good example here is cotton in Mozambique, where, in the late 1970s and early 1980s, administratively set producer prices were held constant for 3-4 years at a time, only being (partially) adjusted with a lag to changing world price and macroeconomic trends.

[7] This assumes that inflated margins have not been covered by subsidy from the central state to the parastatal marketing organization involved.

[8] In the Tanzania country study, for example, it is noted that "it is quite possible that for cash crops such as tea, cotton, beans, and tobacco, the negative estimates reflect market inefficiencies in addition to (and perhaps even more than) policy distortions" (Morrissey and Leyaro 2007, p324).

[9] The NRA estimates for French-speaking WCA countries reported in Baffes (2007) are carefully constructed, so the comments in this

section are directed at the other seven countries.

[10] In most countries only 1-3 seed cotton varieties are planted at any given time, usually zoned by region. When new varieties are introduced they commonly embody an incremental increase in ginning out-turn ratio over the varieties that they replace, but research systems in many countries have not performed well, such that a decade or more can sometimes pass between varietal releases.

[11] It would have been desirable to recalculate the NRAs for Nigeria and Egypt as well, given that we have grounds for believing that both are over-estimated. However, we do not have the knowledge of these sectors that is necessary for this task.

[12] A index data was obtained from the International Cotton Advisory Committee (ICAC).

[13] Tanzanian cotton was our entry point for this paper, as it was where we first spotted the problems with existing NRA estimates.

[14] In the original Tanzania estimates, the GOR was simply not taken into account. In the original Zambia and Zimbabwe estimates, the GOR is also not taken into account, but the margin (common to both countries) that is added to the farm-gate price is too large to capture ginning and marketing costs – albeit insufficient to cover the ginning transformation.

[15] In Ghana the margin averages 67% over the longer period 1976-2004.

[16] On the other hand, there are equal difficulties in obtaining reliable ex-ginnery or f.o.b. export prices for Tanzanian lint, given the large number of ginners and exporters, and the pervasive quality problems in the sector that result in regular but idiosyncratic price discounts for lint consignments. This effectively rules our use of approach 1 for calculating NRAs.

[17] One of the first statistical features of the Tanzanian cotton sector that analysts have to come to terms with is the practice of the Tanzanian Cotton Board of organizing all data according to so-called "lint marketing years", which begin on August 1st. Thus, seed cotton which was grown during the production season November 2002 – June 2003 and sold to ginners during June – August 2003 – which all agricultural economists would record as 2002-03 production season (or 2003 harvest) is recorded by TCB as the production associated with lint marketing year 2003-04. This is so even though, in a year of low harvest, ginning operations can be completed before the end of the calendar year! The same "quirk" affects recorded seed cotton prices.