AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

TMD DISCUSSION PAPER NO. 91

ASSESSING IMPACTS OF DECLINES IN THE WORLD PRICE OF TOBACCO ON CHINA, MALAWI, TURKEY, AND ZIMBABWE

Xinshen Diao
Sherman Robinson
Marcelle Thomas
Peter Wobst
International Food Policy Research Institute

Trade and Macroeconomics Division
International Food Policy Research Institute
2033 K Street, N.W.
Washington, D.C. 20006, U.S.A.

March 2002

TMD Discussion Papers contain preliminary material and research results, and are circulated prior to a full peer review in order to stimulate discussion and critical comment. It is expected that most Discussion Papers will eventually be published in some other form, and that their content may also be revised. This paper is available at http://www.cgiar.org/ifpri/divs/tmd/dp.htm

Abstract

This study quantitatively analyzes the general equilibrium effects of declines in world demand for tobacco products. The study finds that tobacco exports and production in the three developing countries, Malawi, Zimbabwe, and Turkey, would be badly hit if world tobacco prices fall due to the decline in tobacco demand. Moreover, for a given decrease in the world tobacco price, the more important the tobacco sector is in an economy, the worse the tobacco sector is hit. Tobacco is quite important to the Malawian and Zimbabwean economies as tobacco production and trade accounted for, respectively, 17% and 43% of agricultural GDP and tobacco exports accounted for 50% and 35% of national exports in these two countries. The negative effects of a decline in world tobacco prices on the Malawian and Zimbabwean economies are much larger than that on the Turkish economy. In the case of China, tobacco production, marketing, cigarette processing, distribution, and foreign trade are strictly controlled by the government and tobacco trade accounted for a small share of production and consumption. Thus, the decline in the world tobacco prices would hardly affect China's tobacco sector. The study shows that it is highly risky for a developing country to highly depend on exports of a single agricultural commodity. To reduce such risk, a country has to create a more diversified and flexible export structure.

Table of contents

Chapter One: Summary 1
1. Introduction 1
2. Effects on tobacco exports 2
3. Effects on tobacco production 3
4. Effects on farmers and workers 4
5. Effects on non-tobacco sector 5
6. Macroeconomic effects 6
7. Demand side effects 7
8. What we have learned from the model simulations 7

Chapter Two: Malawi 8
1. Introduction 8
2. Background 8
3. Effects of Decreasing Tobacco Export Price 10
Tobacco profits under no labor adjustment 12
Tobacco profits under labor adjustment 13
Non-tobacco sectors under labor adjustment 14
Returns to agricultural factors 15
Marketing sector 16
Governments buying power 17
Non-tobacco exports 18
Macroeconomic effects 19
References 20
Appendix 21

Chapter Three: Zimbabwe 24
1. Introduction 24
2. The Model Structure and the Data 24
3. Effects of Decreasing Tobacco Export Price -- Simulation Results 27
Adjustments in Large-Scale Agriculture 27
Effects on the Small-Holder Agriculture 29
Effects on Non-Tobacco Sectors' Production and Trade 30
Macroeconomic Effects 31
References: 32
Appendix 33

Chapter Four: Turkey 36
1. Structure of the Model 36
2. Simulation Analysis 36
Experiment1: Reducing the world tobacco price 37
Experiment 2-1: Increasing the cigarette sales tax 39
Experiment 2-2: Removing production subsidies in the tobacco sector 40
Reference 40
Appendix 41

Chapter Five: China 44
1. Structure of the Model 44
Data and China's Social Accounting Matrix 44
Model Structure 44
2. Simulation Analysis 47
Experiment 1-1: Increasing cigarette consumption taxes 47
Experiment 1-2: Raising cigarette prices 49
Experiment 1-3: cutting low-quality cigarette production 50
Experiment 2: Reducing tariffs on tobacco imports 50
References 52
Appendix 61

List of Discussion Papers 64

Chapter One:
Simulating a Decrease in the World Price of Tobacco within a CGE Model – Summary

Xinshen Diao

1. Introduction

This paper is drawn from our research findings from the project "Analyzing the Impact of Reduction in Tobacco Use on National Economy Using the CGE Model" funded by the Trade and Commodities Division, FAO. In this research project, we quantitatively analyze the general equilibrium effects of declines in world demand for tobacco products and of declines in tobacco prices on tobacco producing and exporting countries. Four countries are chosen for the study: China, Turkey, Malawi, and Zimbabwe, and each country is individually analyzed.

For the four countries chosen for the study, China is the largest producer and consumer of tobacco in the world, while Turkey, Malawi and Zimbabwe are among the largest tobacco exporting countries in the world. Due to differences in economic development, tobacco accounts for quite a small share in Turkey's GDP and total national exports while Malawi's and Zimbabwe's economies heavily depend on tobacco production, and, more importantly, on tobacco exports. While China is the largest consumer of tobacco in the world, trade accounted for a trivial share of both the country's tobacco production and consumption and hence tobacco does not play a crucial role in the economy (table 1).

Table 1. Tobacco in the economy

	Tobacco production in GDP	Tobacco production in agriculture	Tobacco exports in total exports
	---------- % ----------		
China	0.5	1.5	small
Turkey	1.0	1.5	2
Malawi	14.4*	17.0	50
Zimbabwe	7.0	43.0	35

* Including tobacco-related market services

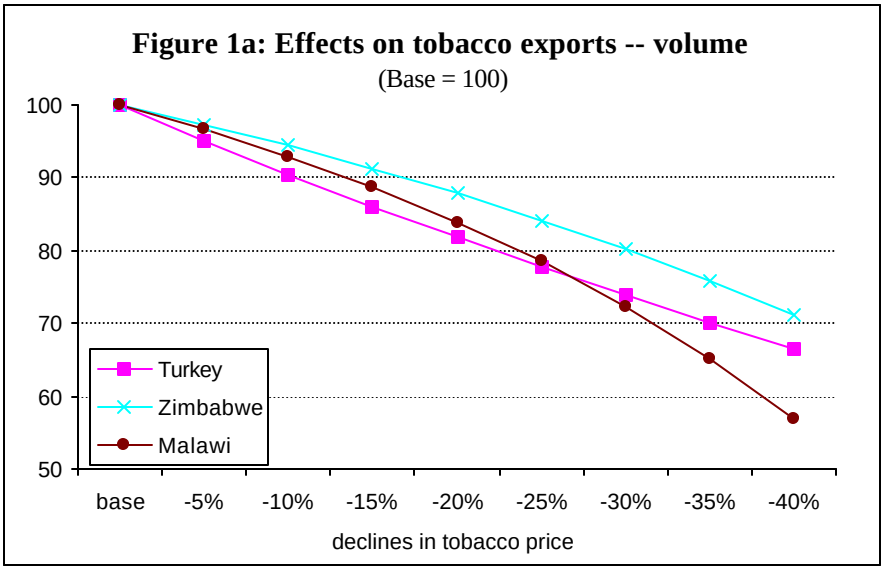
The study is conducted by using a computable general equilibrium model for each country. The decline in world tobacco demand is modeled as a series of exogenous shocks on world tobacco prices. Specifically, the simulations are carried out by decreasing the four countries' export prices of tobacco from 5% to 40% in 8 consecutive steps. We summarize our findings in Chapter one, following by the discussions for each country in Chapters two through four.

In a CGE model, the importance of the tobacco sector to a country's economy determines the degree of the impacts on a country's economy when world tobacco demand and prices decline. As we mentioned before, even though China is the largest producer and consumer of tobacco in the world, tobacco trade accounted for a trivial share in that country's tobacco production and consumption. Moreover, tobacco production, marketing, cigarette processing, distribution and trade are strictly controlled by the Chinese government. For these reasons, we did not consider the possible impact of changing world tobacco prices on China's exports.

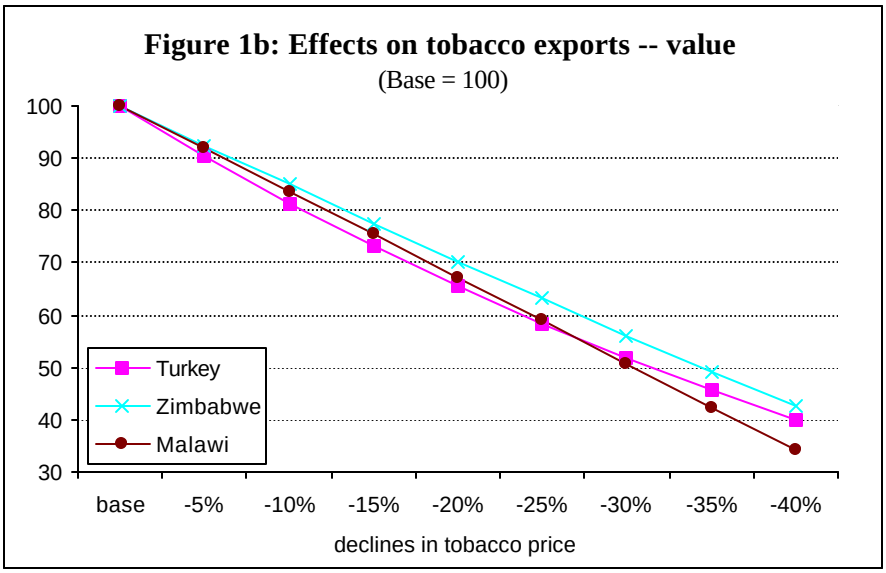
As Malawi's and Zimbabwe's economies heavily depend on tobacco production and exports, these two economies are expected to suffer more seriously than the other two countries when world tobacco prices decline. Given that these two countries are among the poorest countries in the world, the negative effects of decreased world tobacco prices on their rural economies would be more significant.

2. Effects on tobacco exports

As expected, a decline in world tobacco prices directly hits the volume of tobacco exports from Turkey, Malawi and Zimbabwe (figure 1a). With the decline in world tobacco prices, the revenue from tobacco exports declines more. For example, if world tobacco prices fall by 40%, tobacco export revenues would fall by 66% for Malawi and 57% for Zimbabwe (figure 1b).



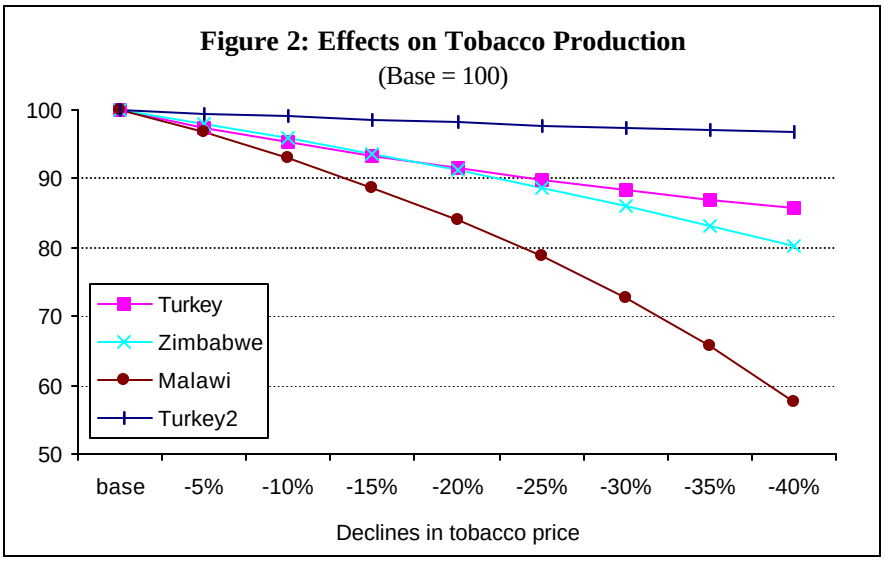
Source: Model results



Source: Model results

3. Effects on tobacco production

A decline in world demand for tobacco exports causes tobacco production to fall in these countries. The model results show that for a given decrease in world tobacco prices, the more important tobacco production is in an economy, the worse the tobacco sector is hit. For example, while tobacco accounted for 43% of Malawian agricultural GDP, a 40% decline in the tobacco prices may cause Malawi's tobacco production to fall more than 50%; in Turkey, where tobacco accounted for less than 2% of agricultural GDP, the same 40% decline in prices only causes Turkey's tobacco production to fall by less than 15% (figure 2).



Turkey2: Cigarette output
Source: Model results

4. Effects on farmers and workers

These results are obtained by assuming that farmers can adjust their cropping mix once tobacco prices decline. However in the case of Malawi, tobacco is the most important crop for farmers to make cash revenue. The export demand for tobacco leaf has been quite stable over time, while market conditions for other crops may not exist. This characteristic constrains farmers' choices of growing other cash crops, and hence forces farmers to not account for their family labor cost in tobacco production. That is, if the output price received by farmers can cover their cash expenditures on fertilizers, interest payments to the bank and so on, farmers may continue to grow tobacco, ignoring the decline in the tobacco price. In this case, while production of tobacco in Malawi may not decline, the revenue from tobacco production becomes much smaller.

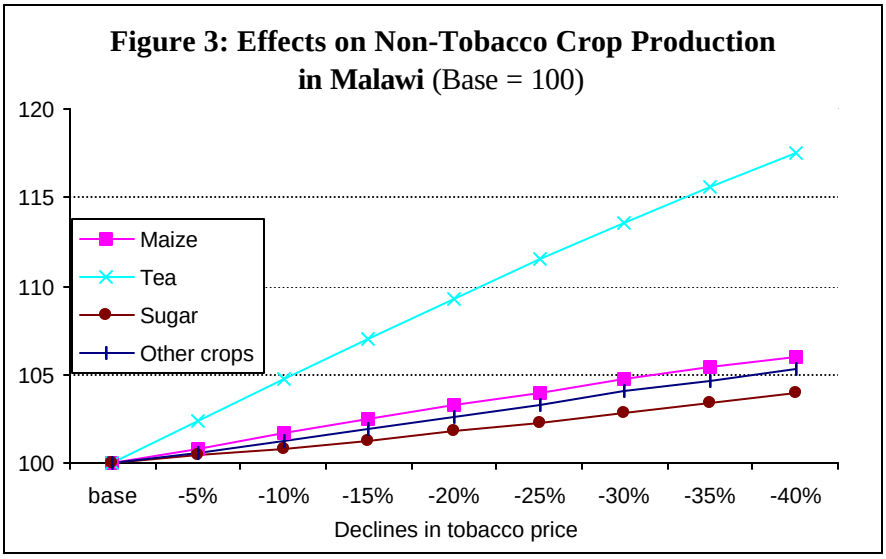
We calculate the effects of the lowered tobacco price on farmer cash profits by different farm sizes in Malawi. The decline in farmers' cash income is not only due to the lowered export prices, but also to the increase in the prices for intermediate inputs, such as fertilizers. As tobacco accounted for more than 50% of Malawi's national exports, the large decline in the export price of tobacco causes the country's real exchange rate to depreciate, which causes imports to be more expensive in domestic currency. Chemical fertilizers are all imported in Malawi, and hence, farmers have to pay a higher price in domestic currency to buy the same amount of fertilizer inputs.

We normalize the revenue per unit of tobacco products at the base year to be 100. Of the total revenue from selling tobacco products, the smallholders spend 41.8 on purchasing the intermediate inputs, while the large farmers spend 36.8. That is, the cash profits are about 58.2 – 63.2% of sale's price for the small and large farmers, respectively. When tobacco export prices decline by 40% but farmers still grow the same amount of tobacco, the cost of intermediate inputs increases to 43.2 for the smallholders and 38 for the large farmers. In the meantime, the revenue from selling tobacco falls to 45 from 100 in the base. Putting these two factors together, the cash profits of tobacco production fall to less than 2 for the smallholders and less than 7 for the large farmers (table 2 in Chapter two). This implies that the revenue from selling tobacco leaves can just cover the farmers' cash expenditure to grow tobacco. Tobacco production, which used to be quite profitable by generating large cash profits to farmers, yields almost no profit, especially for the small farmers.

In the case of Zimbabwe, tobacco is mainly grown on large farms. Labor demand in tobacco production accounted for almost 50% of unskilled workers employed in the base year (figure 2 in Chapter three). Declines in tobacco exports and production reduce demand for workers employed in the tobacco sector, which drives the wage rate down and the unemployment rate up.

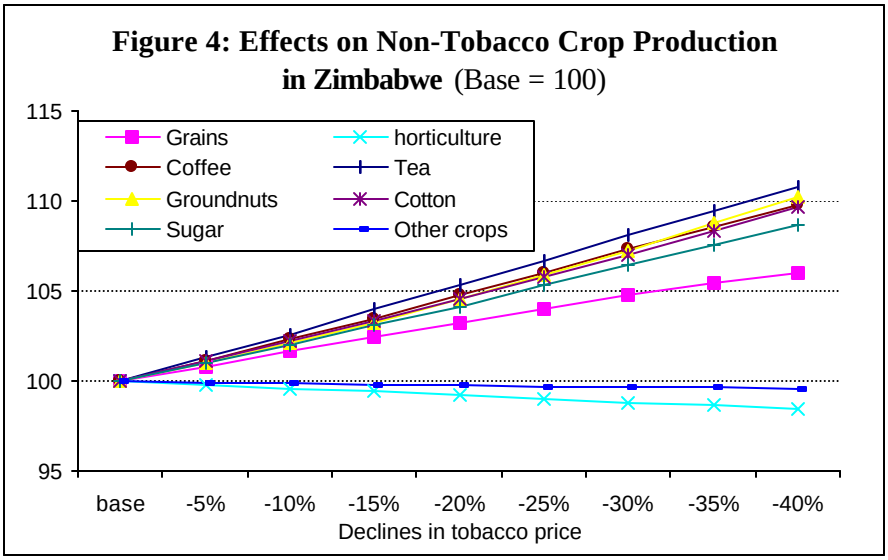
5. Effects on non-tobacco sector

If farmers can switch to other crops after tobacco prices decline tremendously, what other crops they can grow? In a general equilibrium model, we can also look at the possible effects on other agricultural sectors due to the decline in tobacco prices.



Source: Model results

In the case of Malawi, maize and tea production rise more when farmers shift away from tobacco production (figure 3), while in the case of Zimbabwe, output of other cash crops, such as tea, coffee, groundnuts, cotton, and sugar, rise more (figure 4).



Source: Model results

Switching to other crops can reduce the negative effect on farmers' income caused by the decline in tobacco prices. However, the results are obtained under the assumption that

farmers can easily shift to the production of these crops and that world prices for them are not affected by tobacco prices or the increase in the supply of these crops from these countries. In many cases, especially in the less developed countries, like Malawi and Zimbabwe, this assumption does not hold. These results should be read as the possible direction for these countries' farmers to adjust their production structure if the additional production and market conditions are improved for them.

6. Macroeconomic effects

In the general equilibrium model, the decline in tobacco prices also indirectly affects the aggregate economy. The macroeconomic indicators in table 2 to table 4 are used to evaluate these effects. A comparison of the results for Turkey with those for the other two less-developed countries shows that since tobacco plays a more important role in Malawi and Zimbabwe, the macroeconomic effects of world tobacco prices in these two countries are much larger than in Turkey, where tobacco accounted for a small share of GDP.

Table 2. Macroeconomic Effects in Malawi (% change from the base)

	Tobacco export price falls by			
	10%	*20%*	*30%*	*40%*
Exchange rate	5.0	10.3	15.7	21.3
Consumer price index	0.8	1.6	2.5	3.5
Real GDP at factor price	-0.1	-0.4	-0.9	-1.8
Exports at the world price	0.0	-0.7	-2.5	-6.0
Imports at the world price	-3.4	-6.6	-9.8	-12.8
Government revenue	0.6	1.0	1.4	1.5

Table 3. Macroeconomic Effects in Zimbabwe (% change from the base)

	Tobacco export price falls by			
	10%	*20%*	*30%*	*40%*
Exchange rate	4.0	8.0	11.9	15.6
Consumer price index	0.1	0.1	0.2	0.2
Real GDP at factor price	-1.1	-2.3	-3.4	-4.5
Exports at the world price	0.9	1.6	1.8	1.4
Import at the world price	-2.0	-4.0	-5.8	-7.4
Government revenue	0.3	0.5	0.8	0.9

Table 4. Macroeconomic Effects in Turkey (% change from the base)

	Tobacco export price falls by			
	10%	*20%*	*30%*	*40%*
Exchange rate	0.055	0.100	0.139	0.171
Consumer price index	0.036	0.069	0.099	0.126
Exports at the world price	0.046	0.073	0.083	0.077
Import at the world price	-0.062	-0.117	-0.167	-0.212
Government revenue	0.077	0.142	0.196	0.243

7. Demand side effects

While Malawi and Zimbabwe are chosen for the study due to the importance of tobacco production and exports to these countries' economies and because they are among the least developed countries in the world, China and Turkey are among the largest tobacco consumption countries. For this reason, we also simulate the effects of increasing the sales tax on cigarette demand as well as the indirect effect on other economic indicators due to the decline in domestic tobacco consumption. Detailed discussions about the consumption effect for China are in Chapter five and Turkey in Chapter four.

8. What we have learned from the model simulations

It is very risky for a developing country to highly depend on exports of a single agricultural or primary commodity. In order to reduce such risk, it is necessary for a country to diversify its trade structure and build up production and export capacity in non-traditional commodity markets. This is the key for Malawian and Zimbabwean economies to increase their capacity to cope with any severe negative world price shock.

Although world price declines for tobacco have an inevitable negative effect on the tobacco sector as well as on overall economic performance, the economic adjustments shown by the model simulations present a group of new conditions that may benefit the long-term economic development and growth in these economies. However, to achieve this result, these countries will surely need help from wealthy countries and international organizations as many of them are among the poorest countries in the world.

Chapter Two:
Simulating a Decrease in the World Price of Tobacco within a CGE Model – Results for Malawi

Peter Wobst and Xinshen Diao

1. Introduction

Malawi heavily depends on tobacco production and, more importantly, on tobacco exports, which constitute about half of the country's export earnings. Tobacco is produced in a dual system by both smallholders and large-scale farmers and, while containing intermediate input links with the rest of the economy, it is most strongly linked to the marketing sector of Malawi, which includes the auction floor activities that handle the marketing of tobacco exports. The government currently relies greatly on revenues from tobacco production and related economic activities through the regulated auctioning of tobacco exports, corporate taxes paid by tobacco producers and traders, as well as some minor export tax revenue from tobacco trade.

This paper analyzes the effects of 5 - 40% declines in the export price of tobacco using a computable general equilibrium (CGE) model of Malawi developed by Löfgren (2001). The model incorporates linkages between the tobacco sector and the rest of the economy and potential shifts of productive resources from tobacco to other economic activities. The model also captures the distinction between effects on smallholder versus large-scale production under a number of different scenarios.

The model distinguishes 4 smallholder agricultural (cropping) sectors, 4 large-scale agricultural (cropping) sectors, 3 other agricultural (non-cropping) sectors (fishing, forestry, and livestock), 15 manufacturing sectors, and 7 service sectors, including a distribution sector that provides marketing services particularly important to tobacco export trade. Tea, tobacco, and "other crops" are produced by both small and large-scale farmers; maize is a pure smallholder sector; and sugar is only produced by large-scale agriculture. In the data used for the study, agriculture represents 36% of GDP at factor costs, of which 22.5% is smallholder agriculture, 10.7% large-scale agriculture, and 2.8% non-crop agriculture. Manufacturing accounts for 20% of total GDP, while services account for the largest share in GDP, with 44%. The distribution sector alone accounts for 16.4% of total GDP.

2. Background

According to data from a 1998 social accounting matrix (SAM) for Malawi (Chulu and Wobst, 2001), tobacco production contributes 6% of total GDP and 17% of agricultural GDP. Smallholders contribute approximately one-third of production, while two-thirds of production is generated through the large-scale farms. The large-scale farming shows a slightly higher value-added share in sectoral production and is more capital (including

land) intensive than the smallholder production (table 1). The model assumes that land and capital markets in agriculture are segmented between the small and large-scale farmers, while there is a uniform labor market for all agriculture sectors.[1]

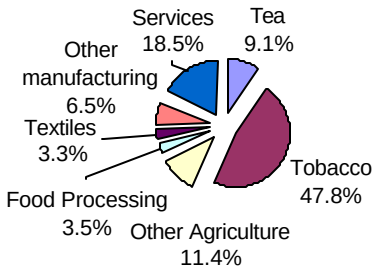
Table 1: Smallholder and large-scale tobacco production in Malawi's

	Smallholder production		Large-scale production	
	Share of GDP	Share of gross output	Share of GDP	Share of gross output
Intermediates		41.8		36.8
Labor	50.2	29.2	23.4	14.8
Land	29.9	17.4	30.4	19.2
Capital	19.9	11.6	46.2	29.2
Total	100.0	100.0	100.0	100.0

Source: Calculations based on Chulu and Wobst (2001).

Marketing costs accounted for 43% of final consumer prices of tobacco, which are explicitly incorporated into the data and modeling framework. The marketing services are provided by a distribution sector that constitutes 16% of total GDP and 11% of Malawi's total gross output. The marketing costs associated with tobacco (exports) account for 41% of total marketing costs in the economy and 89% of all export-related marketing costs, which underlines the links and dependencies between the two sectors.

Figure 1
Composition of Total Exports Values at World Market Prices (in %)

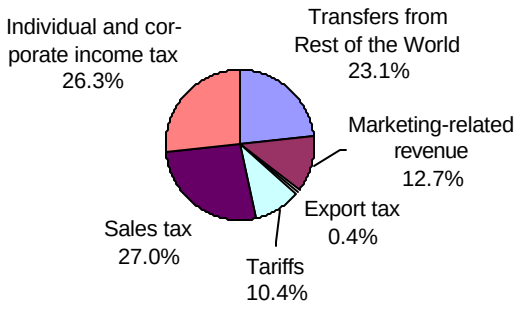


Almost all tobacco output is exported (98.2%) and tobacco contributes about 50% of total export earnings in Malawi. There is a minor (less than one percent) export tax on tobacco trade, generating a negligible amount (0.5%) of total government revenue. The Malawi SAM features a producer tax on the distribution sector that is equivalent to

[1] The data features four different labor categories that are distinguished by their level of education for agriculture, four educational labor categories for non-agriculture, two land categories (smallholder and large-scale), and three capital categories (smallholder and large-scale agriculture capital, as well as non-agriculture capital).

approximately 40% of the marketing costs associated with the tobacco sector, which captures government involvement in the auctioning process of tobacco in Malawi. The producer tax on distribution services accounts for 13% of government revenue, and more than 10% of non-agriculture corporate taxes are largely associated with the distribution sector, in which tobacco marketing accounted for the highest tax revenue earning activities in Malawi. Figure 1 shows the composition of Malawi's export earnings at world market prices, while Figure 2 shows the composition of total government revenue.

Figure 2
Composition of Total Government Revenue (in %)

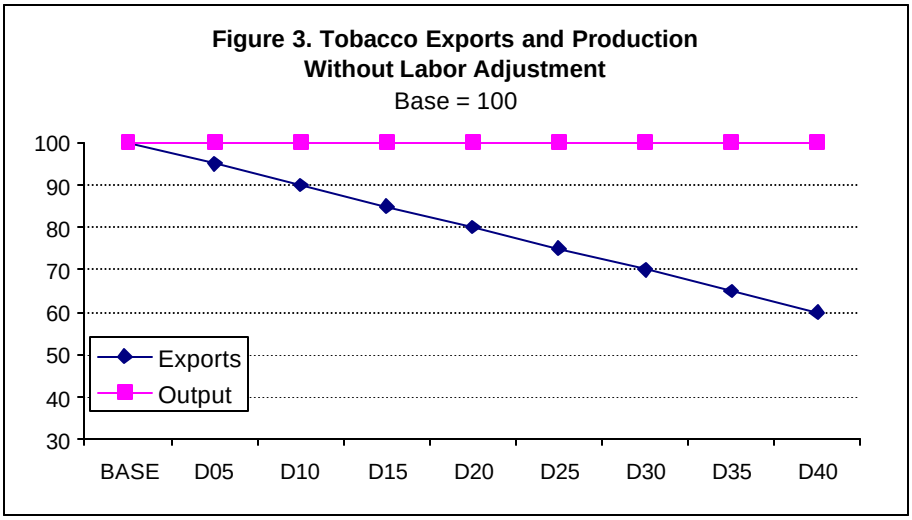


3. Effects of Decreasing Tobacco Export Price

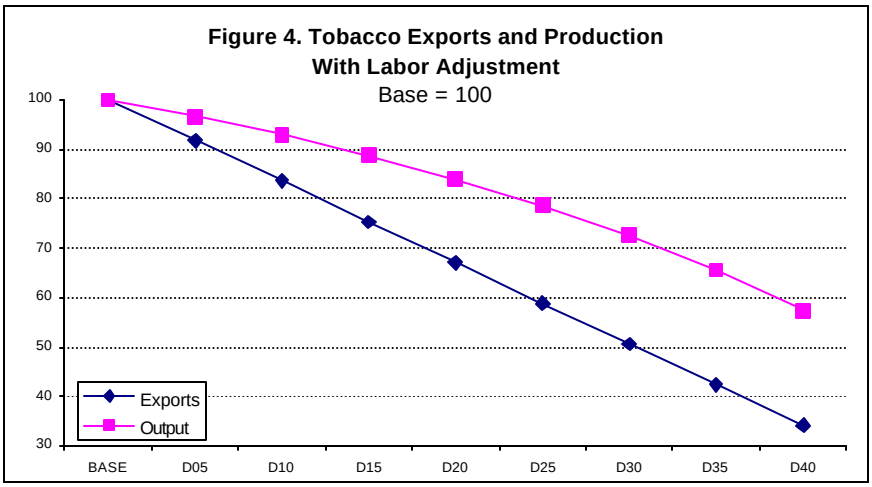
A simulation series is carried out which decreases the export price of tobacco by 5 percentage points in 8 consecutive steps to 60% of its initial value. In Malawi, tobacco is the largest cash crop that can steadily generate cash income to farmers. Moreover, as an export product, the market demand is relatively stable, and hence, the risk in growing tobacco is relatively small, compared to a crop highly dependent on the domestic market, such as maize or beans. For this reason, the cash profit, i.e., tobacco revenue minus cash expenditure such as the costs of fertilizers and payments to the bank interests, instead of total profit, is often the major concern for many farmers in making their production decisions. Thus, farmers may not count their labor costs (which are dominated by family labor) and returns to land (for farmers who own the land) when they grow tobacco. Hence, if the revenue from selling the products is more than the cash expenditure, farmers may still continue to grow tobacco even if the export price falls. For this reason, in the first scenario, we assume that farmers do not respond to the decline in the export price and still produce the same amount of tobacco products as in the base year. This scenario allows us to evaluate the effect of the declines in the export price of tobacco on farmers' income at a given level of production. In the second scenario, we assume that labor is mobile among agricultural sectors (but cannot move between agriculture and non-agriculture), while employment of land and capital is fixed at the base level. This scenario is employed to evaluate if, after a fall in the export price of tobacco, farmers

adjust their production by reallocating their labor among activities, if they change their production mix and what benefits or costs they face.

It is obvious that tobacco exports are badly hurt by the decline in the export price. Without adjusting production, the quantity of tobacco exports does not change, while revenue from tobacco exports falls by 40% if the tobacco export price declines by 40% (figure 3). If farmers respond to the decline in the export price by reducing labor supply employed in tobacco production, Malawi's total tobacco production falls by 43% with a 40% decline in the export price. Taking into account the decline in price, the value of tobacco exports at border prices falls by as much as 66% in this scenario (figure 4). Given that tobacco exports accounted for almost 50% of total national exports, such a huge decline in exports would definitely affect the entire economy, such as GDP, exchange rate and the level of domestic prices that consumers face. Moreover, as more than 10% of the agricultural labor force and almost 20% of land are employed in tobacco production, the external shock of the export price of tobacco would not only directly hurt farmers engaged in tobacco production, but also would affect those in the other production activities through the effect on the wage rate and returns to land and capital. In addition, the country's marketing activities absorbed about 17 and 11% of national labor force and total capital, respectively, and more than half of them are related to tobacco trading and exports. The decline in tobacco exports due to the fall in the tobacco price would also affect the non-agricultural economy and urban income. In the following sub-sections, we will discuss these effects in detail.



D05 – D40: Tobacco export price falls by 5 – 40 percent.



D05 – D40: Tobacco export price falls by 5 – 40 percent.

Tobacco profits under no labor adjustment

Without labor adjustment, farmers who engage in tobacco production are badly hurt by the decline in their cash income. The decline in cash income is not only due to the decline in the export price, but also due to the increase in the prices for intermediate inputs. As tobacco accounted for more than 50% of national exports, the large decline in the export price of tobacco causes the country's real exchange rate to depreciate. For example, the real exchange rate depreciates by 11.7% if the export price for tobacco falls by 40%. The depreciation in the exchange rate causes imports to be more expensive, and hence farmers have to pay more for the same amount of intermediate inputs, such as fertilizers, which are all imported. In the following table (table 2), revenue and cash expenditure per unit of tobacco products are presented.

Table 2. Revenue, intermediate cost, and profits per unit of tobacco output

(Revenue per unit of output in the base year is normalized to 100)

			Tobacco export price declines by							
	Base		*10%*		*20%*		*30%*		*40%*	
Farm Size	Small	Large	Small	Large	Small	Large	Small	Large	Small	Large
Revenue	100	100	87.61	87.61	74.33	74.33	60.12	60.12	44.94	44.94
Intermediate costs	41.81	36.76	42.16	37.08	42.50	37.39	42.84	37.70	43.18	38.01
Profits*	58.19	63.24	45.45	50.53	31.82	36.94	17.28	22.42	1.76	6.93

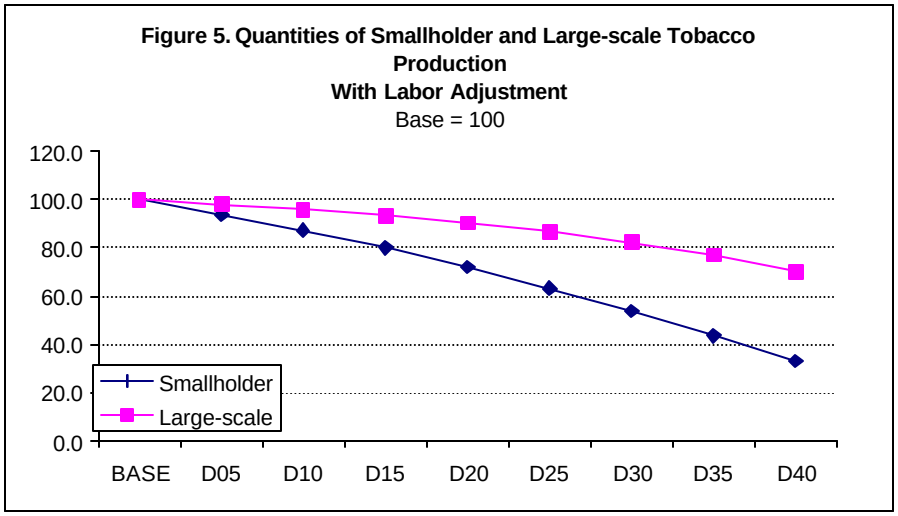
* Profits include returns to land, capital and labor.

Revenue is calculated as sales price multiplied by the quantity of output. For ease of comparison, we normalize the revenue per unit of tobacco products in the base year to be 100. Among the total revenue from selling tobacco products in the base year, the smallholders have to spend 41.8 on purchasing intermediate inputs, while the large farmers spend 36.8 on these. That is to say, returns to land, labor and capital accounted for, respectively, 58.2% and 63.2% of total revenues for the small and large farmers in

tobacco production. When the export price of tobacco declines by 40% but farmers still grow the same amount of tobacco, the costs of intermediate inputs increase to 43.2 for the smallholders and 38 for the large farmers. In the meantime, the revenue from selling tobacco falls to 45 from 100 in the base year. Putting these two factors together, the profits of tobacco production (sales revenue minus intermediate costs) fall to less than 2 for the smallholders and less than 7 for the large farmers (table 2), which implies that the profits now only account for 4% and 15% of sales revenue, respectively, for the small and large farmers. Tobacco production, once quite profitable by generating large profits at around 60% of sales revenues, becomes almost unprofitable, especially for the small farmers, as sales revenues barely cover the cash expenditure for purchasing intermediate inputs.

Tobacco profits under labor adjustment

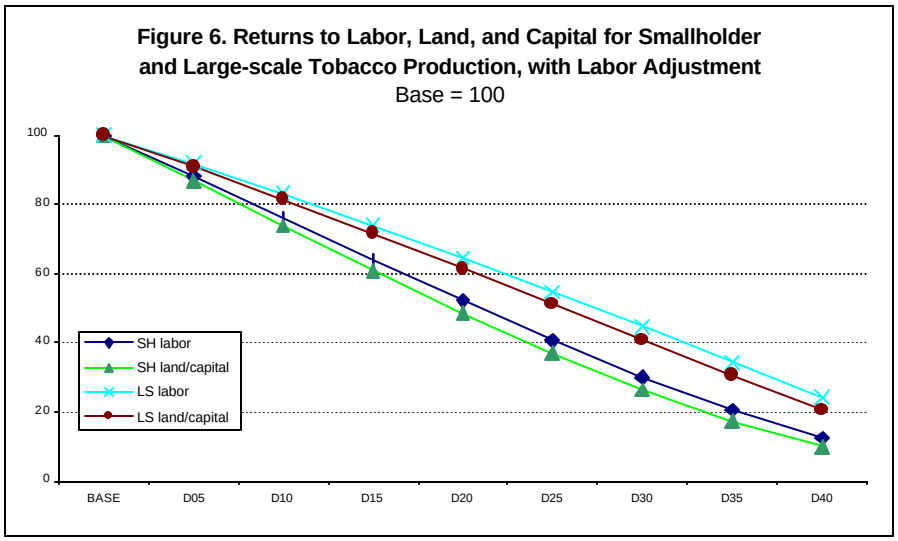
In the second scenario, we allow farmers to adjust their labor supply in tobacco production. In this scenario, both the small and large farmers in tobacco sectors are hurt due to the decline in both the price and output. Moreover, the smallholder's tobacco production falls more than the output of large-scale production (figure 5). In the base-line data, about 43% of tobacco was produced by the smallholders. The decline in the tobacco price causes the output of smallholders to fall by 67%, while the decline in the large-scale production is about 30%; the share of tobacco output produced by the smallholders falls to less than 4% of total output.



D05 – D40: Tobacco export price falls by 5 – 40 percent.

The difference in factor intensity between smallholders and large-scale production can partially explain why the production of the smallholders falls more. In general, smallholder agriculture is more labor intensive, while large-scale is more capital intensive (Appendix table 3). In the case of tobacco production, labor costs accounted for 50% of value-added for the smallholders, while labor costs only accounted for 23% of value-added for large-scale farming. Thus faced with the same external shock, the labor-intensive smallholders can adjust relatively more easily than the capital-intensive large-

scale producers. The model results show that if tobacco's export price falls by 40%, then the demand for labor in tobacco production falls by almost 90% among the smallholders, while it falls by 76% among the large-scale producers (figure 6).



D05 – D40: Tobacco export price falls by 5 – 40 percent.

Severe contraction in tobacco production reduces returns to land and capital employed in the tobacco sector. Still, returns to smallholder's land and capital fall more than to the large-scale producers, as smallholder production falls more (figure 6).

Non-tobacco sectors under labor adjustment

Table 3 Share of labor employment by sector, with labor adjustment
(Total agriculture is 100)

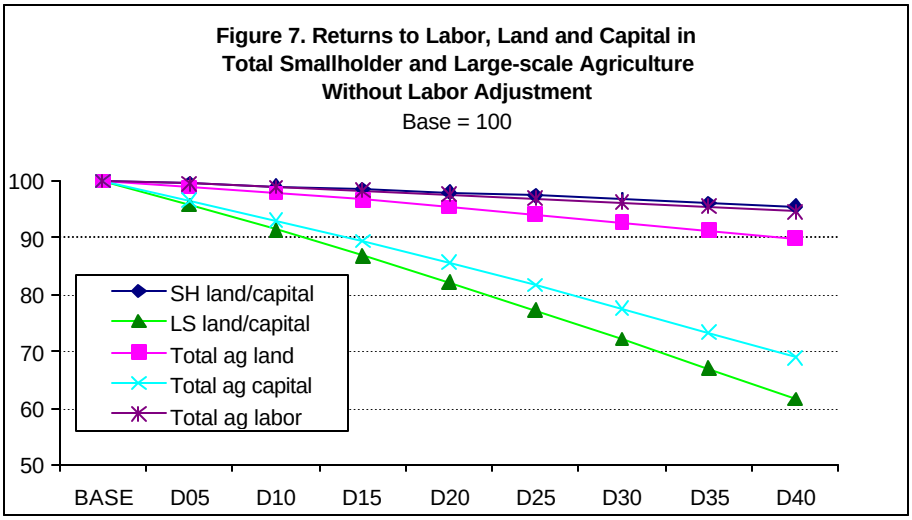
	Tobacco export price falls by				
	Base	*10%*	*20%*	*30%*	*40%*
Maize	26.4	27.2	28.0	28.7	29.4
Tea	1.3	1.5	1.8	2.0	2.3
Tobacco	10.2	8.2	6.0	3.8	1.9
Sugar	0.3	0.3	0.3	0.3	0.3
Other crops	51.0	52.1	53.3	54.6	55.7
Fishing	2.2	2.2	2.2	2.2	2.2
Livestock	3.4	3.4	3.3	3.3	3.3
Forestry	5.2	5.2	5.1	5.0	4.9

In the second scenario in which agricultural labor is mobile across all agricultural sectors, with the decline in tobacco production, more than 80% of workers or family laborers who formerly worked in the tobacco sector now have to find a job in the other agricultural activities. The released labor force is equivalent to 8% of the total agricultural labor supply, and most of the laborers move to the other crops and maize production. This causes the share of total agricultural labor employed in the other crops and maize to increase to 55.7% and 29.4%, respectively, while in the base year, the shares are 51% and

26.4%, respectively (table 3). Since in this scenario the model assumes that labor adjustment across sectors can be realized and hence the base year's total agricultural labor supply can be fully employed, we do not observe an increase in unemployment. However, it is quite possible that the released workers or family laborers from tobacco production cannot easily find a job in the other agricultural sectors which raises the unemployment rate. The model results presented here show that the maximum level of unemployment or underemployment due to the decline in tobacco production would be equivalent to 8% of the agricultural labor force.

Returns to agricultural factors

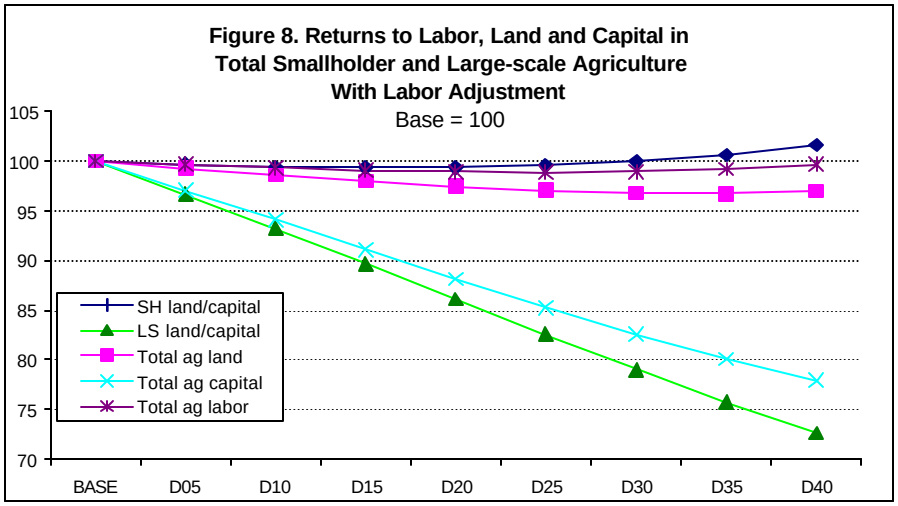
Given the full employment assumption, the wage rate for agricultural labor falls with the decreased tobacco price (figures 7 and 8). Without labor adjustment in tobacco production (Scenario 1), total returns to agricultural labor fall by 0.5 – 5.4%. The larger the decline in the tobacco price, the lower the returns to agricultural labor (figure 7). However, with labor adjustment in tobacco production (Scenario 2), the lowest level of labor return is observed if the tobacco price falls by 20 – 30% (the wage rates fall by 1%, figure 8). After that, the decline in the wage rate becomes smaller (with a slight fall of 0.3%). We explain this phenomenon by the difference in labor intensity across agricultural sectors. Except for smallholder tea production, tobacco production (both for the smallholder and large-scale farming) employs less labor per unit of output than the other agricultural sectors. In order to increase one unit of output, the other sectors need to employ more labor than what the tobacco sector releases. This eventually drives up the wage rate and hence causes the returns to labor to decline less than when more laborers are released from the tobacco sector.



D05 – D40: Tobacco export price falls by 5 – 40 percent.

While the returns to labor do not change much if the tobacco price falls, the total returns to other agricultural factors, especially to agricultural capital, fall more significantly. Returns to total agricultural land fall by 1.1 – 10.2% without labor adjustment in tobacco production (figure 7), and fall by 0.7 - 3% with labor adjustment (figure 8). Returns to

total agricultural capital, including operational profits, fall by 3.4 – 31.1% without labor adjustment (figure 7), and fall by 2.9 - 22% with labor adjustment (figure 8). Moreover, without labor adjustment in tobacco production, returns to land and capital fall in both small and large-scale production, but fall more in the large-scale production (figure 7). With labor adjustment, returns to land and capital in large-scale production fall by 3.7 - 27%, while returns to land and capital for the smallholders fall slightly if the price declines by less than 30%. These returns rise (to 1.7%) when the price further declines (figure 8).



D05 – D40: Tobacco export price falls by 5 – 40 percent.

The different results for the total returns to land and capital in the smallholder and large-scale agriculture still can be explained by the factor intensity, i.e., the difference in the mix of labor, land, and capital in the two agricultural segments. Since the smallholder agriculture is more labor intensive compared to the large-scale agriculture (Appendix table 3), returns to the relatively scarce resources – land and capital in the smallholder agriculture – would fall less than the decline in the returns to the same resources that are relatively abundant in the large-scale agriculture.

Marketing sector

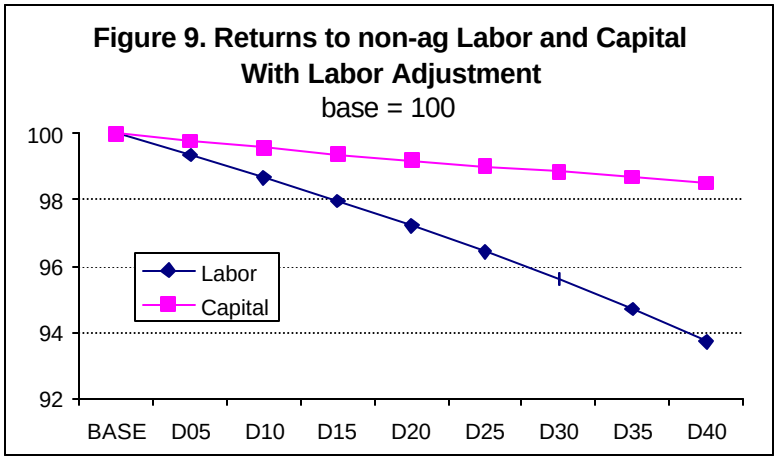
With the decline in tobacco production and exports, the marketing sector, which provides services in trade and transportation activities, is also badly hurt. As tobacco is the most important exporting commodity in the economy, revenue of the marketing service sector depends highly on tobacco trade. In the second scenario when labor is allowed to adjust in tobacco production, the decline in tobacco prices, and hence the fall in tobacco production and exports, leads to a reduction in the revenue of tobacco-related marketing services by 9 - 49% (table 4). Moreover, the decline in the demand for marketing services causes demand for labor in the sector to fall by 6 - 29%. As more than 17% of the national labor force is employed by the marketing sector, the 6 - 29% decline in the marketing labor demand implies that about 1 - 6% of the national labor force has to be relocated to other economic activities (table 4).

Table 4. Effects on the Marketing Service Sector, with Labor Adjustment

% change from the base

	Tobacco export price falls by			
	10%	*20%*	*30%*	*40%*
Sector revenue	-8.9	-19.7	-32.8	-49.1
Demand for labor	-5.5	-11.9	-19.5	-28.8
Returns to sectoral capital	-5.9	-12.9	-21.1	-31.0

The decline in the demand for the services of the marketing sector negatively affects the wage rate for non-agricultural labor, while the effects on capital returns among the different non-agricultural sectors differ. For some sectors, mainly exportable ones such as textile and tradable services, returns to sectoral capital rises as exports and hence output rise, while for the other sectors, typically those highly dependent on imports or non-tradables, such as chemical products and non-traded services, returns to sectoral capital falls as output of these sectors falls. In total, returns to the non-agricultural capital fall slightly by 0.2 - 1.5% (while returns to non-agricultural labor falls by 0.7 - 6.3%, see figure 9 for the case with labor adjustment).

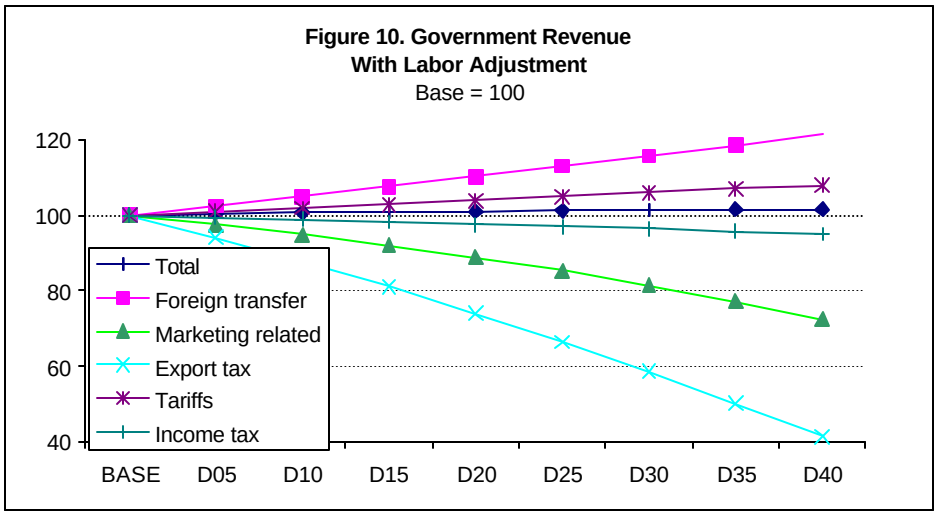


D05 – D40: Tobacco export price falls by 5 – 40 percent.

Governments buying power

Tobacco is one of the most important sources of Malawi's government income. However, even though government revenue from tobacco and tobacco-related activities (mainly corporate income tax from the marketing services) falls, total government revenue, calculated in the domestic currency, does not fall if the export price of tobacco falls (figure 10). There are two reasons to explain this phenomenon. First, government revenue is based in the domestic currency. When the export price of tobacco falls, as a large tobacco exporting country, the real exchange rate depreciates by 5 – 21.3% in the second scenario (with labor adjustment, see table 5). This causes government income from foreign transfers to appreciate in terms of the domestic currency. As foreign

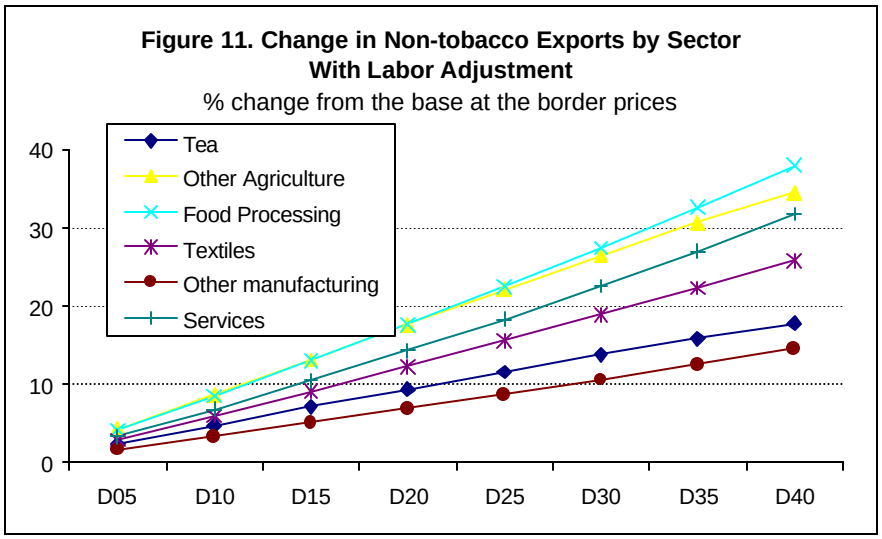
transfers accounted for more than 20% of the government total revenue (figure 2), the domestic currency depreciation allows the government income's buying power to increase. Second, the tariff revenue calculated by the domestic currency also increases due to the depreciation. While the total imports at the border price fall by 3.4 – 12.8% (table 5), the value of total imports in the domestic currency rises, allowing the government to have 2 - 8% more tariff income in terms of the domestic currency. Putting these factors together, total revenue for the government rises by 0.6 - 1.5% in terms of the domestic currency (figure 10).



D05 – D40: Tobacco export price falls by 5 – 40 percent.

Non-tobacco exports

The depreciation which results from the decline in tobacco prices encourages exports of non-tobacco commodities. After tobacco, there are six other important exporting sectors in the economy (see figure 1). While commodity exports from all six sectors rise, exports by processed food, other agricultural and tradable services such as hotel, banking and business services sectors, rise the most (more than 30% for a 40% fall in tobacco prices, see figure 11). It should be noticed that tourist related services are the second largest exporting sector after tobacco in Malawi, as foreign exchange earnings by this sector accounted for almost 20% of the total foreign exchange income in the economy. Moreover, this sector produces about 15% of GDP and employs more than 16% of the national labor force. Thus, to reduce the negative impact of the external shock caused by the world price decline, a country such as Malawi has to reduce its high dependency on a single agricultural good's exports and create a more diversified and flexible export structure.



D05 – D40: Tobacco export price falls by 5 – 40 percent.

Macroeconomic effects

The results of the macroeconomic effects of the decline in tobacco export price are summarized in table 5 for the case with labor adjustment. A 10 - 40% decline in the price of tobacco causes Malawi's real exchange rate to depreciate by 5 - 21%. While total exports at world prices fall by 0.01 - 6%, imports fall by 3.4 - 13%.[2] Total GDP at factor prices decreases by 0.1 - 1.8% and the consumer price level rises by 0.8 - 3.5%.

Table 5. Macroeconomic Effects, with Labor Adjustment
(% change from the base)

	Tobacco export price falls by			
	10%	*20%*	*30%*	*40%*
Exchange rate	5.0	10.3	15.7	21.3
Consumer price index	0.8	1.6	2.5	3.5
Real GDP at factor price	-0.1	-0.4	-0.9	-1.8
Exports at the world price	0.0	-0.7	-2.5	-6.0
Imports at the world price	-3.4	-6.6	-9.8	-12.8

4. Concluding Remarks

The above analysis provides evidence that despite the large share that Malawi's tobacco sector contributes to production, export earnings, and government revenues, there is potential for structural shifts within the economy. Although the tobacco sector suffers

[2] Because the producer price index of non-traded goods is chosen as the numeraire of the model, the real exchange rate of the model complies with neoclassical theory in the sense that it is defined as the relative price of traded to non-traded goods.

enormously from a decrease in its export price and the economy as a whole experiences a slight contraction and an increase in the domestic price level, other sectors adjust to the new situation, absorb displaced workers from the tobacco sector, increase production, substitute for losses in export earnings, and increase the overall tax base for the government.

In addition to the underscoring the role of relative prices between commodities in general and traded and non-traded goods in particular, the results show that factor markets are crucial in determining inter-sector shifts and structural changes within the economy. Both the relative factor use in a particular sector and the relative factor use in the entire economy (or respective segments, namely, smallholder agriculture, large-scale agriculture, and non-agriculture) drive the shifts of production and foreign trade. Furthermore, factor intensity turns out to be important in the context of Malawi's dual structure of tobacco production, featuring smallholder and large-scale activities. Employing most of the large-scale land and capital resources, the large-scale tobacco sector proves to be much less flexible to react to the negative exogenous price shock than the smallholder tobacco sector, which employs relatively little of total smallholder land and capital. Consequently, the large-scale sector shows a smaller decrease in production, but higher decrease in its land and capital returns than the smallholder sector.
The results also show that total government revenues do not necessarily decline when a large income-generating activity is negatively affected through price changes. Although income collected from tobacco-related taxes (export tax, marketing-related revenues, and corporate taxes) falls, overall government revenue slightly increases. This result occurs because of the real exchange rate depreciation which results in an increased value of transfers from abroad, as well as an increase in import and consumption prices which are the basis for the respective tax collections.

In sum, the analysis shows that it is highly risky for a developing country to heavily depend on exports of a single agricultural or primary commodity. To reduce such risk, a country has to create a more diversified and flexible export structure. This is the key for the Malawian economy to increase its capacity to cope with any severe negative world price shock. Although there is an inevitable negative effect on the tobacco sector as well as on the overall economy, the economic adjustments shown by the model simulations present a group of new conditions that may benefit the long-term economic development and growth in Malawian economy.

References

Chulu, O. and P. Wobst. 2001. A 1998 Social Accounting Matrix for Malawi. Trade and Macroeconomics Division Discussion Paper Series 69. International Food Policy Research Institute: Washington, D.C.

Löfgren, H. 2001. A CGE Model for Malawi: Technical Documentation. Trade and Macroeconomics Division Discussion Paper Series 70. International Food Policy Research Institute: Washington, D.C.

Appendix

Table A1: Structure of the economy by activity

	GDP[1]	Production	Labor share	Capital share	Land share
Maize	9.5	6.1	9.1	1.5	33.5
Tea, small-farmer	0.2	0.5	0.1	0.1	0.4
Tea, large-farmer	0.8	2.2	0.3	1.1	2.0
Sugar	0.2	0.3	0.1	0.3	0.6
Tobacco, small-farmer	2.1	2.1	1.8	1.3	5.5
Tobacco, large-farmer	4.2	3.9	1.7	6.3	11.5
Fish	0.6	0.4	0.8	0.4	
Livestock	1.1	1.8	1.2	1.4	
Forestry	1.2	0.8	1.8	0.6	
Other agr., small-farmer	11.6	6.9	12.2	3.7	30.7
Other agr., large-farmer	5.8	3.5	5.4	2.9	15.8
Mine	1.3	0.8	1.8	1.0	
Meat	0.7	2.0	0.4	1.4	
Dairy	0.6	0.6	0.4	1.2	
Grain milling	2.0	9.5	1.3	3.9	
Bakery	0.3	0.5	0.2	0.7	
Processed sugar	1.1	1.7	0.7	2.1	
Beverages	1.9	2.8	0.7	4.9	
Textile	0.9	2.8	0.6	1.8	
Wood	1.0	2.3	1.2	1.0	
Paper	1.6	1.9	0.4	4.5	
Chemicals	0.8	2.3	0.4	1.7	
Soap	1.6	1.9	0.6	4.2	
O. manufacturing	2.9	4.4	2.2	5.3	
Electricity	1.5	3.2	1.2	2.8	
Construction	2.4	3.2	1.8	4.3	
Distribution	13.4	10.8	17.1	11.3	
Hotel	4.1	3.2	4.8	4.3	
Telecommunications	4.7	3.6	4.4	7.1	
Financial services	4.0	3.0	4.3	4.8	
Business services	1.9	1.7	1.9	2.7	
Public services	10.4	6.7	15.2	5.2	
Personal services	3.7	2.6	4.0	4.5	
Total agriculture	37.2	28.5	34.5		
Total non-agriculture	62.8	71.5	65.5		
Total	100.0	100.0	100.0	100.0	100.0

[1] GDP at factor costs.

Table A2: Structure of the economy by commodity

	Composition (%)			Ratios (%)		Elasticity in	
	Export share	Import share	Absorption share	Exports to production	Imports to consumption	Imports	Exports
Maize	0.7	7.5	5.8	2.4	26.4	0.5	1.1
Tea, small-farmer	9.1	0.0	2.0	75.8	1.4	1.5	1.1
Tea, large-farmer			0.2				
Sugar	47.8		7.3	174.1		1.2	
Tobacco, small-farmer	0.1	0.0	0.3	6.2	2.1	1.5	1.5
Tobacco, large-farmer		0.0	1.3		0.3		1.1
Fish			0.6				
Livestock	10.6	0.3	7.7	22.4	1.1	1.5	1.5
Forestry			0.6				
Other agr., small-farmer		2.9	2.1		28.6		1.5
Other agr., large-farmer		0.5	0.6		23.5		1.5
Mine	0.1	2.4	7.4	0.2	6.9	1.5	1.5
Meat		0.7	0.6		30.2		1.5
Dairy	2.9	0.8	1.5	37.7	16.4	1.5	1.5
Grain milling	0.5	0.7	2.8	3.6	7.0	1.5	1.5
Bakery	3.3	6.8	3.6	25.7	49.5	1.5	1.3
Processed sugar	0.4	1.1	1.9	3.7	14.2	0.5	1.1
Beverages	0.8	3.1	2.3	8.9	33.0	0.5	1.1
Textile		6.8	1.6		95.5		
Wood	0.2	8.1	3.5	2.2	49.4	0.5	1.1
Paper	0.4	1.2	1.8	4.2	15.5	1.5	1.1
Chemicals	4.8	30.6	10.8	23.7	68.1	0.5	1.1
Soap			2.4				
O. manufacturing			2.8				
Electricity			7.5				
Construction	4.3	7.2	3.8	29.1	45.6	0.8	1.2
Distribution	5.1	8.5	4.7	31.6	46.8	0.8	1.2
Hotel	7.2	7.1	3.6	52.5	56.8	0.8	1.2
Telecommunications	1.9	3.6	1.9	24.4	43.4	0.8	1.2
Financial services			5.3				
Business services			1.9				

Table A3: Structure of production by activity

	Labor share	Capital share	Land share	Intermediates	Elasticity[1]
Maize	55.4	5.0	39.7	9.2	0.9
Tea, small-farmer	45.0	25.0	30.0	80.9	0.9
Tea, large-farmer	24.5	45.4	30.1	79.2	0.9
Sugar	24.9	45.0	30.0	56.3	0.9
Tobacco, small-farmer	50.2	19.9	29.9	41.8	0.9
Tobacco, large-farmer	23.4	46.2	30.4	36.8	0.9
Fish	79.0	21.0		16.4	0.9
Livestock	61.4	38.6		64.3	0.9
Forestry	84.6	15.4		10.1	0.9
Other agr., small-farmer	60.4	9.9	29.7	1.8	0.9
Other agr., large-farmer	54.0	15.4	30.6	2.0	0.9
Mine	76.3	23.7		6.9	0.9
Meat	36.5	63.5		80.5	0.9
Dairy	36.3	63.7		43.0	0.9
Grain milling	38.5	61.5		87.8	0.9
Bakery	40.9	59.1		60.4	0.9
Processed sugar	36.6	63.4		63.7	0.9
Beverages	20.2	79.8		59.3	0.9
Textile	38.7	61.3		80.4	0.9
Wood	69.4	30.6		74.5	0.9
Paper	14.7	85.3		48.8	0.9
Chemicals	33.2	66.8		80.0	0.9
Soap	20.6	79.4		50.6	0.9
O. manufacturing	42.9	57.1		61.5	0.9
Electricity	43.7	56.3		71.7	0.9
Construction	43.7	56.3		57.0	0.9
Distribution	73.7	26.3		9.8	0.9
Hotel	67.2	32.8		25.5	0.9
Telecommunications	53.2	46.8		21.6	0.9
Financial services	62.5	37.5		21.8	0.9
Business services	55.8	44.2		33.9	0.9
Maize	84.2	15.8		9.6	0.9
Tea, small-farmer	61.9	38.1		16.0	0.9
Agr. average	53.4	16.4	30.2		
Nagr. average	60.0	40.0			
Average	57.5	31.2	11.2		

[1] Elasticity of substitution among factor inputs in the CES production function

Chapter Three:
Simulating a Decrease in the World Price of Tobacco within a CGE Model – Results for Zimbabwe

Marcelle Thomas and Xinshen Diao

1. Introduction

Tobacco is the most important crop in Zimbabwe's agricultural sector. It accounts for 43% of agricultural value added, and nearly 41% of agricultural production. It represents 7% of total GDP and 35% of total exports.[3] Although production and trade have been increasing in the 1990s relative to the 1980s, they also have been more volatile. The 1992 and 1994-95 droughts may account for some of this volatility although tobacco is relatively drought tolerant (Keyser 2001). In the period from 1990 to 1993, production and area harvested increased by 55% and 57%, respectively. This is consistent with increases in the tobacco producer price, which peaked in 1991 at $Z 12,000 per metric ton, a 78% price increase from the previous year. Exports followed the same trend and saw a 59% increase during the same period. These trends were maintained for the rest of the 1990s but with more volatility.

This paper examines the changes in growth and income distribution, as well as shifts in the agricultural production structure, in Zimbabwe from a decrease in the world price of tobacco. The simulations, which consist of a series of 8 consecutive decreases of 5% each in the world price of tobacco, use a computable general equilibrium model for Zimbabwe (ZimCGE) with 1991 as the base period (Bautista, *et al*. 2000). Some important features of the Zimbabwe CGE model are an explicit focus on agriculture, distinction among various rural and urban household groups, and detailed specification of factor markets. The model also captures the extremely dualistic agrarian structure of the Zimbabwe economy and distinguishes between large-scale commercial farms and smallholder farms (mostly communal farms). The model makes use of a 1991 social accounting matrix (SAM) for Zimbabwe as the database.

2. The Model Structure and the Data

The ZimCGE model distinguishes among 27 commodities, including 13 agricultural commodities: maize, wheat, other grains, horticulture, coffee, tea, groundnuts, cotton, sugar, tobacco, other crops, cattle, and other livestock; three other primary-producing sectors: fishery, forestry, and mining; six manufacturing sectors: grain milling, other food processing, textiles, other light manufacturing, fertilizer, and other manufacturing; and five tertiary sectors: electricity, construction, trade and transport, private services, and public services. The Zimbabwe CGE model differentiates between smallholder and large

[3] These shares are based on the 1991 SAM used in this analysis but Keyser (2001) reports very similar shares for 2001.

scale farming (LSC) for the following commodities: maize, other grains, horticulture, groundnuts, cotton, other crops, cattle, other livestock, and forestry.

There are four labor categories in the ZimCGE model: unskilled workers working on LSC farms, formal unskilled workers, informal unskilled workers, and skilled workers. For historical and institutional reasons, the unskilled labor market in the LSC farm sector is isolated from the rest of the economy, and hence, we assume that unskilled workers in the LSC sector stay within this sector, but can move among different production activities within the sector. Because of this assumption, the average wage rate for the workers in the LSC sector may be different from the wage rate for other unskilled workers in the economy. It is assumed that there is an integrated labor market for the other unskilled workers working for the smallholder farms or for the non-agricultural sectors. It is reported that in Zimbabwe the minimum wage requirements and strict anti-dismissal rules artificially raise the real wages for unskilled workers in the non-agricultural sectors (World Bank 1995b), resulting in excess labor supply. The scarcity of formal-sector jobs forces many unskilled laborers to work in the lower-paying informal non-farm sector and smallholder farms. Given this fact, we exogenously fixed the wage rate for the formal unskilled workers and hence the formal unskilled-labor employment in the non-agricultural sector is demand-determined. Subtracting this from the fixed total supply of unskilled workers (net of those working in LSC farms) yields the supply of unskilled workers for smallholder farm and informal non-agricultural production. Their marginal products determine demand for the latter workers, and the market-clearing wage rate is inevitably lower than the exogenously determined formal-sector wage rate. Skilled workers, including those occupying management positions in LSC farms and in the non-agricultural sectors, are relatively scarce in Zimbabwe (Davies, *et al*. 1994,157). The skilled workers are assumed to be fully employed in the model and mobile across sectors. However, there are inter-sectoral differences in skilled labor wage rates, with the average rate determined by equating the fixed supply with total demand.

Land appears as a factor of production in the crop sectors only, and land market segmentation between smallholder and LSC farms is assumed in the model. Within each farming system, land is allocated among the various crop sectors according to its marginal value-added in those sectors.

Capital markets are segmented into three categories: smallholder agriculture, LSC agriculture, and the non-agricultural sector. Given the medium-term perspective of the present study, it is assumed that capital is mobile across sectors within each capital market category.

The model differentiates among five household groups, including three in rural: LSC farm owner/manager, LSC farm-laborer, and smallholder farm households; and two in urban: high-income (non-agricultural capitalist and skilled worker) and low-income (informal and unskilled worker) households. The induced relative income changes in the five household groups provide the basis for assessing the equity impact of policy experiments in the ZimCGE model.

Tobacco is mainly produced by large-scale farms in Zimbabwe. As in 1991, the share of tobacco products produced by the smallholders was quite small; we do not include a separate tobacco production activity for the smallholders. In the large-scale sector, tobacco accounts for almost 60% of production, 48% of unskilled labor, and 58% of cropped land. Including both skilled and unskilled workers, the large-scale tobacco production is quite labor-intensive, employing 48% of the unskilled and 67% of the skilled workers who are working in the large-scale farming sector (table 1). In terms of the sector's value-added, the share of labor costs accounts for more than 28% of total value added in tobacco production, which is the highest one among large-scale crop production activities (table 2).

Table 1. Large-Scale Farms Production by Activity (Large-scale sector is 100)

	Unskilled-Share	Skilled-Share	Capital Share	Land Share	Value-add Share	Production Share
Maize	5.8	3.0	4.9	6.2	3.8	4.7
Wheat	4.9	2.5	2.9	9.5	2.4	3.9
Other grains	0.6	0.3	0.4	0.6	0.4	0.4
Horticulture	4.6	2.4	3.8	4.7	4.1	3.7
Coffee	3.1	2.3	2.5	2.5	2.2	2.5
Tea	2.4	1.7	1.9	1.9	1.6	1.8
Groundnuts	0.5	0.3	0.4	0.5	0.4	0.4
Cotton	4.6	3.5	3.6	3.7	3.5	3.6
Sugar	7.0	5.4	5.6	5.8	5.0	5.7
Tobacco	47.7	67.1	57.1	57.9	50.7	59.2
Other crops	6.7	3.5	5.6	6.9	4.7	5.4
Cattle	3.0	1.9	2.2	0.0	8.9	1.8
Other livestock	6.8	5.2	6.4	0.0	10.4	5.1
Fish	0.9	0.4	0.9	0.0	1.1	0.7
Forestry	1.5	0.6	1.7	0.0	0.8	1.2
Large-scale farms in total agriculture	12.7	100.0	86.9	77.0	73.1	82.2

Source: Calculations based on Thomas and Bautista (2000).

Tobacco is the most important sector in terms of the country's exports. It made up more than 80% of agricultural exports and 35% of the country's total exports (see table 2 in the Appendix).

Table 2: Structure of Large-Scale Farm Production by Activity
(For labor, capital and land shares, sector's value-added = 100
For intermediate inputs, value of sector's output = 100)

	LABSHR	CAPSHR	LANDSHR	INPUT
Maize	18.6	60.9	20.5	34.6
Wheat	18.6	43.4	37.9	34.5
Other grains	18.6	60.9	20.5	34.6
Horticulture	18.7	61.2	20.1	36.7
Coffee	25.5	58.6	15.9	33.0
Tea	24.5	59.4	16.1	33.5
Groundnuts	18.9	63.3	17.9	31.8
Cotton	25.8	58.4	15.9	39.4
Sugar	25.6	58.5	15.9	33.5
Tobacco	28.1	56.6	15.3	33.6
Other crops	18.7	61.2	20.1	31.8
Cattle	28.3	71.7		87.9
Other livestock	27.1	72.9		70.8
Fish	19.2	80.8		33.5
Forestry	15.6	84.4		14.0

Source: Calculations based on Thomas and Bautista (2000).

3. Effects of Decreasing Tobacco Export Price -- Simulation Results

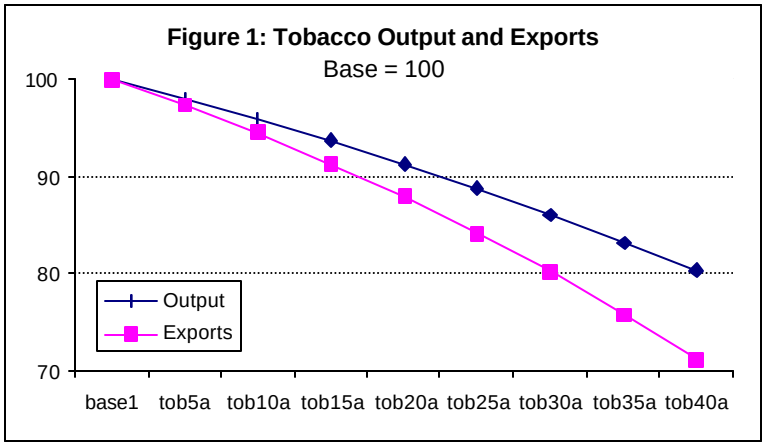
A simulation series is carried out by decreasing the world price for tobacco. We choose a 5-percent decline in the price in each simulation, and in total there are eight simulations in sequence. Since tobacco is the largest cash crop in Zimbabwe and its exports account for the largest share in country's total exports, a decline in the world price for tobacco will affect the whole economy, through its direct impact on tobacco production and trade.

Adjustments in Large-Scale Agriculture

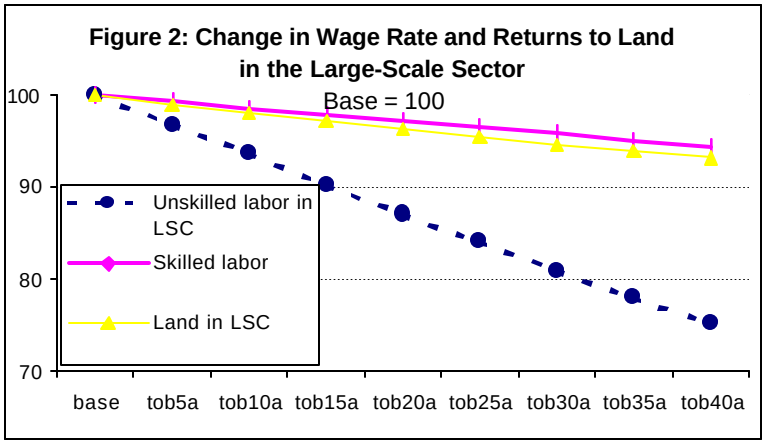
Not surprisingly, both the exports and production of tobacco are negatively affected by the fall in its world price (figure 1). Corresponding to the decline in production, farmers shift land to other crops and hence reduce their demand for hired workers in tobacco production. In the simulation, the price declines of 5 to 40% cause labor demand in tobacco production to fall by 2.5% to 26% (table 3).

The decline in the demand for workers by tobacco production drives the wage rate for unskilled labor down. The data show that in the base almost 50% of unskilled workers who are working on large-scale farms are hired in tobacco production, and tobacco production is quite labor intensive, i.e., absorbing more workers per unit of output than other factors. Moreover, those unskilled workers working on large-scale farms cannot freely move into urban non-agriculture, nor can they be hired by the small farmers. For these three reasons, even though other agricultural activities can hire more workers at a lower wage rate, the increased labor demand in other production activities still cannot

pull the wage rate up. Thus, in the simulations the wage rate for unskilled labor working in the large-scale farming sector falls by 3 to 25% with the simulated declines of the world tobacco price of 5 to 40%. On the other hand, as skilled workers can easily find jobs in the urban non-agricultural sectors, the wage rate for skilled labor only declines by 5% at most. (Figure 2)



tob5a – tob40a: reducing world price of tobacco by 5-40%.



tob5a – tob40a: reducing world price of tobacco by 5 to 40%.

The decline in tobacco production as well as the lowered wage rate create an opportunity for other crops' production to expand and hence to increase labor demand. In the simulations, almost all agricultural activities increase their demand for unskilled labor, and more than 60% of unskilled workers released from tobacco production are hired into sugar, cotton, coffee and maize production (table 3).

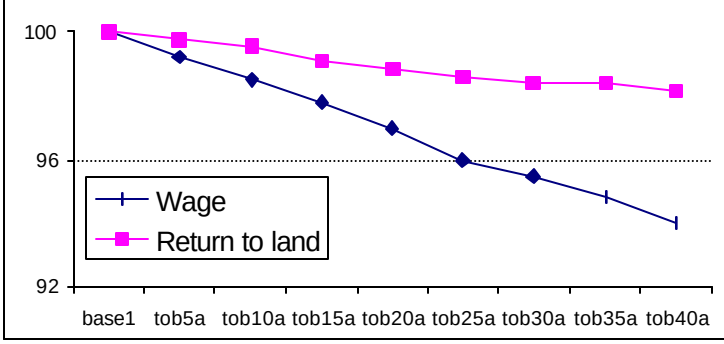
Table 3: Unskilled Worker Mobility among Production Activities in the Large-Scale Farming Sector

	Tobacco price declines by							
	5%	*10%*	*15%*	*20%*	*25%*	*30%*	*35%*	*40%*
	Total unskilled workers released from tobacco production is 100							
Maize	12.00	11.97	11.95	11.94	11.92	11.90	11.89	11.87
Wheat	4.92	4.92	4.91	4.91	4.90	4.89	4.88	4.87
Other grains	0.90	0.89	0.88	0.87	0.86	0.85	0.85	0.84
Horticulture	5.40	5.41	5.42	5.43	5.43	5.43	5.43	5.41
Coffee	11.82	11.80	11.78	11.77	11.77	11.78	11.80	11.82
Tea	9.81	9.78	9.75	9.73	9.71	9.70	9.70	9.70
Groundnuts	1.20	1.22	1.22	1.21	1.21	1.21	1.22	1.22
Cotton	12.78	12.70	12.64	12.58	12.53	12.48	12.43	12.40
Sugar	24.33	24.30	24.28	24.27	24.27	24.29	24.32	24.37
Other crops	9.45	9.42	9.38	9.33	9.28	9.22	9.17	9.11
Livestock	5.91	6.01	6.08	6.16	6.23	6.29	6.33	6.37
Fishing	0.75	0.75	0.74	0.74	0.73	0.73	0.72	0.71
Forestry	1.83	1.81	1.79	1.78	1.77	1.75	1.74	1.72
Percent of total tobacco workers released (compared to base)								
	-2.46	-5.15	-8.08	-11.23	-14.60	-18.17	-21.88	-25.69

Effects on the Small-Holder Agriculture

The small farmers are indirectly affected by the decline in the world prices, as the model does not include a separated tobacco sector for the smallholders. For this reason, the effect is quite small. The decline in the wage rate for unskilled labor hired by the large farmers causes the wage rate and land returns for the small-holders to fall, though this decrease is quite small (figure 3).

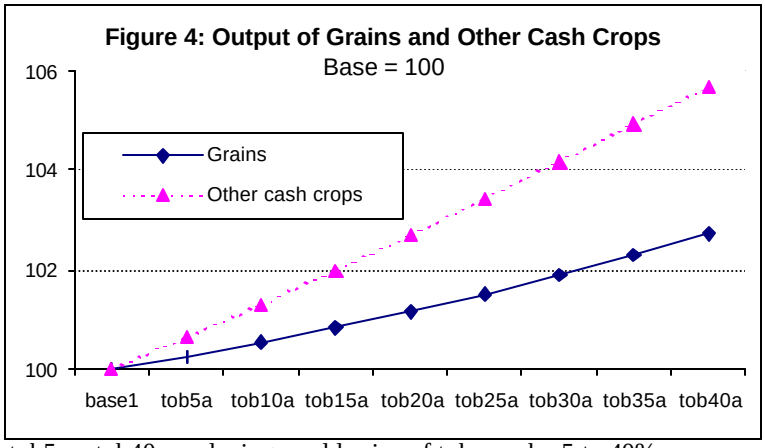
Figure 3: Change in Wage Rate and Returns to Land for the Small Farmers, base = 100



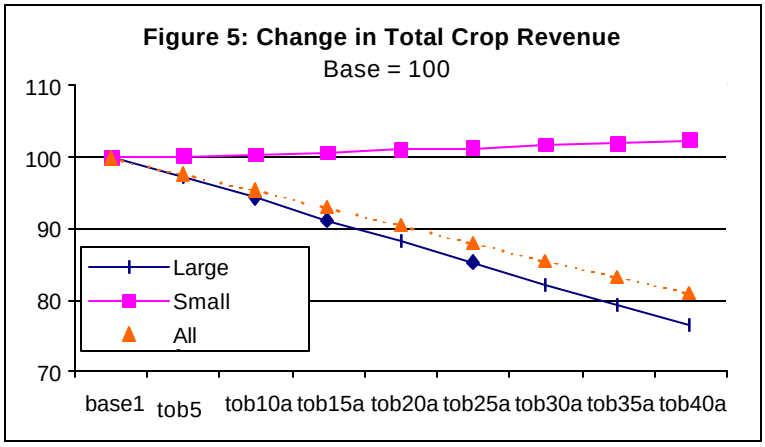
tob5a – tob40a: reducing world price of tobacco by 5 to 40%.

Effects on Non-Tobacco Sectors' Production and Trade

With the decline in tobacco production and lowered labor costs, the non-tobacco sectors' output increases, as do their exports. In the base, grains account for more than 10% of total crop production, while other cash crops (excluding tobacco) account for more than 30%. Output of both grains and other crops increases as labor and land are released from tobacco production. The production of other crops increases by 6% and grain production rises by less than 2% when tobacco prices decline by 40% (figure 4). However, as tobacco accounts for almost 60% of crop production in the base, total farm revenues generated from crop production still decline. While total crop revenue declines by more than 20% for the large farmers, total revenue of small farmers rises slightly (figure 5).



tob5a – tob40a: reducing world price of tobacco by 5 to 40%.



tob5a – tob40a: reducing world price of tobacco by 5 to 40%.

Exports from other agricultural sectors also change after tobacco production and exports decline. Besides tobacco products, there are 8 other exportable commodities among the agricultural sectors included in the model. All of these commodities' exports increase in the simulation (table 4). However, as tobacco products account for more than 80% of

total agricultural exports, increases in the exports of other commodities cannot replace the decline in tobacco exports, at least in short- to medium-run.

Table 4: Change in Agricultural Exports

	Share in total ag exports Total = 100	Tobacco prices decline by 5%	10%	15%	20%	25%	30%	35%	40%
		Base = 100							
Maize	2.6	103.7	107.5	111.3	115.3	119.4	123.4	127.5	131.6
Horticulture	0.5	102.2	104.4	106.5	108.8	110.9	113.1	115.2	117.3
Coffee	2.8	102.0	104.0	106.1	108.2	110.2	112.3	114.3	116.3
Tea	1.5	103.2	106.4	109.7	112.9	116.1	119.2	122.3	125.3
Groundnuts	0.3	104.5	109.1	114.0	119.0	124.2	129.5	134.9	140.4
Cotton	5.6	102.3	104.6	107.0	109.4	111.9	114.4	116.9	119.3
Sugar	3.5	103.4	106.9	110.4	114.0	117.5	121.0	124.4	127.8
Livestock	0.8	104.0	108.0	112.2	116.4	120.7	125.0	129.4	133.6
Tobacco	82.3	97.4	94.5	91.4	87.9	84.2	80.2	75.9	71.3

Macroeconomic Effects

The results of the macroeconomic effects of the decline in the export price of tobacco are summarized in table 6. A 5 to 40% decline in the world price of tobacco causes Zimbabwe's real exchange rate to depreciate by 2 to 16%. As tobacco is produced mainly for exports, the domestic consumer price level is barely affected by the change in the world price of tobacco. While total exports (including nonagricultural exports) measured in world prices rise slightly, total imports fall by 1 to 7%. Given that tobacco accounts for more than 7% of GDP, even though some other agricultural production rises, the decline in tobacco production causes real GDP to fall by 0.6 to 4.5%. With the depreciation of the exchange rate, government revenue does not decline, even though the revenue from tobacco-related activities falls.

Table 6: Macroeconomic Effects (% change from the base)

	Tobacco price declines by *5%*	*10%*	*15%*	*20%*	*25%*	*30%*	*35%*	*40%*
Exchange rate	2.0	4.0	6.0	8.0	10.0	11.9	13.8	15.6
Consumer price index	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Real GDP at factor price	-0.6	-1.1	-1.7	-2.3	-2.8	-3.4	-4.0	-4.5
Exports at the world price	0.5	0.9	1.3	1.6	1.7	1.8	1.7	1.4
Import at the world price	-1.0	-2.0	-3.0	-4.0	-4.9	-5.8	-6.6	-7.4
Government revenue	0.1	0.3	0.4	0.5	0.6	0.8	0.8	0.9

References:

Bautista, Romeo M. and Marcelle Thomas. "Macroeconomic and agricultural reforms in Zimbabwe: Policy complementarities toward equitable growth," TMD Discussion Paper No. 57, International Food Policy Research Institute, Washington, DC, June 2000.

Keyser, John C. "The costs and profitability of agriculture," paper prepared for the World Bank Health, Nutrition and Population Division. March 2001.

Appendix

Table 1: Structure of the Economy by Activity

	GDPFC	PROD	LABSHR	CAPSHR	LANDSHR
Maize, large-scale	0.5	0.4	0.2	0.7	4.7
Maize, small-holder	1.0	0.8	1.2	0.5	8.1
Wheat	0.4	0.4	0.2	0.4	7.3
Other grains, large-scale	0.0	0.0	0.0	0.1	0.4
Other grains, small-holder	0.2	0.2	0.3	0.1	1.5
Horticulture, large-scale	0.4	0.4	0.2	0.5	3.6
Horticulture, small-holder	0.2	0.2	0.3	0.1	1.9
Coffee	0.3	0.2	0.1	0.3	1.9
Tea	0.2	0.2	0.1	0.3	1.5
Groundnuts, large-scale	0.0	0.0	0.0	0.1	0.4
Groundnuts, small-holder	0.3	0.2	0.3	0.1	2.1
Cotton, large-scale	0.4	0.4	0.2	0.5	2.8
Cotton, small-holder	0.6	0.4	0.6	0.2	8.5
Sugar	0.6	0.5	0.3	0.8	4.4
Tobacco	6.6	5.6	3.8	7.6	44.6
Other crops, large-scale	0.6	0.5	0.2	0.8	5.3
Other crops, small-holder	0.1	0.1	0.1	0.0	1.0
Cattle, large-scale	0.2	0.9	0.1	0.3	
Cattle, small-holder	1.2	0.7	1.7	0.7	
Other livestock, large-scale	0.6	1.1	0.3	0.9	
Other livestock, small-holder	0.4	0.3	0.6	0.3	
Fish	0.1	0.1	0.0	0.1	
Forestry, large-scale	0.1	0.1	0.0	0.2	
Forestry, small-holder	0.1	0.1	0.2	0.0	
Mining	4.5	4.1	2.8	6.4	
Grain milling	0.6	1.0	0.4	0.8	
Other food processing	6.9	8.1	1.7	12.3	
Textile	3.0	3.7	2.9	3.3	
Other light manufacturing	6.0	6.2	6.5	5.7	
Fertilizers	0.5	1.0	0.4	0.6	
Other manufacturing	10.3	12.8	8.1	12.9	
Electricity and water	2.7	2.1	1.9	3.6	
Construction	3.1	6.4	4.8	1.5	
Trade and transport	16.7	17.2	19.0	15.2	
Public services	14.1	9.9	21.8	7.0	
Private services	16.5	13.9	18.5	15.4	
Total agriculture	15.3	13.6	11.2	15.4	100.0
Total non-agriculture	84.7	86.4	88.8	84.6	
Total	100.0	100.0	100.0	100.0	100.0

Table 2: Structure of the Economy by Commodity

	Composition			Ratios		Elasticity	
	Export share	Import share	Absorption share	Export ratio	Import ratio	Export 1.25	Import 3.00
Maize	1.0	0.0	0.5	22.3	0.0	1.25	3.00
Wheat	0.0	0.2	0.2	0.0	9.8	1.25	3.00
Other grains	0.0	0.1	0.1	0.0	24.7	1.25	3.00
Horticulture	0.2	0.1	0.4	7.2	1.7	1.25	3.00
Coffee	1.2	0.0	0.2	72.9	0.0	1.25	3.00
Tea	0.6	0.0	0.1	52.9	0.0	1.25	3.00
Groundnuts	0.1	0.0	0.1	28.7	0.0	1.25	3.00
Cotton	2.4	0.0	0.6	43.3	0.0	1.25	3.00
Sugar	1.5	0.0	0.4	39.0	0.0	1.25	3.00
Tobacco	34.5	0.2	4.7	91.7	0.5	1.25	3.00
Other crops	0.0	0.0	0.5	0.0	0.0	1.25	3.00
Cattle	0.0	0.0	1.3	0.0	0.0	1.25	3.00
Other livestock	0.4	0.0	1.0	4.5	0.0	1.25	3.00
Fish	0.0	0.0	0.1	0.0	0.0	1.25	3.00
Forestry	0.0	0.0	0.1	0.0	0.0	1.25	3.00
Mining	12.6	1.2	3.5	44.1	4.1	1.25	0.75
Grain milling	0.0	0.0	1.1	0.0	0.0	2.00	1.25
Other food processing	2.5	2.0	6.9	4.8	3.3	2.00	1.25
Textile	1.7	3.7	3.6	6.7	11.7	2.00	1.50
Other light manufacturing	2.0	5.3	5.8	4.7	10.4	2.00	1.50
Fertilizers	0.1	4.0	1.5	2.0	31.2	2.00	1.50
Other manufacturing	16.5	77.6	23.4	18.6	38.1	2.00	1.50
Electricity and water	0.0	0.0	1.5	0.0	0.0	2.00	1.25
Construction	0.0	0.0	4.6	0.0	0.0	2.00	1.24
Trade and transport	0.0	0.0	11.8	0.0	0.0	0.50	0.50
Trade and transport-export	0.0	0.0	1.4		0.0		
Trade and transport-import	0.0	0.0	2.4		0.0		
Trade and transport-domestic	0.0	0.0	4.9		0.0		
Public services	0.0	0.0	7.0	0.0	0.0	0.50	0.50
Private services	22.6	5.6	10.2	24.0	6.3	0.50	0.50

Table 3: Structure of Production by Activity

	LABSHR	CAPSHR	LANDSHR	INPUT	ELAST-P
Maize, large-scale	18.64	60.88	20.48	34.57	0.75
Maize, small-holder	58.71	23.33	17.95	24.69	0.75
Wheat	18.64	43.44	37.93	34.51	0.75
Other grains, large-scale	18.62	60.87	20.51	34.57	0.75
Other grains, small-holder	61.36	21.92	16.72	24.65	0.75
Horticulture, large-scale	18.71	61.19	20.10	36.75	0.75
Horticulture, small-holder	61.17	20.36	18.47	20.70	0.75
Coffee	25.52	58.59	15.89	33.01	0.75
Tea	24.54	59.36	16.10	33.48	0.75
Groundnuts, large-scale	18.88	63.26	17.86	31.83	0.75
Groundnuts, small-holder	60.36	20.94	18.70	20.70	0.75
Cotton, large-scale	25.78	58.37	15.85	39.39	0.75
Cotton, small-holder	52.34	14.31	33.36	20.84	0.75
Sugar	25.58	58.55	15.88	33.48	0.75
Tobacco	28.12	56.61	15.27	33.57	0.75
Other crops, large-scale	18.70	61.23	20.07	31.83	0.75
Other crops, small-holder	60.51	19.59	19.89	20.70	0.75
Cattle, large-scale	28.29	71.71		87.88	0.75
Cattle, small-holder	70.93	29.07		12.03	0.75
Other livestock, large-scale	27.13	72.87		70.76	0.75
Other livestock, small-holder	64.65	35.35		2.43	0.75
Fish	19.17	80.83		33.52	0.75
Forestry, large-scale	15.56	84.44		14.03	0.75
Forestry, small-holder	91.09	8.91		0.00	0.75
Mining	30.63	69.37		38.68	0.50
Grain milling	34.65	65.35		67.17	1.50
Other food processing	12.44	87.56		52.38	1.50
Textile	46.78	53.22		54.78	1.50
Other light manufacturing	53.22	46.78		46.49	1.50
Fertilizers	41.31	58.69		71.39	1.50
Other manufacturing	38.58	61.42		55.29	1.50
Electricity and water	34.65	65.35		30.76	1.50
Construction	76.01	23.99		73.12	1.50
Trade and transport	55.66	44.34		45.55	0.90
Public services	75.70	24.30		20.72	1.50
Private services	54.57	45.43		33.56	1.50
Total agriculture	35.87	49.32	14.81	37.15	
Total non-agriculture	51.24	48.76		45.21	
Total	48.89	48.85	2.26	44.11	

Chapter Four:
Simulating a Decrease in the World Price of Tobacco within a CGE Model - Results for Turkey

Xinshen Diao

1. Structure of the Model

The Turkey-tobacco CGE model is based on a 1997 social accounting matrix (SAM) for Turkey built using the Global Trade Analysis Project (GTAP) database version 5, pre-release #3. This SAM aggregates the Turkish economy into 14 production sectors (including 8 agricultural sectors), and there is a one-to-one mapping between production activities (the producing sectors) and commodities (the outputs produced). However, there are no tobacco and cigarette production sectors in the original data. Thus, some necessary adjustments are made according to the purpose of the study. We split the "*tobacco leaf*" sector from the " *other crops*" sector that is included in the original dataset and "*cigarettes*" from the "*cigarette and beverage*" sector according to the production and trade shares of tobacco and cigarettes in the economy. These shares are obtained from the report "Economics of Tobacco Production in Turkey (Kasnakoglu and Cakmak, 2000).

The Turkey-tobacco model is used to simulate the possible impact of a fall in the world tobacco price and changes in domestic tobacco policies. Like other CGE models, the model has a medium-run focus. We report the results of comparative static experiments in which we "shock" the model by changing some exogenous variables and then compute the new equilibrium solution. The model incorporates a simple macro closure that does not account for any short-run adjustment mechanisms (such as Keynesian multipliers). In the model, aggregate real investment, government consumption, and the trade balance are assumed fixed (with the real exchange rate adjusting to equilibrate aggregate exports and imports), so domestic savings are assumed to adjust to achieve macro equilibrium.

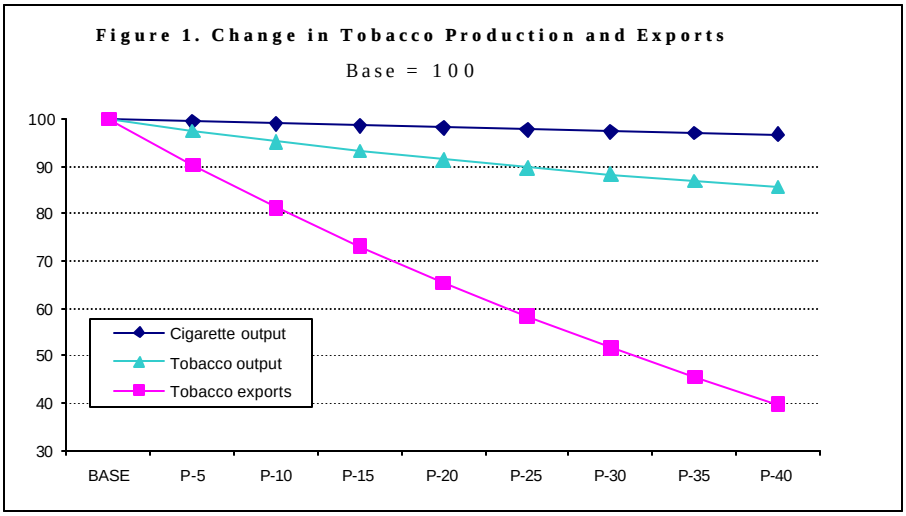
2. Simulation Analysis

Two groups of policies are simulated using the Turkey-tobacco model. The first group of simulations focuses on the possible reduction of tobacco production and exports and their impact on the rest of the Turkish economy due to declines in the world tobacco price. This simulation series is carried out by reducing world tobacco prices by 40 percent in 8 consecutive steps of 5 percent decreases. As Turkey ranked as the 4th largest tobacco exporter in the world and tobacco exports accounted for about 50 percent of production, this scenario is designed to evaluate how the Turkish economy will be affected if the world tobacco price continuously declines in the coming years. The second group of simulations focuses on domestic policies. There are two scenarios: increasing the cigarette sales tax, and removing government subsidies on tobacco production. These two scenarios are employed to evaluate the possible impacts of a change in domestic

policies on cigarette consumption and tobacco production in Turkey. Given its general equilibrium features, the model also captures the spillover effects of changes in production and consumption of tobacco products on the rest of economy.

Experiment1: Reducing the world tobacco price

As exports accounted for about half of total tobacco output, it is obvious that the falling world price of tobacco hurts the tobacco sector seriously, i.e., exports of unprocessed tobacco products decline by 34 percent and production contracts by 14 percent when the world price falls by 40 percent. The reduction in the tobacco supply also negatively affects cigarette production since domestic sources of unprocessed tobacco accounted for more than 80 percent of total tobacco inputs employed by the cigarette industry (figure 1).



P-5 – P-40: World price of tobacco falls by 5 – 40 percent.

While Turkey is one of the largest tobacco exporters in the world, tobacco exports only accounted for 2 percent of total exports by Turkey. For this reason, the decline in the world price of tobacco does not generate strong impacts on the Turkish macro economy. For example, the real exchange rate, defined as the ratio of prices for non-tradable and tradable goods, only depreciates by 0.2 percent and the consumer price index only rises by 0.13 percent if the world tobacco price falls by 40 percent. The slight depreciation in the real exchange rate encourages exports by other sectors while imports contract, but these changes are quite small (see table 1 for the change in exports by non-tobacco sectors).

The decline in the world price of tobacco does not affect government revenue much. Revenues from tobacco-related activities accounted for about 5 percent of Turkish government revenue (Kasnakoglu and Cakmak). A decline in tobacco production and exports could negatively affect government revenue, while a depreciated exchange rate could raise government revenue collected from non-tobacco activities. Putting these two

factors together, government revenue calculated in real terms actually rises slightly (about 0.2 percent, see table 2).

Table 1. Model Results: Change in Exports from Non-Tobacco Sectors (% change from the base)

	P-5	P-10	P-15	P-20	P-25	P-30	P-35	P-40
Grains	0.16	0.30	0.43	0.54	0.65	0.75	0.84	0.92
Vegetable & fruits	0.22	0.42	0.60	0.77	0.92	1.06	1.19	1.31
Oilseeds	0.33	0.64	0.91	1.17	1.40	1.62	1.82	2.01
Sugar	0.14	0.27	0.38	0.49	0.59	0.67	0.75	0.83
Cotton	0.38	0.72	1.04	1.32	1.58	1.82	2.04	2.24
Other industrial crops	0.14	0.26	0.37	0.47	0.56	0.64	0.71	0.77
Livestock	0.11	0.22	0.31	0.39	0.47	0.53	0.59	0.65
Beverage	0.05	0.09	0.13	0.16	0.20	0.23	0.25	0.28
Other processed food	0.01	0.02	0.02	0.01	0.01	0.00	-0.01	-0.02
Textile	0.24	0.46	0.65	0.83	0.99	1.13	1.27	1.39
Other manufacturing	0.08	0.15	0.21	0.28	0.33	0.39	0.44	0.49
Services	0.07	0.14	0.20	0.26	0.31	0.36	0.41	0.45

P-5 – P-40: World price of tobacco falls by 5 – 40 percent.

Table 2. Model Results: Change in Government Revenue (% change from the base)

	P-5	P-10	P-15	P-20	P-25	P-30	P-35	P-40
Total	0.04	0.08	0.11	0.14	0.17	0.20	0.22	0.24
Tariffs	-0.02	-0.04	-0.06	-0.07	-0.09	-0.11	-0.12	-0.14
Indirect tax	0.13	0.24	0.35	0.45	0.54	0.62	0.70	0.77
Sales tax	0.03	0.05	0.07	0.09	0.11	0.12	0.14	0.15

P-5 – P-40: World price of tobacco falls by 5 – 40 percent.

Table 3. Model Results: Change in Returns to Factors (% change from the base)

	P-5	P-10	P-15	P-20	P-25	P-30	P-35	P-40	S-ALL
Total land	-0.25	-0.47	-0.68	-0.87	-1.04	-1.20	-1.34	-1.48	-0.70
Land for tobacco	-2.62	-4.96	-7.07	-8.96	-10.68	-12.25	-13.67	-14.97	-0.22
Unskilled labor	-0.07	-0.13	-0.19	-0.24	-0.29	-0.34	-0.38	-0.43	-0.001
Skilled labor	0.004	0.007	0.008	0.008	0.007	0.006	0.004	0.001	-0.038
Capital	0.004	0.006	0.007	0.007	0.006	0.004	0.001	-0.002	-0.078

P-5 – P-40: World price of tobacco falls by 5 – 40 percent.
S-ALL: Removing subsidies in tobacco production.

Land devoted to tobacco production is about 1.5% of total cultivated land in Turkey while tobacco manufacturing generated roughly 1% of GDP. Thus, the fall in the world

price of tobacco also affects returns to production factors. While the negative effect on the return to land devoted to tobacco production is much larger than the effect on land in other sectors, returns to skilled labor and capital are almost unchanged (table 3).

Experiment 2-1: Increasing the cigarette sales tax

More than 5 billion packs of cigarettes are consumed in Turkey annually, and cigarette consumption has increased by 2.5 times in the last 30 years (Kasnakoglu and Cakmak). This makes Turkish people vulnerable to smoking health hazards. In 1996, the government issued a law to discourage smoking and cigarette advertising. However, cigarette consumption has still increased in recent years. In this scenario, we assume that the government will raise the cigarette sales tax to discourage smoking. According to Kasnakoglu and Cakmak, the sales tax on cigarettes is about 36 percent of the retail price. We incorporate this rate into the base, and then increase it by 10%, 20% and 30% to show the sensitivity of tobacco demand to the tax increase. A 10% tax increase implies that for a given tobacco price, consumers have to spend 10% more to consume the same amount of tobacco products.

Data on the price elasticity of cigarette demand is not available for Turkey. For this reason, we choose an elasticity that we used for the case of China. That is, we assume that if consumers have to pay a 1% higher price to buy a pack of cigarettes, their demand for this brand of cigarettes would fall by about 0.4 percent. With this elasticity, demand for tobacco products falls slightly with increase in the cigarette tax. With a 10-percent increase in the sales tax, demand for tobacco products falls by 2 percent, while when the tax increases by 30 percent, demand falls by 6 percent. Since demand does not fall much and the price (including tax) paid by consumers rises, consumers have to spend more on tobacco products. Cigarette spending increases by 4 percent when the tax rate rises by 10 percent and increases by 13 percent when the tax rate rises by 30 percent (table 4).

Table 4. Model Results: Change in Tobacco Demand and Supply (% change from the base)

	P-10	P-20	P-30	T-10	T-20	T-30	S-ALL
Demand for cigarettes	-0.78	-1.47	-2.08	-2.02	-4.05	-6.07	-1.73
Expenditure on cigarettes	1.23	2.36	3.39	3.89	8.29	13.29	2.87
Supply of tobacco	-4.69	-8.49	-11.61	-0.48	-0.96	-1.44	-5.33
Supply of cigarettes	-0.91	-1.71	-2.41	-2.02	-4.04	-6.06	-2.02

P-10 – P-30: World price of tobacco falls by 10 – 30 percent;
T-10 – T-30: Cigarette sales tax rises by 10 – 30 percent;
S-ALL: Removing subsidies in tobacco production.

As Turkey's cigarette exports are insignificant, domestic cigarette production falls with the decline in demand for cigarettes (table 4). This further affects tobacco production negatively. For example, a 30-percent increase in the cigarette sales tax results in a 1.5 percent decline in tobacco output. As domestic demand for tobacco leaves falls due to the decline in cigarette production, exports of unprocessed tobacco products rise by almost 2 percent.

Experiment 2-2: Removing production subsidies in the tobacco sector

As with other crops, the Turkish government employs price supports and input subsidies to support tobacco production. In this scenario, we remove the subsidies in the tobacco sector (but leave the subsidies in the other crop sectors unchanged) to assess the possible impact of such a policy change. The subsidy rate in the base is equivalent to 10 percent of the value of the inputs employed by tobacco production. Removing this subsidy implies that tobacco growers have to pay the full price for the inputs they use in production and hence tobacco production becomes less profitable.

As table 4 shows, tobacco production is negatively affected by the subsidy removal as the supply of tobacco production falls by more than 5 percent. This effect is larger than the change in the scenario where the world tobacco price falls by 10 percent. Moreover, due to the decline in tobacco production, output of cigarettes and hence demand for cigarettes both fall. Such declines are also relatively strong compared to a 10-percent fall in the world price of tobacco.

Reference

Kasnakoglu, Haluk and Erol H. Cakmak (2001) "Economics of Tobacco in Turkey," research report submitted to FAO.

Appendix

Table 1: Structure of the economy by activity

	GDP	Production	Total labor	Capital	Land
Grains	2.5	1.8	3.3	0.6	14.7
Vegetable & fruits	6.4	3.4	8.5	1.4	38.1
Oilseeds	0.4	0.2	0.5	0.1	2.1
Sugar	1.0	1.2	1.3	0.2	5.7
Cotton	0.1	0.1	0.1	0.0	0.4
Tobacco	0.9	0.4	1.1	0.2	5.0
Other industrial crops	2.2	1.3	2.9	0.5	13.0
Livestock	4.7	4.3	5.0	2.6	21.0
Cigarettes	0.1	0.3	0.1	0.1	0.0
Beverage	0.9	0.8	0.4	1.3	0.0
Other processed food	2.0	4.7	1.5	2.6	0.0
Textile	3.0	5.7	1.8	4.1	0.0
Other manufacturing	15.8	26.9	10.4	21.6	0.0
Services	60.2	48.8	63.1	64.6	0.0
Total agriculture	18.1	12.7	22.6	5.6	100.0
Total non-agriculture	81.9	87.3	77.4	94.4	0.0

Table 2: Structure of the economy by commodity

	Composition (%)			Ratios (%)		Elasticities	
	Export share	Import share	Absorption share	Export ratio	Import ratio	In Armington	In CET
Grains	0.2	0.7	1.5	1.1	7.7	1.5	1.5
Vegetable & fruits	5.1	0.5	2.6	16.3	3.4	1.5	1.5
Oilseeds	0.1	0.4	0.2	6.1	26.6	1.5	1.5
Sugar	0.0	0.0	0.9	0.0	0.0	1.5	1.5
Cotton	0.2	0.9	0.2	21.3	70.9	1.5	1.5
Tobacco	1.8	0.0	0.3	46.0	0.0	0.5	0.0
Other industrial crops	0.3	0.7	1.1	2.3	10.9	1.5	1.5
Livestock	0.6	1.9	3.7	1.6	8.2	1.5	1.5
Cigarettes	0.0	0.2	0.5	1.0	5.7	0.5	0.5
Beverage	0.5	0.6	0.6	6.3	17.1	1.5	1.5
Other processed food	4.7	2.0	3.9	10.8	8.8	1.5	1.5
Textile	30.2	5.0	5.2	56.8	29.1	1.5	1.5
Other manufacturing	31.4	59.5	37.6	12.6	27.1	1.5	1.5
Services	24.9	27.7	41.7	5.5	11.1	1.5	1.5

Table 3: Structure of production by activity

	Total value added = 100			Intermediate
	labor	Capital	Land	Inputs (1)
Grains	53.0	12.0	35.0	48.1
Vegetable & fruits	53.0	12.0	35.0	18.4
Oilseeds	53.0	12.0	35.0	20.1
Sugar	53.0	12.0	35.0	66.4
Cotton	53.0	12.0	35.0	71.8
Tobacco	53.0	12.0	35.0	23.1
Other industrial crops	53.0	12.0	35.0	23.1
Livestock	43.2	30.3	26.6	56.7
Cigarettes	35.4	64.6		76.1
Beverage	20.9	79.1		52.7
Other processed food	31.0	69.0		81.8
Textile	24.7	75.3		77.6
Other manufacturing	26.6	73.4		72.8
Services	42.3	57.7		45.9
Average	50.4	16.7	32.8	
Ag average	38.1	61.9		
Non-ag average	40.4	53.7	5.9	

(1) Value of output is 100.

Chapter Five:
Impact of Tobacco Control on China's Economy
– A General Equilibrium Analysis

Xinshen Diao and Sherman Robinson*

1. Structure of the Model

Data and China's Social Accounting Matrix

The data used for the China-tobacco CGE modeling study are originally from the 1997 Chinese social accounting matrix (SAM) obtained from China. This SAM aggregates China's economy into 124 production sectors, and there is a one-to-one mapping between production activities (the producing sectors) and commodities (the outputs produced). The SAM provides an input-output table, values of labor and capital inputs, operational surpluses, government indirect taxes, value of output for 124 sectors, rural and urban consumers' expenditures by commodity, investment and inventory by sector, and values of imports and exports of each commodity.

Based on the original SAM, we create an 18-sector SAM for the China-tobacco study (see table 1 for sector specification). However, there is no tobacco leaf production sector in the original SAM. Moreover, the original SAM lacks information regarding land inputs and tariff rates, and government expenditure by commodity (except for government expenditure on social services). Thus, the following adjustments are made according to the goals of the study. First, we split the "*tobacco leaf*" sector from the "*crops*" sector according to the value of tobacco leaf products. Data for the output of tobacco leaf products is from FAO, while the price data are drawn from the annual household "National Crop Production Cost and Labor Productivity Survey," published by the National Bureau of Statistics in *China Rural Statistical Yearbook*. The split tobacco leaf sector accounted for 3% of total crop production in value terms. Second, the value of land inputs is split from the value of labor inputs in crop and tobacco leaf sectors according to the ratio of each input in the total value added of crop sectors in the GTAP (Global Trade Analysis Project) database, version 5. Third, government expenditures by commodity are split from the urban household expenditures according to information from GTAP. Finally, import tariff rates by commodity are added into the SAM. While the tariff rates for tobacco leaves and tobacco products are found in the data provided by FAO, tariff rates for other sectors are from the GTAP database.

Model Structure

Based on the 18-sector SAM, we develop a China-tobacco CGE model for the study. Except for the tobacco sectors, the model is in the tradition of a single country, static

* We are grateful to Moataz El-Said for outstanding research assistance in data aggregation and computer program development.

CGE model developed by Robinson et al (1982). For each of the 18 sectors, the model specifies output-supply and input-demand equations. Output supply is given by constant elasticity of substitution (CES) functions with constant returns to scale over inputs of labor, capital and land while intermediate inputs are demanded in fixed proportions. Profit-maximization by producers is assumed, implying that each factor is demanded so that marginal revenue product equals marginal cost (except for the tobacco sector).

According to the "Law of the People's Republic of China on Tobacco Monopoly" issued by the government in 1992, tobacco production, marketing, cigarette processing, distribution and trade are strictly controlled by the government. For this reason, prices and production quotas for tobacco leaf and cigarettes are solely determined by the government, while production activities are conducted by individual farmers (in the case of tobacco leaf production) or firms (in the case of tobacco products). In general, these producers have profit maximizing motivation in making input combination decisions (even though most of the firms are still state-owned), but cannot produce more than the quota level, as the government is the monopolist buyer. This is typical behavior for a centrally planned economy with market activities in which a production quota prevails, and hence, the standard monopoly model cannot adequately capture this feature. For this reason, we do not introduce a monopolist structure in the tobacco sector. Instead, we allow the CES production function to exhibit decreasing returns to scale over inputs of labor, capital and land for tobacco leaf and cigarette production, while the output quotas and their corresponding prices are chosen by the government at levels such that there exists a positive profit in the tobacco sector. While after-tax profit in tobacco leaf production goes to farmers, most of the profits from cigarette production are taken away by the government. Moreover, at given quota levels, marginal revenue product is not necessarily equal to marginal cost in the tobacco sector. As tobacco production is generally more profitable than other crops and cigarette production is one of the most profitable sectors in China, we assume that the marginal revenue product in the tobacco sector is higher than the marginal cost measured by the factor rental rates in the economy. Specifically, we define a shadow price for each input employed in the tobacco sector which is higher than the rental rates paid by farmers and firms in the non-tobacco sectors.

The factor payments become households' income in the model. We disaggregate factor payments into incomes for rural and urban households. Urban per capita income is much higher than rural income in China. However, as the rural population accounted for about 70% of total population, we assume that total income for the rural and urban groups are almost the same (but the sources of income are different for the two groups). Except for the returns to land, total capital income earned by the urban households is higher than the capital income for the rural. Given their income level, the demand for commodities by the two aggregate households is derived from a linear expenditure system, i.e., the income elasticity for each commodity is not unitary and hence the expenditure share on each commodity is not fixed.

There are more than 1000 different cigarette brands of which the qualities are quite different. For this reason, we disaggregate tobacco products into two quality groups – low- and high-quality tobacco products, each of which accounts for 50% of the total.

Moreover, the price for the low-quality product (and hence the profit margin) is about 30% lower than that for the high-quality one. We further assume that the rural households consume more low quality tobacco products and the urban households consume more high quality ones.

On the foreign trade side, as with other CGE models, the China-tobacco model specifies that goods produced domestically are imperfect substitutes with foreign goods. Composite demand is an aggregation of imports and domestic goods supplied to the domestic market. Demands for imports and domestic goods are derived from an Armington function. On the supply side, exports and domestic good supplies are derived from a CET (constant elasticity of transformation) function by maximizing revenue from total sales; the CET aggregation of supply to foreign and domestic market equals the total output.

Trade in tobacco leaves and tobacco products accounted for quite a small share both in total production and consumption. Moreover, trade is strictly controlled by the government. For these two reasons, demand for tobacco imports and exports of tobacco leaves and products are assumed to be exogenous variables, and not derived from the traditional Armington and CET functions (which are employed for the other non-tobacco sectors). However, in the tobacco trade liberalization scenario, we have to relax this assumption on the import side to allow imports and hence demand to be affected by liberalization (while tobacco exports is still an exogenous variable).

According to the information provided by FAO, domestic cigarettes are quite different from imported ones in terms of flavor and taste and hence it is difficult and takes time for Chinese smokers to change their preference. For this reason, we choose a very low level of substitution elasticity between imported and domestic tobacco products, while the substitution elasticity for the high- and low-quality domestic products is quite high. In addition, as the price for foreign cigarettes is higher than the domestic type, we assume that all imported cigarettes are high-quality ones; that is, there is imperfect substitutability between imported cigarettes and high-quality domestic cigarettes.

The China-tobacco model is used to simulate the possible impact of changing domestic tobacco policies or trade policies. Like other CGE models, the model has a medium-run focus. We report the results of comparative static experiments in which we “shock” the model by changing some exogenous variables and then compute the changed equilibrium solution. We do not explicitly consider how long it might take the economy to reach the new equilibrium, or what other adjustments (such as investment changes, technology transfers, productivity shifts, etc.) might occur as well. The model's time horizon has to be viewed as “long enough” for full adjustment to occur, given the shock. While useful to understand the pushes and pulls the economy will face after introducing a shock, this approach has obvious shortcomings. In particular, it does not consider the costs of adjustment, such as transitional unemployment, that might occur while moving to the final equilibrium. However, given the fact that tobacco manufacturing only employed a very small portion of total urban workers (about 500,000), and most of Chinese farmers

who grow tobacco leaves also plant other crops at the same time, this shortcoming is not too critical in affecting the robustness of the model results.

Given the medium-run focus of the analysis, the model incorporates a simple macro closure that does not account for any short-run adjustment mechanisms (such as Keynesian multipliers). In the model, aggregate real investment and government consumption are assumed to be fixed proportions of aggregate GDP. The trade balance is also assumed fixed (with the real exchange rate adjusting to equilibrate aggregate exports and imports), so domestic savings are assumed to adjust to achieve macro equilibrium.

2. Simulation Analysis

Two groups of policies are simulated using the China-tobacco model. The first group of simulations focuses on the possible reduction of tobacco consumption due to changes in some domestic policies. We choose three scenarios: increasing cigarette consumption taxes, raising the price of cigarettes, and reducing low-quality cigarette production. The second group of simulations focuses on the impact of tariff reduction on imports and consumption of tobacco products. Given the general equilibrium features of the model, each simulation also results in changes in production and consumption of both tobacco and non-tobacco products, in employment of tobacco manufacturing workers, in income of farmers, and in government revenues.

Experiment 1-1: Increasing cigarette consumption taxes

China is the largest cigarette consuming country with more than 320 million smokers. This makes China quite vulnerable to smoking health hazards. In this scenario, we assume that the government will use a cigarette consumption tax policy to discourage smoking. Data on the current level of cigarette consumption taxes are not available and hence are not included in the SAM. For this reason, we impose a uniform consumption tax for all tobacco products consumed by consumers in the simulations. We choose three different tax rates, 10%, 20% and 30%, to show the sensitivity of tobacco demand to the consumption tax. The tax base is the tobacco expenditure in the base year. A 10% increase in the consumption tax means that if the tobacco price is unchanged, consumers have to spend 10% more to consume the same amount of tobacco products.

While several recent studies on demand for cigarettes in China (Mao et al, 1999; Hu et al, 1999) argue that cigarettes are a normal good in China, which implies that demand for cigarettes would fall with an increase in the price of cigarettes, the data did not support this argument. For this reason, we choose two different price elasticities for cigarette demand: low and high. The low elasticity is about one-third of the elasticities for other consumption goods (-0.1), while the high elasticity is the same as that for other consumption goods (-0.4). With the low elasticity, demand for tobacco products falls slightly with a cigarette consumption tax. With a 10% increase in the consumption tax, demand for tobacco products falls by less than 1%, while when the consumption tax increases to 30%, the demand falls by 2%. With the high elasticity, demand for cigarettes would fall by 3.6 - 9% with the 10 – 30% increase in the consumption tax. In the

following analysis, we only discuss the results obtained from the low elasticity scenarios. As the demand does not fall much and prices (including tax) paid by consumers rise, consumers have to spend more on tobacco products. Total tobacco expenditure rises by 9% when the consumption tax rate is 10% and rises by 27% when the tax rate is 30%. For this reason, the share of tobacco spending in total consumption expenditure rises to 4.9% and 5.4% for the rural and urban households, respectively, from the base levels of 3.9% and 4.3% (table 1.1-1).

If tobacco products become more expensive and if consumers' income remains unchanged, demand for the other commodities should fall. However, in a general equilibrium model, households' income also changes. In the model, rural households' income comes from returns to land and capital, labor income, and profits of tobacco leaf production, while urban income comes from returns to capital and wages. Given the static features of the model, we assume that capital cannot move across sectors (that is, the level of capital employed by each sector does not change in the simulations). With a decrease in demand for tobacco products at given level of stocks, we assume that the government will reduce the production quota for farmers who grow tobacco leaves and reduce the output plan for firms who are in the tobacco manufacturing sector. A lowered production quota forces the farmers to grow less tobacco leaves and, as a result, land and labor move to the other sectors. This causes returns to land and especially to capital and profits in tobacco leaf production to fall, resulting in a 0.02% to 0.06% decline of rural household income (table 1.1-2). The effect of a high consumption tax on wage rates is minimal as the tobacco sector employs quite a small portion of the total labor force (first row in table 1.1-2). On the other hand, while returns to capital employed in the tobacco sector fall, capital returns in many other manufacturing sectors and services rise. For these reasons, income for the urban households actually rises slightly. The government's income also rises, mainly from the increased tobacco consumption tax. Excluding the new consumption tax revenue, the government income from the tobacco sector (mainly from profits and indirect taxes on producers) falls (the last two rows in table 1.1-2).

As rural households' income falls and urban income rises slightly after imposing the tobacco consumption tax, rural consumers' demand for the non-tobacco goods also falls, while the urban demand for the non-tobacco goods rises slightly. Thus, measured by the equivalent variation, the rural consumers are worse off. The net welfare loss for rural consumers is about 4.4 to 13.3 billion RMB (table 1.1-3). The effect on urban consumers is mixed. If the decline in tobacco consumption is a dominant factor, urban consumers will be worse off too. Otherwise, the urban consumers are better off. In this simulation, the negative effect of declining tobacco consumption on welfare plays a dominant role and hence urban consumers are also worse off due to the increase in the tobacco consumption tax. The net welfare loss for them is about 2 to 6 billion RMB (table 1.1-3). However, this welfare measure does not take into account the health effect, which, due to lack of data, is not included in the study.

Tobacco production and hence employment are also affected by the tobacco consumption tax. Even though tobacco output is determined by the government, farmers and firms have to make input combination decisions. Due to the decline in the demand for tobacco

products after the consumption tax is imposed, the government has to adjust tobacco production plans in order not to increase the stock. For example, a 30% increase in the tobacco consumption tax results in a 1.2% decline in leaf production and 1.9% decrease in manufacturing production. The fall in the production quota forces farmers to employ less land and labor and causes firms to employ less labor in tobacco production. While land can be shifted to grow other crops, the released labor surplus is mostly employed by the construction sector (table 1.1-4).

Experiment 1-2: Raising cigarette prices

Results from the previous simulation show that imposing a tobacco consumption tax cannot effectively reduce tobacco consumption much. Given the fact that China's tobacco sector is highly controlled by the government, it is more feasible for the government to directly raise tobacco prices instead of imposing a consumption tax. For this reason, we conduct the second experiment in which instead of a tobacco consumption tax, the government directly raises the prices for all tobacco products (but not for tobacco leaves). We exogenously raise tobacco product prices by 10%, 20%, and 30%, similar to the case of imposing consumption taxes in the first experiment. By so doing, we can compare the results of this experiment with what we discussed in the previous sub-section.

Raising cigarette price seems less effective in discouraging tobacco consumption than imposing a consumption tax. Total cigarette demand only falls by 0.01 – 0.02% with a 10 – 30% rise in cigarette prices (table 1.2-1). However, raising tobacco prices affects returns to land, capital, wages and hence household income much more than the rise in tobacco consumption taxes. Comparing table 1.2-2 with table 1.1-2, we notice that the wage rate falls by 0.11 to 0.33% in the second experiment, while the wage rate is almost unchanged in the first experiment. Even though the returns to land and profits from tobacco leaf production fall less than the decline in the first scenario, as labor returns fall, total income for rural households falls by 0.08 – 0.23%, much more than in the first scenario (table 1.1-2 and table 1.2-2).

High cigarette prices make tobacco manufacturing much more profitable than before and hence both capital returns and profits in this sector significantly rise (table 1.2-2). This result contrasts with the result from the first experiment in which both capital returns and profits in the tobacco production sector fall. That demand and output of tobacco products fall but returns to capital and profits in the sector rise is a sign of an incorrect policy choice in terms of economic efficiency, as such high prices can build up an umbrella to protect low-efficiency, state-owned firms in the sector.

While returns to the tobacco sector's capital rise, capital returns in most other manufacturing and service sectors fall in the second experiment. This, together with a fall in wages, causes urban households' income to fall, while in the first experiment, it rises slightly (table 1.2-2).

Raising tobacco product prices directly increases the government's revenues. A 30% hike in tobacco product prices results in a 33% increase in government revenue coming from the tobacco sector. However, as the economy becomes less efficient, total government revenue rises less than in the first experiment (0.64 – 1.92% compared to 1.79 – 5.32%; see the last two rows in table 1.1-2 and table 1.2-2).

Experiment 1-3: cutting low-quality cigarette production

A careful analysis of the reality of China's cigarette production and consumption suggests that reducing low-quality cigarette production would be a more effective way to discourage cigarette consumption. We assess this possibility by conducting the third experiment in which the government gradually reduces the production plans for low-quality cigarette production. We choose the reduction range between 5 – 50% with a 5-percentage increase for each scenario.

As expected, cigarette demand falls much more than in the first two experiments. Total demand falls by 8.4% when the low-quality cigarette output is cut by 50% (table 1.3-1a). This result holds with either the low or high price elasticity for cigarette demand, i.e., the choice of demand elasticity does not affect this outcome. Moreover, demand for the low quality cigarettes falls by 70%, while demand for the high quality one only rises by 43%. As low quality cigarettes are more harmful for health, substituting from low-quality to high-quality products would further reduce the unhealthy effects on smokers.

With the decline in demand for low-quality cigarettes, total cigarette and therefore, tobacco leaf, production falls. When low-quality cigarette production is cut by 50%, output of tobacco manufacturing and tobacco leaves falls by 5.6% and 3.2%, respectively (table 1.3-3). However, as high-quality cigarettes are more profitable than the low-quality type, the negative effect on total income is smaller than in the first two experiments for the rural households and than in the first experiment for the urban household. Moreover, government revenue from the tobacco sector rises by 9.3% when the low-quality production is cut by 50%, resulting in a slight increase in total government revenue (table 1.3-2).

Experiment 2: Reducing tariffs on tobacco imports

We further experiment to assess the possible impact of trade liberalization on the tobacco sector. While China is the largest tobacco producer and consumer in the world, trade in tobacco leaves, cigarettes or other tobacco products is quite small. In the base year of 1997, tobacco leaf imports and exports accounted for 1.5% and 3.4% of total consumption and production, respectively, while imports and exports for tobacco products accounted for 6.6% and 3.2% of total consumption and production, respectively (table 2-1).

Tobacco trade is strictly controlled by the government in China and imports face a high tariff barrier. The government announced that the tariff rate for tobacco leaf imports is 40% for Most Favored Nation-status countries and 70% for non-MFN-status countries

and the tariff rate for cigarette imports is 65% for the MFN and 180% for the non-MFN. However, the *applied* rates are much lower than the allowed rates and vary from year to year. For this study, we choose the MFN rates of 40% for leaf imports and 65% for the product imports as the base. According to China's WTO commitments, the average tariff rates in China will be reduced to 17% from the current level of 22%. Data on the specific commitments to tobacco trade are not available and hence in this scenario we reduce tariff rates for tobacco leaf and product imports by 24%, which is a same percentage that China promised for the average tariff cut.

Given that imported cigarettes are different from China's domestically produced ones in flavor and taste, we choose a low elasticity for the substitution between foreign and domestic tobacco products in the scenario. With such a low elasticity, a 24% cut in tariffs imposed on tobacco imports (including imports of leaves and products) only induces 1.7% and 5.5% more imports for the leaves and products, respectively, and shares of imported products in total consumption are almost unchanged (table 2-1). If we double the elasticity, imports of tobacco leaves and products will increase by 3.6% and 9.8%, respectively. Again, the share of imports in total consumption only rises slightly.

Cigarette production is a highly profitable sector and most profits are taken away by the government. The data from the SAM show that in the base year (1997) total government revenue from the tobacco sector was about 81 billion RMB, which accounted for 6.4% of total government revenue. As imports accounted for a small amount of total consumption, and tariff revenue from tobacco imports was about 4 billion RMB, equivalent to 1.7% of total tariff revenue (table 2-2). Given that tobacco import tariffs are not a major source of government revenue, the 24% tariff reduction in tobacco imports only lightly affects the government's total revenue (table 2-2).

The effect of the tariff reduction on consumers is quite small. Cigarette consumption accounted for about 5% of consumers' expenditure both in the rural and urban areas. As the low- and high-quality cigarettes are highly substitutable, with increased demand for the high-quality products, demand for the low-quality types falls, resulting in less than a 1% change in the total cigarette demand both for the rural and urban households (table 2-3).

The effects of the tariff reduction on tobacco production as well as on farmer income and employment in tobacco manufacturing are very small. If stocks of tobacco leaves and products remain unchanged, output of both tobacco leaves and cigarettes falls slightly, by -0.05% and 0.7%, respectively (table 2-4). With a slight fall in tobacco leaf production, about less than 1% of labor and land leave this sector and go to other crop production. Moreover, farmer's production profit from growing tobacco falls by 0.7%. In the tobacco manufacturing sector, the employment number falls by 2% (table 2-4).

References

China's National Statistical Bureau, Department of Rural Social and Economies (1985-98) *China Rural Statistical Yearbook*, Beijing, China: China Statistical Publishing House.

Robinson, Sherman, Kemal Dervis, and Jaime de Melo (1982) *General Equilibrium Models for Development Policy*, Cambridge University Press, 1982. Reprinted by the World Bank, 1989.

Table 1. Sector specification in the SAM for the study

	Name of the sector in the model	Specification of the sector
1.	CROPS	Crops
2.	TOBLEAF	Tobacco leaf
3.	FORESTRY	Forestry and products
4.	LIVESTOCK	Livestock and products
5.	OTHERAGR	Other agricultural products
6.	BEVERAGE	Beverage
7.	TOBACCO	Tobacco products
8.	ENERGY	Energy
9.	INDUSTRY	Other heavy industry
10.	OTHERIND	Special industrial equipment, motor vehicles and other transport equipment
11.	TEXTILES	Textiles and toys
12.	ELCTRONIC	Electronic products
13.	ELECTRCTY	Electricity and other utility
14.	CONST	Construction
15.	TRANSPORT	Transportation
16.	SALES	Sales services
17.	FINANCE	Financial services
18.	SOCIALSER	Social services

Table 1.1-1 Impact of tobacco consumption tax on consumers' demand

% change from the base -- demand elasticity is -0.1

	Base			10% increase			20% increase			30% increase		
	All	*Rural*	*Urban*	*All*	*Rural*	*Urban*	*All*	*Rural*	*Urban*	*All*	*Rural*	*Urban*
Demand for total tobacco products				-0.83	-0.77	-0.91	-1.53	-1.40	-1.67	-2.11	-1.94	-2.31
Expenditure on total tobacco products				9.08	9.16	9.00	18.16	18.32	18.00	27.24	27.47	27.00
Demand for high-quality tobacco products				-0.85	-0.77	-0.91	-1.56	-1.40	-1.67	-2.16	-1.94	-2.31
Expenditure on high-quality tobacco products				9.06	9.16	4.19	18.12	18.32	8.37	27.19	27.47	12.30
Demand for low-quality tobacco products				-0.81	-0.77	-0.91	-1.48	-1.40	-1.67	-2.05	-1.94	-2.31
Expenditure on low-quality tobacco products				9.11	9.16	6.98	18.22	18.32	13.95	27.33	27.47	20.92
Share of high-quality tobacco expenditure	2.57	1.90	3.34	2.79	2.07	3.63	3.02	2.24	3.92	3.25	2.41	4.21
Share of low-quality tobacco expenditure	1.49	1.96	0.94	1.62	2.13	1.02	1.75	2.31	1.11	1.88	2.49	1.19
(total consumption expenditure is 100)												

Table 1.1-2 Impact of tobacco consumption tax on factor returns, profit, household, and government income

% change from the base

	10% increase	20% increase	30% increase
Labor	0.000	0.001	0.002
Land	-0.22	-0.43	-0.63
Capital			
Tobacco leaves	-0.84	-1.55	-2.16
Other crops	-0.20	-0.39	-0.59
Livestock and products	-0.11	-0.22	-0.33
Beverage	-0.50	-1.01	-1.52
Tobacco products	-0.92	-1.68	-2.31
Energy	0.02	0.04	0.06
Textile	-0.04	-0.09	-0.14
Electronic products	0.03	0.06	0.09
Construction	0.24	0.47	0.70
Profit			
Tobacco leaves	-0.84	-1.55	-2.16
Tobacco products	-0.93	-1.70	-2.35
Household income			
Rural	-0.02	-0.04	-0.06
Urban	0.01	0.03	0.04
Government income			
Total	1.79	3.56	5.32
From tobacco sector	-0.69	-1.27	-1.75

Table 1.1-3 Impact of tobacco consumption tax on consumers' welfare

Compared to the base

	10% increase		*20% increase*		*30% increase*	
	Rural	Urban	Rural	Urban	Rural	Urban
Change in million RMB	-4,479	-2,057	-8,919	-4,096	-13,326	-6,117
Change in %	-0.29	-0.15	-0.57	-0.30	-0.86	-0.45

Table 1.1-4 Impact of tobacco consumption tax on production

% change from the base

	10% increase			*20% increase*			*30% increase*		
	Output	Demand for labor	Demand for land	Output	Demand for labor	Demand for land	Output	Demand for labor	Demand for land
Tobacco leaves	-0.47	-0.59	-0.44	-0.86	-1.09	-0.79	-1.20	-1.52	-1.08
Tobacco products	-0.73	-1.99		-1.34	-3.61		-1.86	-4.96	
Other crops	-0.07	-0.14	0.01	-0.14	-0.27	0.02	-0.41	-0.25	0.03
Livestock and products	-0.07	-0.08		-0.14	-0.15		-0.23	-0.08	
Beverage	-0.17	-0.35		-0.35	-0.71		-1.07	-0.31	
Energy	0.01	0.02		0.01	0.03		0.04	0.06	
Textile	-0.02	-0.03		-0.04	-0.06		-0.10	0.05	
Electronic products	0.01	0.02		0.02	0.04		0.06	0.05	
Construction	0.10	0.17		0.20	0.33		0.49	0.38	

Table 1.2-1 Impact of raising tobacco prices on consumers' demand, % change from the base

	Base			10% increase			20% increase			30% increase		
	All	Rural	Urban	All	Rural	Urban	All	Rural	Urban	All	Rural	Urban
Demand for total tobacco products				-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02
Expenditure on total tobacco products				9.99	9.99	9.99	19.99	19.99	19.98	29.98	29.98	29.98
Demand for high-quality tobacco products				-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02
Expenditure on high-quality tobacco products				9.99	9.99	4.19	19.99	19.99	8.37	29.98	29.98	12.30
Demand for low-quality tobacco products				-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02
Expenditure on low-quality tobacco products				9.99	9.99	6.98	19.99	19.99	13.95	29.98	29.98	20.92
Share of high-quality tobacco expenditure	2.57	1.90	3.34	2.82	2.09	3.68	3.08	2.28	4.01	3.34	2.47	4.35
Share of low-quality tobacco expenditure (total consumption expenditure is 100)	1.49	1.96	0.94	1.64	2.15	1.04	1.79	2.35	1.13	1.94	2.55	1.23

Table 1.2-2 Impact of raising tobacco prices on factor returns, profit, household and government income

% change from the base

	10% increase	20% increase	30% increase
Labor	-0.11	-0.22	-0.33
Land	-0.10	-0.20	-0.30
Capital			
Tobacco leaves	-0.11	-0.23	-0.34
Other crops	-0.10	-0.20	-0.30
Livestock and products	-0.10	-0.21	-0.31
Beverage	-0.11	-0.21	-0.32
Tobacco products	38.37	76.74	115.09
Energy	-0.08	-0.16	-0.24
Textile	-0.09	-0.17	-0.26
Electronic products	-0.10	-0.19	-0.29
Construction	-0.10	-0.21	-0.31
Profit			
Tobacco leaves	-0.11	-0.23	-0.34
Tobacco products	38.58	77.14	115.70
Household income			
Rural	-0.08	-0.15	-0.23
Urban	-0.07	-0.15	-0.22
Government income			
Total	0.64	1.28	1.92
From tobacco sector	11.07	22.15	33.22

Table 1.3-1a Impact of reducing low-quality tobacco production on consumers' demand

% change from the base, for all households

		Range of the reduction in low-quality tobacco production									
	Base	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Demand for total tobacco products		-0.93	-1.85	-2.74	-3.62	-4.48	-5.32	-6.13	-6.92	-7.67	-8.39
Expenditure on total tobacco products		0.29	0.58	0.85	1.12	1.38	1.63	1.87	2.11	2.35	2.57
Demand for high-quality tobacco products		4.04	8.13	12.25	16.41	20.62	24.89	29.20	33.58	38.02	42.55
Expenditure on high-quality tobacco products		4.04	8.13	12.25	16.41	20.62	24.89	29.20	33.58	38.02	42.55
Demand for low-quality tobacco products		-6.95	-13.91	-20.87	-27.85	-34.84	-41.84	-48.85	-55.88	-62.93	-69.99
Expenditure on low-quality tobacco products		-6.19	-12.46	-18.83	-25.30	-31.87	-38.54	-45.33	-52.23	-59.28	-66.48
Share of high-quality tobacco expenditure	2.57	2.67	2.77	2.88	2.99	3.09	3.20	3.31	3.43	3.54	3.66
Share of low-quality tobacco expenditure (total consumption expenditure is 100)	1.49	1.39	1.30	1.21	1.11	1.01	0.91	0.81	0.71	0.60	0.50

Table 1.3-1b Impact of reducing low-quality tobacco production on consumers' demand

% change from the base, for rural households

		Range of the reduction in low-quality tobacco production									
	Base	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Demand for total tobacco products		-1.06	-2.13	-3.21	-4.29	-5.36	-6.43	-7.49	-8.54	-9.56	-10.56
Expenditure on total tobacco products		0.40	0.80	1.19	1.57	1.94	2.31	2.67	3.02	3.37	3.72
Demand for high-quality tobacco products		6.23	12.67	19.34	26.25	33.38	40.76	48.39	56.27	64.44	72.90
Expenditure on high-quality tobacco products		6.23	12.67	19.34	26.25	33.38	40.76	48.39	56.27	64.44	72.90
Demand for low-quality tobacco products		-6.01	-12.18	-18.51	-25.00	-31.65	-38.46	-45.41	-52.52	-59.78	-67.19
Expenditure on low-quality tobacco products		-5.24	-10.71	-16.41	-22.35	-28.54	-34.97	-41.65	-48.60	-55.82	-63.34
Share of high-quality tobacco expenditure	1.89	2.01	2.13	2.26	2.39	2.53	2.66	2.81	2.96	3.11	3.27
Share of low-quality tobacco expenditure	1.95	1.85	1.74	1.63	1.52	1.40	1.27	1.14	1.00	0.86	0.72
(total consumption expenditure is 100)											

Table 1.3-1c Impact of reducing low quality tobacco production on consumers' demand

% change from the base, for urban households

		Range of the reduction in low-quality tobacco production									
	Base	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Demand for all tobacco products		-0.78	-1.52	-2.21	-2.86	-3.46	-4.03	-4.56	-5.04	-5.49	-5.89
Expenditure on all tobacco products		0.18	0.34	0.50	0.65	0.79	0.92	1.05	1.17	1.28	1.38
Demand for high-quality tobacco products		2.61	5.14	7.59	9.96	12.26	14.47	16.62	18.69	20.70	22.65
Expenditure on high-quality tobacco products		2.61	5.14	7.59	9.96	12.26	14.47	16.62	18.69	20.70	22.65
Demand for low-quality tobacco products		-9.20	-18.05	-26.54	-34.68	-42.48	-49.95	-57.10	-63.94	-70.48	-76.72
Expenditure on low-quality tobacco products		-8.46	-16.67	-24.64	-32.37	-39.86	-47.11	-54.14	-60.96	-67.57	-74.00
Share of high-quality tobacco expenditure	3.35	3.43	3.52	3.60	3.68	3.76	3.83	3.90	3.97	4.04	4.10
Share of low-quality tobacco expenditure	0.94	0.86	0.79	0.71	0.64	0.57	0.50	0.43	0.37	0.31	0.25
(total consumption expenditure is 100)											

Table 1.3-2 Impact of reducing low-quality tobacco production on factor returns, profit, household and government income

% change from the base

	Range of the reduction in low-quality tobacco production									
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Labor	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01
Land	-0.03	-0.05	-0.08	-0.10	-0.13	-0.15	-0.17	-0.19	-0.21	-0.23
Capital										
Tobacco leaves	-0.79	-1.54	-2.24	-2.89	-3.48	-4.01	-4.47	-4.86	-5.16	-5.37
Other crops	0.00	-0.01	-0.01	-0.02	-0.02	-0.03	-0.04	-0.05	-0.06	-0.07
Livestock and products	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Beverage	0.03	0.05	0.07	0.09	0.10	0.10	0.10	0.10	0.09	0.06
Tobacco products	0.45	1.04	1.75	2.60	3.60	4.77	6.15	7.79	9.79	12.31
Energy	0.00	0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.03	-0.04	-0.05
Textile	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.01	0.00	-0.01
Electronic products	0.00	0.01	0.01	0.01	0.01	0.00	0.00	-0.01	-0.02	-0.03
Construction	0.01	0.02	0.03	0.03	0.04	0.04	0.04	0.04	0.03	0.02
Profit										
Tobacco leaves	-0.79	-1.54	-2.24	-2.89	-3.48	-4.01	-4.47	-4.86	-5.16	-5.37
Tobacco products	0.89	1.64	2.23	2.66	2.90	2.95	2.77	2.32	1.57	0.44
Household income										
Rural	-0.01	-0.01	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.04	-0.04
Urban	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03
Government income										
Total	0.06	0.12	0.18	0.24	0.29	0.35	0.41	0.46	0.52	0.57
From tobacco sector	0.92	1.83	2.75	3.67	4.59	5.52	6.45	7.39	8.34	9.31

Table 1.3-3 Impact of reducing low-quality tobacco production on other sectors' production

% change from the base

	Range of the reduction in low-quality tobacco production									
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Tobacco leaves	-0.489	-0.951	-1.384	-1.785	-2.153	-2.483	-2.772	-3.015	-3.205	-3.335
Tobacco products	-0.810	-1.577	-2.296	-2.964	-3.576	-4.126	-4.608	-5.014	-5.333	-5.552
Other crops	0.006	0.012	0.016	0.020	0.023	0.024	0.025	0.023	0.021	0.016
Livestock and products	0.007	0.012	0.017	0.020	0.023	0.024	0.023	0.021	0.017	0.011
Beverage	0.011	0.020	0.028	0.034	0.038	0.041	0.041	0.038	0.033	0.025
Energy	0.001	0.002	0.002	0.002	0.001	0.000	-0.003	-0.006	-0.009	-0.014
Textile	0.005	0.008	0.011	0.013	0.014	0.014	0.013	0.011	0.006	0.000
Electronic products	0.003	0.005	0.007	0.008	0.008	0.007	0.005	0.003	-0.001	-0.006
Construction	0.007	0.012	0.017	0.021	0.023	0.024	0.024	0.023	0.019	0.013

Table 2-1. Impact of Tariff Reduction on Tobacco Trade in China

	Base	*24% of tariff reduction*		
	Value $ million	% in toal production or consumption	% increase in value	% in total production or consumption
Exports				
Tobacco leaves	1330.67	3.44	--	
Tobacco products	4776.81	3.21	--	
Imports				
Tobacco leaves	569.12	1.50	1.65	1.53
Tobacco products	10148.70	6.58	5.48	6.94

Table 2-2. Impact of Tariff Reduction on Chinese Government Revenue

	Income from tobacco sector		*Tariffs from tobacco imports*	
	Million RMB	% in total government revenue	Million RMB	% in total tariff revenue
Base	81454.10	6.37	4160.58	1.72
24% tariff reduction	82356.80	6.30	3330.75	1.38
% change from the base	-1.11		-19.94	

Table 2-3. Impact of Tariff Reduction on Cigarette Consumption

	Rural consumers			**Urban consumers**		
		Base	*24% tariff reduction*		*Base*	*24% tariff reduction*
	Million RMB	% in total	% change	Million RMB	% in total	% change
Total	73101.96		-0.46	63205.86		-0.34
High-quality	29552.21	40.43	2.70	45052.74	71.28	1.15
Low-quality	43549.75	59.57	-2.60	18153.12	28.72	-4.06

Table 2-4. Impact of 24% Tariff Reduction on Tobacco Production

-- % change from the base

	Tobacco leaves	Tobacco products
Output	-0.45	-0.71
Employment	-0.51	-1.85
Land use	-0.50	
Returns to capital	-0.73	-0.28
Profit	-0.73	0.03

Appendix

Table A1. Structure of the economy by activity

	GDP	Production	Labor share	Capital share	Land share
All other crops	12.0	6.2	11.0	3.3	99.0
Tobacco leaf	0.4	0.2	0.3	0.0	1.0
Forestry	1.6	1.3	2.1	1.0	
Livestock	8.2	6.1	12.4	2.5	
Other agriculture	3.2	4.4	2.9	4.1	
Beverage	0.8	1.3	0.6	1.1	
Tobacco products, low-quality	0.1	0.3	0.1	0.1	
Tobacco products, high-quality	0.1	0.4	0.1	0.1	
Energy	3.3	1.9	2.6	5.0	
Industry	19.1	27.1	17.0	25.0	
Other industry	2.3	3.3	2.0	3.2	
Textiles	6.4	8.5	6.1	7.6	
Electronic	4.8	6.9	4.1	6.4	
Electricity	2.5	2.2	1.4	4.5	
Construction	9.0	9.6	9.5	9.4	
Transport	5.5	3.5	4.0	8.7	
Sales	7.8	6.7	8.3	7.8	
Finance	2.1	1.8	1.7	3.0	
Social services	10.9	8.3	13.8	7.5	
Total agriculture	25.4	18.1			
Total non-agriculture	74.6	81.9			

Table A2. Structure of the economy by commodity

	Export share	Import share	Absorption share
All other crops	1.5	2.7	6.0
Tobacco leaf	0.1	0.0	0.2
Forestry	1.7	1.0	1.2
Livestock	2.7	1.1	5.8
Other agriculture	1.7	2.5	4.2
Beverage	0.5	0.1	1.2
Tobacco products, low-quality			0.3
Tobacco products, high-quality	0.3	0.6	0.5
Energy	1.8	6.9	2.2
Industry	24.0	43.7	28.1
Other industry	1.6	8.5	3.7
Textiles	27.1	7.9	8.6
Electronic	20.4	18.9	7.7
Electricity	0.2	0.0	2.1
Construction	0.2	0.5	9.1
Transport	3.5	1.0	3.4
Sales	7.8	0.4	6.3
Finance	0.1	0.4	1.7
Social services	4.9	3.9	8.0

Table A3. Structure of production by activity

	Labor share	Capital share	Land share
All other crops	54.0	10.0	36.0
Tobacco leaf	53.6	3.4	35.7
Forestry	77.1	22.9	
Livestock	89.1	10.9	
Other agriculture	53.8	46.3	
Beverage	48.7	51.3	
Tobacco products, low-quality	64.4	35.6	
Tobacco products, high-quality	57.0	43.0	
Energy	46.1	53.9	
Industry	52.5	47.5	
Other industry	50.3	49.7	
Textiles	56.3	43.7	
Electronic	51.2	48.8	
Electricity	33.2	66.8	
Construction	62.2	37.8	
Transport	42.7	57.3	
Sales	63.3	36.7	
Finance	48.2	51.8	
Social services	74.9	25.1	
Average	59.0	36.4	4.4

List of Discussion Papers

No. 40 - "Parameter Estimation for a Computable General Equilibrium Model: A Maximum Entropy Approach" by Channing Arndt, Sherman Robinson and Finn Tarp (February 1999)

No. 41 - "Trade Liberalization and Complementary Domestic Policies: A Rural-Urban General Equilibrium Analysis of Morocco" by Hans Löfgren, Moataz El-Said and Sherman Robinson (April 1999)

No. 42 - "Alternative Industrial Development Paths for Indonesia: SAM and CGE Analysis" by Romeo M. Bautista, Sherman Robinson and Moataz El-Said (May 1999)

No. 43* - "Marketing Margins and Agricultural Technology in Mozambique" by Channing Arndt, Henning Tarp Jensen, Sherman Robinson and Finn Tarp (July 1999)

No. 44 - "The Distributional Impact of Macroeconomic Shocks in Mexico: Threshold Effects in a Multi-Region CGE Model" by Rebecca Lee Harris (July 1999)

No. 45 - "Economic Growth and Poverty Reduction in Indochina: Lessons From East Asia" by Romeo M. Bautista (September 1999)

No. 46* - "After the Negotiations: Assessing the Impact of Free Trade Agreements in Southern Africa" by Jeffrey D. Lewis, Sherman Robinson and Karen Thierfelder (September 1999)

No. 47* - "Impediments to Agricultural Growth in Zambia" by Rainer Wichern, Ulrich Hausner and Dennis K. Chiwele (September 1999)

No. 48 - "A General Equilibrium Analysis of Alternative Scenarios for Food Subsidy Reform in Egypt" by Hans Lofgren and Moataz El-Said (September 1999)

No. 49*- " A 1995 Social Accounting Matrix for Zambia" by Ulrich Hausner (September 1999)

No. 50 - "Reconciling Household Surveys and National Accounts Data Using a Cross Entropy Estimation Method" by Anne-Sophie Robilliard and Sherman Robinson (November 1999)

No. 51 - "Agriculture-Based Development: A SAM Perspective on Central Viet Nam" by Romeo M. Bautista (January 2000)

No. 52 - "Structural Adjustment, Agriculture, and Deforestation in the Sumatera Regional Economy" by Nu Nu San, Hans Löfgren and Sherman Robinson (March 2000)

No. 53 - "Empirical Models, Rules, and Optimization: Turning Positive Economics on its Head" by Andrea Cattaneo and Sherman Robinson (April 2000)

No. 54 - "Small Countries and the Case for Regionalism vs. Multilateralism" by Mary E. Burfisher, Sherman Robinson and Karen Thierfelder (May 2000)

No. 55 - "Genetic Engineering and Trade: Panacea or Dilemma for Developing Countries" by Chantal Pohl Nielsen, Sherman Robinson and Karen Thierfelder (May 2000)

No. 56 - "An International, Multi-region General Equilibrium Model of Agricultural Trade Liberalization in the South Mediterranean NIC's, Turkey, and the European Union" by Ali Bayar, Xinshen Diao and A. Erinc Yeldan (May 2000)

No. 57* - "Macroeconomic and Agricultural Reforms in Zimbabwe: Policy Complementarities Toward Equitable Growth" by Romeo M. Bautista and Marcelle Thomas (June 2000)

No. 58 - "Updating and Estimating a Social Accounting Matrix Using Cross Entropy Methods " by Sherman Robinson, Andrea Cattaneo and Moataz El-Said (August 2000)

No. 59 - "Food Security and Trade Negotiations in the World Trade Organization : A Cluster Analysis of Country Groups " by Eugenio Diaz-Bonilla, Marcelle Thomas, Andrea Cattaneo and Sherman Robinson (November 2000)

No. 60* - "Why the Poor Care About Partial Versus General Equilibrium Effects Part 1: Methodology and Country Case'' by Peter Wobst (November 2000)

No. 61 - "Growth, Distribution and Poverty in Madagascar : Learning from a Microsimulation Model in a General Equilibrium Framework " by Denis Cogneau and Anne-Sophie Robilliard (November 2000)

No. 62 - "Farmland Holdings, Crop Planting Structure and Input Usage: An Analysis of China's Agricultural Census" by Xinshen Diao, Yi Zhang and Agapi Somwaru (November 2000)

No. 63 - "Rural Labor Migration, Characteristics, and Employment Patterns: A Study Based on China's Agricultural Census" by Francis Tuan, Agapi Somwaru and Xinshen Diao (November 2000)

No. 64 - "GAMS Code for Estimating a Social Accounting Matrix (SAM) Using Cross Entropy (CE) Methods" by Sherman Robinson and Moataz El-Said (December 2000)

No. 65 - "A Computable General Equilibrium Analysis of Mexico's Agricultural Policy Reforms" by Rebecca Lee Harris (January 2001)

No. 66 - "Distribution and Growth in Latin America in an Era of Structural Reform" by Samuel A. Morley (January 2001)

No. 67 - "What has Happened to Growth in Latin America" by Samuel A. Morley (January 2001)

No. 68 - "China's WTO Accession: Conflicts with Domestic Agricultural Policies and Institutions" by Hunter Colby, Xinshen Diao and Francis Tuan (January 2001)

No. 69 - "A 1998 Social Accounting Matrix for Malawi" by Osten Chulu and Peter Wobst (February 2001)

No. 70 - "A CGE Model for Malawi: Technical Documentation" by Hans Löfgren (February 2001)

No. 71 - "External Shocks and Domestic Poverty Alleviation: Simulations with a CGE Model of Malawi" by Hans Löfgren with Osten Chulu, Osky Sichinga, Franklin Simtowe, Hardwick Tchale, Ralph Tseka and Peter Wobst (February 2001)

No. 72 - "Less Poverty in Egypt? Explorations of Alternative Pasts with Lessons for the Future" by Hans Löfgren (February 2001)

No. 73 - "Macro Policies and the Food Sector in Bangladesh: A General Equilibrium Analysis" by Marzia Fontana, Peter Wobst and Paul Dorosh (February 2001)

No. 74 - "A 1993-94 Social Accounting Matrix with Gender Features for Bangladesh" by Marzia Fontana and Peter Wobst (April 2001)

No. 75 - " A Standard Computable General Equilibrium (CGE) Model" by Hans Löfgren, Rebecca Lee Harris and Sherman Robinson (April 2001)

No. 76 - " A Regional General Equilibrium Analysis of the Welfare Impact of Cash Transfers: An Analysis of Progresa in Mexico" by David P. Coady and Rebecca Lee Harris (June 2001)

No. 77 - "Genetically Modified Foods, Trade, and Developing Countries" by Chantal Pohl Nielsen, Karen Thierfelder and Sherman Robinson (August 2001)

No. 78 - "The Impact of Alternative Development Strategies on Growth and Distribution: Simulations with a Dynamic Model for Egypt" by Moataz El-Said, Hans Löfgren and Sherman Robinson (September 2001)

No. 79 - "Impact of MFA Phase-Out on the World Economy an Intertemporal, Global General Equilibrium Analysis" by Xinshen Diao and Agapi Somwaru (October 2001)

No. 80* - "Free Trade Agreements and the SADC Economies" by Jeffrey D. Lewis, Sherman Robinson and Karen Thierfelder (November 2001)

No. 81 - "WTO, Agriculture, and Developing Countries: A Survey of Issues" by Eugenio Díaz-Bonilla Sherman Robinson Marcelle Thomas Yukitsugu Yanoma (January 2002)

No. 82 - "WTO, food security and developing countries" by Eugenio Díaz-Bonilla, Marcelle Thoms and Sherman Robinson (November 2001)

No. 83 - "Economy-wide effects of El Niño/Southern Oscillation ENSO in Mexico and the role of improved forecasting and technological change" by Rebecca Lee Harris and Sherman Robinson (November 2001)

No. 84 - "Land reform in Zimbabwe: Farm-level effects and cost-benefit analysis" by Anne-Sophie Robilliard, Crispen Sukume, Yuki Yanoma and Hans Löfgren (December 2001)

No. 85 - "Developing country interest in agricultural reforms under the World Trade Organization" by Xinshen Diao, Terry Roe and Agapi somwaru (January 2002)

No. 86 - "Social accounting matrices for Vietnam 1996 and 1997" by Chantal Pohl Nielsen (January 2002)

No. 87 - "How China's WTO accession affects rural economy in the less-developed regions: A multi-region, general equilibrium analysis" by Xinshen Diao, Shenggen Fan and Xiaobo Zhang (January 2002)

No. 88 - "HIV/AIDS and macroeconomic prospects for Mozambique: An initial assessment" by Channing Arndt (January 2002)

No. 89 - "International spillovers, productivity growth and openness in Thailand: An intertemporal general equilbrium analysis" by Xinshen Diao, Jørn Rattsø and Hildegunn Ekroll Stokke (February 2002)

No. 90 - "Scenarios for trade integration in the Americas" by Xinshen Diao, Eugenio Díaz-Bonilla and Sherman Robinson (February 2002)

No. 91 - "Assessing impacts of declines in the world price of tobacco on China, Malawi, Turkey, and Zimbabwe" by Xinshen Diao, Sherman Robinson, Marcelle Thomas and Peter Wobst (March 2002)

TMD Discussion Papers marked with an '*' are MERRISA-related. Copies can be obtained by calling Maria Cohan at 202-862-5627 or e-mail: m.cohan@cgiar.org