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Impact of Structural Adjustment Programme on Household Welfare and Inequality - Pakistan A Case-in-Point for the Developing Countries

Hasnain A. Naqvi, Ph.D.

Assistant Professor, Department of Management Sciences

COMSATS University of Information Technology, Islamabad, Pakistan

Tel: 11-92-300-539-0586 E-mail: h.a.naqvi@comsats.edu.pk

Muhammad Tahir Masood, Ph.D., P.E. (Corresponding author)

Professor, Department of Management Sciences, COMSATS University of Information Technology, Islamabad, Pakistan

Tel: 11-92-323-552-2342 E-mail: dr.tahirmasood@comsats.edu.pk

Rashid A. Naeem, PhD.

Chairman, Department of Economics, Allama Iqbal Open University

Tel**:** 11-92-51-925-0075 E-mail: rashid.naeem@aiou.edu.pk

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Abstract

In this article the impact of Structural Adjustment Programme on Household Welfare and Inequality is discussed and the situation in Pakistan is reviewed as a Case-in-Point which will be useful in studying the situation in other developing countries. A computable general equilibrium model is used to analyse policies under structural adjustment programmes for Pakistan. This model was used to analyse the economic implications of two key elements in the structural adjustment programmes, namely fiscal strictness and trade liberalization policy. The experiment was based on a combination of the said two elements. The objective of this experiment was to determine the possibility of making up the existing trade deficit and revenue losses due to the abolition of tariff. Three variables were considered in this

experiment – increase in sales tax, increase in income tax, and cut in government's consumption expenditures. It was observed that a cut in government consumption expenditure tends to outperform other fiscal stances in terms of household and economy-wide welfare indicators. The results suggest that targeting the government's consumption expenditures tends to be a real and potent tool for reducing government budget deficit and to cover losses arising out of the import tariff abolition.

Keywords: Structural adjustment, Household, Inequality, Economic adjustment, Fiscal strictness, Trade Liberalization, Traffic, Sales tax, Income tax, Government consumption, Welfare indicators

1. Introduction

International Monetary Fund (IMF) loans, or what the IMF calls as its lending 'facility', are intended for the recipient countries to meet their short term liquidity needs. In the case of Pakistan, these include balance of payment deficits, stabilization of currency, rebuilding international reserves to manage its liquidity problems.

It is an established fact that IMF and WB, directly and indirectly, have played a crucial role in the macroeconomics of Pakistan. They have provided direct bilateral support to Pakistan in order to cope with imbalances like balance of payment deficits. On the other hand, the IMF has had indirect influence on lending by other donor agencies. This is evident from the fact that whenever Pakistan enjoyed good relations with the IMF, other lending agencies also provided financial assistant to Pakistan.

In fact IMF has had little problem with its aid operations in Pakistan as the country's development planners have mostly fulfilled the conditions of its loans. However, two conditions – tariff cuts and the cut in the budget deficit - are not fulfilled properly, perhaps due to severe short run implications. Controversy between the IMF and Pakistan was witnessed quite a few times. It is very interesting that each time this controversy was linked with either a refusal of tariff cut or budget deficit cut. This is evident in SAP (1982), SAP (1988) and Standby Arrangement (1993).

The purpose of this paper is to examine the effects of fiscal strictness and trade liberalization on some key variables of Pakistan's economy in general and on the household level welfare and inequality in particular using a computable general equilibrium model. The findings of this research can potentially serve a dual purpose. Firstly, it gives insights into how the Pakistani economy is potentially affected when the IMF's recommendations are implemented. Secondly and more practically, it provides a platform to the government (or policy makers) to base their future policy considerations on.

Based on our research, the paper is organised as follows: Section 2 presents computable general equilibrium model of Pakistan. Section 3 highlights the Data and model calibration. Sections 4 and 5 present welfare and inequality measuring methodologies. Implementations of the simulation (Fiscal strictness to cover revenue losses due to trade liberalization and existing budget deficit) are presented in section 6. Section 7 presents the sensitivity analysis of the model. The final section summarises and concludes the paper**.**

2. Important Key Terms and Concepts Discussed in the article

2.1 Computable General Equilibrium Model (CGE)

These models are a class of economic models that use actual economic data to estimate how an economy might react to changes in policy, technology or other external factors. CGE models are also referred to as Applied General Equilibrium (AGE) models. A CGE model consists of (a) equations describing model variables and (b) a database (usually very detailed) consistent with the model equations. The equations tend to be neo-classical spirit, often assuming cost-minimizing behaviour by producers, average-cost pricing, and household

demands based on optimizing behaviour. However, most CGE models conform only loosely to the theoretical general equilibrium paradigm. For example, they may allow for:

- non-market clearing, especially for labour (unemployment) or for commodities (inventories)
- imperfect competition (e.g., monopoly pricing)
- demands not influenced by price (e.g., government demands)
- a range of taxes
- externalities, such as pollution

2.2 A CGE model database consists of

- tables of transaction values, showing, for example, the value of coal used by the iron industry. Usually the database is presented as an input-output table or as a social accounting matrix. In either case, it covers the whole economy of a country (or even the whole world), and distinguishes a number of sectors, commodities, primary factors and perhaps types of household.
- elasticities: dimensionless parameters that capture behavioural response. For example, export demand elasticities specify by how much export volumes might fall if export prices went up. Other elasticities may belong to the Constant Elasticity of Substitution class. Amongst these are Armington elasticities, which show whether products of different countries are close substitutes, and elasticities measuring how easily inputs to production may be substituted for one another. Expenditure elasticities show how household demands respond to income changes.

3. Computable General Equilibrium Model of Pakistan

The Computable General Equilibrium Model of Pakistan (CGEM-Pak) follows the static model framework developed by Lofgren et al. (2001). It pursues the SAM[1] (2001-02) desegregation of activities, commodities, factors and institutions. The equations of the model explain the interactions and behaviour of these sectors. In addition, the equations guarantee that a set of both micro and macroeconomic constraints are satisfied. In other words these equations ensure that requirements regarding factors and commodity markets, savings and investment, and the government and current account balance are fulfilled.

3.1 Price Block

Detailed handling of the prices is the one of the distinct features of the model. In this model each activity produces only one commodity. Final export price (*PE*) can be obtained by including any taxes that might be imposed on the export of commodities from the producer price (*PX*) of a commodity. The final supply price for the domestic market (*PD*) is determined by the interaction of producer and export prices. By changing focus from production to consumption, the domestic supply price is transformed into the

[1] Social Accounting Matrix

domestic demand price (*PD*). Import prices (*PM*) are calculated by adding tariffs that might be placed on foreign commodities entering the domestic market. The price of composite commodities (*PQ*) is determined by the interaction of domestic and import prices. Sales taxes are then added to the composite price to arrive at a final market price.

3.2 Production and Commodity Block

The production block is defined as the component of the model that establishes the combination of the representative firm's inputs and outputs that will maximise profits within the economy sector. In the model under consideration, activities carry out production in CGEM-Pak. These activities obtain their revenue from selling the commodities that they manufacture. They disburse their revenues in purchasing production inputs, i.e. purchase of intermediate input and payments of wages/rent to primary factors. It is assumed in the model that the activities maximize profits subject to production functions and neoclassical substitutability for factors and fixed co-efficient for intermediate inputs. Moreover, a single commodity is produced by each activity.

CGEM-Pak identifies nine activities (productive sectors) that combine primary factors with intermediate commodities to determine a level of output. These activities consist of Agriculture, mining, food manufacturing, cotton lint/yarn, textile, leather, other manufacturing, energy and services (from now on A-AGRI, A-MINE, A-FMAN, A-YARN, A-TEXT, A-MANF, A-ENGR, and A-SER, respectively). There are eleven factors of production identified in the model: six types of labour - own large farm labour (LA-AGL), own medium farm labour (LA-MF), own small farm labour (LA-SF), agriculture wage labour (LA-AGW), non-agriculture unskilled labour (LA-SKU), and skilled labour (LA-SK) - , four types of land - large farm land (LN-LG), irrigated medium farm land (LN-MG), irrigated small farm (LN-SG), non-irrigated small farm land (LN-DR) - and one type of capital (K).

Producers in the CGEM-Pak maximize their profits subject to constant returns to scale. They make choices between factors of production on the basis of a constant elasticity of substitution (CES) function. This specification permits producers to react to changes in relative factor returns. They can easily substitute between available factors so as to derive a final value added composite. Maximization of profit implies that the factors receive income where marginal revenue equals marginal cost. These marginal cost and revenue are determined on the basis of endogenous relative prices. Once factors are determined, then these factors are combined with fixed-share intermediates using a Leontief specification. The use of fixed-shares in line with the idea that the required combination of intermediates per unit of output, and the ratio of intermediates to value added, is determined by technology rather than by the producers' decision-making.

Production and commodity block covers the following aspects of CGEM-Pak:

- Domestic production and input use.
- The allocation of domestic output to exports and the domestic market.
- The aggregation of supply of domestic market.

A CES (Constant Elasticity of Substitution) Cobb-Douglas production is used to capture the relationship between the factor use and activity levels.

The specification of foreign trade and its interaction with the domestic economy constitutes an important part of the model. According to classical theory of trade, a traded good is assumed to be one which, the country is price taker (small country assumption) and the domestically produced good is a perfect substitute of the corresponding import. In the result of this assumption the domestic price become equal to world price. This in turn means that if domestic and imported goods are perfect substitutes, the trade creation effects of trade policies tend to be larger than when products are imperfect substitutes.

Alternatively, in this model, Armington (1969) approach is followed by supposing an imperfect substitutability between domestic and imported goods. According to this assumption, each country produces a unique set of goods which are substitutes for goods produced in other countries. Although, these goods are not identical, but substitute to a varying degree. Advantages of this specification are: (i) it can accommodate cross hauling (import and export of same good in the same period) in trade data (ii) it avoids the over specialization problem (Mujeri, 2002). Moreover, according to Mustafa Mujeri (2002) it can be achieved by 'bounding the production response to trade policy changes from the demand side, since commodities subscripted by country are treated only as imperfect substitutes'. As imported and domestic goods are only imperfect substitutes, a certain percentage change in the domestic price of imports leads to a slight percentage change in the price of the locally traded goods. Therefore, dropping the assumption of perfect substitution between imports and domestic goods solves the specialization problem. This is especially significant for a developing country like Pakistan. Like other developing countries, there is a huge quality difference between locally produced and imported goods in Pakistan. So, this research study about Pakistan is an ideal example to study the situation in other developing nations.

In addition to this, high level of aggregation is adopted in the model; each sector represents a bundle of different goods. Therefore, it is quite reasonable to suggest that these two goods are not perfect substitutes.

The decision of substitution between domestic and foreign production is governed by the constant elasticity of transformation (CET) function, which differentiates between domestic and exported goods. Maximization of profits drives producers to sell in those markets where they can attain the maximum returns. These returns are based on domestic and export prices. Export prices are attained by multiplying world prices by exchange rate included any taxes and subsidies. As Pakistan is a small country and has no influence on world prices, so under the small-country assumption, Pakistan is assumed to face a perfectly elastic world demand at a fixed world price. The final ratio of exports to domestic goods is determined by the endogenous interaction of relative prices for these two commodity types.

Energy is the only product which is produced and consumed domestically, i.e. the production of energy sector is neither imported nor exported. While domestic demand for other commodities is met through the use of either domestically produced or imported commodities, the supply from these two sources are combined to form a composite commodity, which is

subsequently sold to meet the domestic demand. The demanders are assumed to minimize cost subject to the substitutability between imported and domestically produced commodities. This Substitution between imported and domestic goods takes place under a CES Armington specification (Armington, 1969). The final composite good (combination of imported and domestic goods) is supplied to meet the final and intermediate demand. As explained above, intermediate demand is determined by technology and by the composition of sectoral production. Final demand is dependent on incomes of institutions and the composition of aggregate demand.

3.3 Institution block

There are several sources of income of institutions in the model. The major sources of income of household are income from factors of production. These factors (different types of labour and land, and capital) receive income from their involvement to value added. The income of factors is in turn to be paid to institutions who supply these factors. In CGEM-Pak, incomes from different types of labour and land are dispersed across nine household groups. Conversely, capital income does not only go to households, but also as part of the incomes of capital income accrues to the government and enterprises according to their initial endowment of capital. Consequently, income of capital is distributed to the nine household groups, government and enterprises.

The government receives a large amount of its income from direct and indirect taxes, and then uses it on consumption expenditures and transfers to households. Moreover, the government receives income from capital. Both of these payments are fixed in real terms. The difference between revenues and expenditures is the budget deficit. This is primarily financed through borrowing (or dis-saving) from the domestic capital market. In the CGEM-Pak, the role of government is as a consumer and quantities of government's consumption of each commodity is fixed exogenously. Moreover, transfers of government to households are CPI-indexed, that is, they can be simply fixed in nominal terms.

The only source of enterprises' income is returns from capital. Enterprises then make payment to cover transfers to households and savings. It is assumed that enterprises do not consume commodities. Enterprises' saving can be explained as the difference between income and expenditure.

3.4 Model Closure

For current account balance, Foreign Savings (FS) is fixed, and hence a flexible exchange rate (EXR) clears the current account. For savings/investment account, savings-driven investment is assumed, therefore savings are fixed, and Investment adjustment factor (IADJ) is flexible, permitting investment to adjust. For capital market, it is assumed that capital is activity-specific and fully employed. This means that the price of capital is fixed and factor price distortion adjusts to clear the market. Note that capital is the only factor which is used in all types of activities. There are four types of land in our model and all types are being used in agriculture sector, which has only one activity (agriculture). For land market it is assumed that all types of land are fully employed and hence price of land will clear the

market. There are four types of agriculture and two types of non-agriculture labour in the labour market of the model. They are mutually exclusive and there is no mobility between them. The assumption for four types of agriculture labour is that they are fully employed and hence price of labour will clear the market. In CGEM-Pak, non- agriculture sector has eight types of activities and each type of activity uses two types of labour (non-agriculture labour; skilled and unskilled). Full employment is assumed for non-agriculture labour. Moreover, labour is fully mobile and a unique wage clears the labour market. The sets, parameters, exogenous variables, endogenous variable and equations are presented in Table 1 – 5, respectively.

Table 1. Sets of the Variables

Sets	Definition
$a \in A$	**Activities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$a \in AA \subset A$	**Agriculture Activities:** Agriculture
$a \in ANA \subset A$	**Non-Agriculture Activities:** Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$c \in C$	**Commodities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$c \in CA \subset C$	**Agriculture Commodities:** Agriculture
$c \in CNA \subset C$	**Non-Agriculture Commodities:** Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Energy, Services
$c \in CM \subset C$	**Imported commodities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Services
$c \in CNM \subset C$	**Non-imported commodities:** Energy
$c \in CE \subset C$	**Exported commodities:** Agriculture, Mining, Food manufacturing, Cotton lint/yarn, Textiles, Leather, Other manufacturing, Services
$c \in CNE \subset C$	**Non-exported commodities:** Energy
$f \in F$	**Factors:** Labor, Land , Capital
$la \in LA \subset F$	**Labor:** Own large farm, Own medium farm, Own small farm, Agriculture wage, Non-agriculture unskilled, Skilled
$laa \in LA \subset F$	**Agriculture labor:** Own large farm, Own medium farm, Own small farm, Agriculture wage
$lan \in LA \subset F$	**Non-Agriculture labor:** Non-agriculture unskilled, Skilled
$\ln \in LN \subset F$	**Land:** Large farm, Irrigated medium farm, Irrigated small farm, Non-irrigated small farm
$k \in K \subset F$	**Capital**
$FA \subset F$	**Factors used by agriculture activities:** Own large farm, Own medium farm, Own small farm, Agriculture wage, Large farm, Irrigated medium farm, Irrigated small farm, Non-irrigated small farm, capital
$FNA \subset F$	**Factors used by non agriculture activities:** Non-agriculture unskilled, Skilled, Capital
$i \in I$	**Institutions: households;** Large farm, Medium farm, Small farm, Landless farmers, Rural agriculture landless, Rural non-farm non-poor, Rural non-farm poor, Urban non-poor, Urban poor, **Government, enterprise, Rest of the world**
$h \in H \subset I$	Large farm, Medium farm, Small farm, Landless farmers, Rural agriculture landless, Rural non-farm non-poor, Rural non-farm poor, Urban non-poor, Urban poor
$g \in G \subset I$	**Government**
$s \in S \subset I$	**Enterprise**
$r \in R \subset I$	**Rest of the World**

Table 2. Parameters of the Variables

Parameter	Definition
ad_a	Activity parameter of production function
aq_c	Shift parameter of Armington function
ax_c	Shift parameter for output transformation (CET) function
$cwts_c$	Weight of commodity *c* in the *CPI*
$ir_{c,a}$	Quantity of *c* as intermediate input per unit of activity *a*
$shry_{i,f}$	Share for institutions *i* in income of factor *f*
$\alpha_{f,a}$	Value added share for factor *f* in activity *a*
$\beta_{c,h}$	Share of consumption spending of household *h* on commodity *c*
δq_c	Share parameter for the composite good
δx_c	Share parameter for output transformation
$\theta_{a,c}$	Yield of output *c* per unit of activity *a*
ρq_c	Exponent of Armington function
ρx_c	Exponent used in the CES aggregation function
σq_c	Elasticity of transformation for composite goods
σx_c	Elasticity of transformation for output transformation.

Table3. Exogenous variables

Variable	Definition
CPI	Consumer price index
INV_c	Base year investment demand
$MPSIN_h$	Initial marginal propensity to consume
$MPSDUM_h$	0-1 dummy: 1= for those H that saving changes, 0 otherwise
MPS_h	Marginal propensity to save for household h
PWE_c	World price of exports (Foreign currency units)
PWM_c	World price of imports (Foreign currency units)
QFS_f	Supply of factor f
QG_c	Quantity of consumption of commodity c by government g.
te_c	Sales tax on imports
tm_c	Import tariff rate
tq_c	Rate of sales tax
$TR_{i,j}$	Transfers from institution j to institution i
$TSTAX_c$	Total sales tax on commodity c
$TTAR_c$	Total tariff on commodity c
ty_h	Household income tax rate

Table 4. Endogenous variables

Variable	Definition	No.
$CPIH_h$	Consumer price index of household *h*	9
EH_h	Consumption expenditure of household *h*	9
EXR	Foreign exchange rate as domestic currency per unit of foreign currency	1
$FPD_{f,a}$	Factor price distortion for factor *f* in activity *a*	99
FS	Balance of payment (foreign currency units)	1
GBS	Government budget surplus	1
IADJ	Investment adjustment factor	1
PA_a	Gross revenue per activity (activity price)	9
PD_c	Domestic price of domestic output	9
PE_c	Domestic price of exported good	8
PF_f	Rate of return to factor *f*	11
PM_c	Domestic price of imported goods (local-currency unit),	8
PQ_c	Composite price of commodity *c*	9
PVA_a	Price of value added (factor income per unit of activity)	9
PX_c	Commodity price of producer *c* for activity *a*	9
QA_a	Quantity (level) of activity *a*	9
QD_c	Domestic sales quantity	9
QE_c	Supply of exports	8
$QF_{f,a}$	Quantity demanded of factor *f* from activity *a*	99
QFU_f	Unused supply of factors *f*	11
$QH_{c,h}$	Quantity consumed of commodity *c* by household *h*	81
$QINT_{c,a}$	Quantity of commodity *c* as intermediate input coefficient	81

$QINV_c$	Quantity of investment demand for commodity *c*	9
QM_c	Quantity of imported commodities	8
QQ_c	Quantity of goods supplied to domestic market (composite supply)	9
QX_c	Aggregate quantity of domestic output of commodity	9
UH_h	Utility of household *h*	9
WALR	Dummy variable	1
YFRM	Income of enterprise	1
YFRMTS	Total saving of enterprise	1
$YF_{h,f}$	Transfers of factor income to household	99
$YF_{s,f}$	Transfer of factor income to firms	11
YH_h	Income of household *h*	9
μ_h	Weight of utility of household *h*	9

Table 5. Equations - Price Block

	Equation	Domain	
1	$PM_c = (1+tm_c)\,PWM_c\,EXR$	$c \in CM$	**8**
2	$PE_c = PWE_c(1-te_c)\,EXR$	$c \in CE$	**8**
3	$PQ_c\,QQ_c = (PD_c\,QD_c + PM_c\,QM_c)(1+tq_c)$	$c \in CM$	**8**
4	$PQ_c\,QQ_c = PD_c\,QD_c(1+tq_c)$	$c \in CNM$	**1 R**
5	$PX_c\,QX_c = PD_c\,QD_c + PE_c\,QE_c$	$c \in CE$	**8**
6	$PX_c\,QX_c = PD_c\,QD_c$	$c \in CNE$	**1 R**
7	$PA_a = \sum_{c \in C} \theta_{a,c}\,PX_c$	$a \in A$	**9**
8	$PVA_a = PA_a - \sum_{c \in C} ir_{c,a}\,PQ_c$	$a \in A$	**9**

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Equations - Production Block

9	$QA_a = ad_a \prod_f QF_{f,a}^{\alpha_{f,a}}$	$a \in A$	9
10	$FPD_{f,a}\, PF_f = (\alpha_{f,a}\, PVA_a\, QA_a) / QF_{f,a}$	$f \in F$, $a \in A$	99
11	$QINT_{c,a} = ir_{c,a}\, QA_a$	$a \in A$, $c \in C$	81
12	$QX_c = \sum_{a \in A} \theta_{a,c}\, QA_a$	$c \in C$	9
13	$QX_c = ax_c[(1-\delta x_c) QD_c^{\rho x_c} + \delta x_c\, QE_c^{\rho x_c}]^{1/\rho x_c}$	$c \in CE$	8
14	$QX_c = QD_c$	$c \in CNE$	1
15	$QQ_c = aq_c[(1-\delta q_c) QD_c^{-\rho q_c} + \delta q_c\, QM_c^{-\rho q_c}]^{-1/\rho q_c}$	$c \in CM$	8
16	$QQ_c = QD_c$	$c \in CNM$	1
17	$QM_c / QD_c = [(\delta q_c / 1-\delta q_c)(PD_c / PM_c)]^{\sigma q_c}$, $\sigma q_c = 1/(1+\rho q_c) > 0$	$c \in CM$	8
18	$QD_c / QE_c = [(\delta x_c / 1-\delta x_c)(PD_c / PE_c)]^{\sigma x_c}$, $\sigma x_c = 1/(\rho x_c - 1) > 0$	$c \in CE$	8

Equations - Institution Block

19	$YF_{i,f} = shry_{i,f} \sum_{a \in A} FPD_{f,a} PF_f QF_{f,a};$	$i \in I,$ $f \in F$	**99**
20	$YH_h = \sum_{f \in F} YF_{h,f} + TR_{h,g}\, CPI + EXR \cdot TR_{h,r} + TR_{h,s}$	$h \in H$	**9**
21	$HTS = \sum_h MPS_h (1 - ty_h) YH_h$		**1**
22	$HDS = HTS - \sum_h TR_{h,r} \cdot EXR$		**1**
23	$MPS_h = MPSIN_h (1 + MPSADJ \cdot MPSDUM_h)$		**9**
24	$UH_h = \prod_c \left(\frac{QH_{c,h}}{\beta_{c,h}} \right)^{\beta_{c,h}}$	$h \in H$	**9**
25	$QH_{c,h} = \frac{\beta_{c,h} EH_h}{PQ_c}$	$h \in H,$ $c \in C$	**81**
26	$EH_h = (1 - MPS_h)(1 - ty_h) YH_h$	$h \in H$	**9**
27	$CPIH_h = \prod_c PQ_c^{\beta_{c,h}}$	$h \in H$	**9**
28	$CPI = \sum_h \mu_h \cdot CPIH_h$		**1**
29	$\mu_h = \frac{UH_h}{\sum_h UH_h}$	$h \in H$	**9**
30	$QINV_c = INV_c\, IADJ$	$c \in C$	**9**
31	$GBS = \sum_{h \in H} ty_h YH_h + EXR \cdot TR_{g,r} + \sum_{c \in C} tq_c PD_c QD_c + \sum_{c \in CM} tq_c PM_c QM_c + YF_{g,f} + \sum_{c \in CM} tm_c EXR \cdot PWM_c QM_c + \sum_{c \in CM} te_c EXR \cdot PWE_c QE_c$		**1**

	$-\left[\left(TR_{s,g}+\sum_{h\in H}TR_{h,g}\right)CPI+\sum_{c\in C}PQ_cQG_c\right]$		
32	$YFRM = YF_{s,k}$	$s \in I$	**1**
33	$YFRMTS = YF_{s,k} - TR_{h,s}$		**1**

Equations - System Constraint Block

34	$\sum_{a\in A}QF_{f,a}+QFU_f = QFS_f$	$f \in F$	**11**
35	$QQ_c = \sum_{a\in A}QINT_{c,a}+\sum_{h\in H}QH_{c,h}+QG_c+QINV_c$	$c \in C$	**9**
36	$FS+\sum_{c\in CE}PWE_cQE_c+\sum_{i\in I}TR_{i,r} = \sum_{c\in CM}PWM_cQM+\sum_{i\in I}TR_{r,i}$		**1**
37	$WALR=\left[\sum_{h\in H}MPS_h(1-ty_h)YH_h+YFRMTS+GBS+EXR\cdot BOP\right]-\sum_{c\in C}PQ_c\,QINV_c$		**1**

4. Data and model calibration

Fiscal year 2001-02 is selected as the bench mark year as the most recent, comprehensive and consistent data set was available in the form of Social Accounting Matrix (SAM). It is a 114 x 114 matrix developed by Dorosh, Niazi, and Nazili (2006). This dataset is not only micro-consistent but satisfies all equilibrium conditions and properties of CGEM-Pak. A standard calibration procedure, developed by Mansur and Whalley (1984), is followed based on a base year dataset (SAM 2001-02). Most of the model parameters are calibrated directly from the benchmark data, such as input-output coefficients (IO), shares in the returns to factors by household types and parameters of the Cobb-Douglas functions. The CES and CET functions are taken from existing literature. Other coefficients are implicit in the benchmark data, given the functional forms used in the model equation and other parameters. Thus calibrated, the model reproduces the initial year in the absence of any shock. Generalized Algebraic Modelling System (GAMS) software (Brooke *et al.*, 1997) is used for all model computations.

Ideally, trade elasticities should be estimated econometrically from cross section and time series data. Given limited resources as well as data constraints, it is not possible to estimate elasticity parameters for this study. Therefore elasticity parameters employed by different studies examining similar questions for comparable developing economies have been used.

Table 6 shows the Armington elasticities adopted in selected countries, whereas trade

elasticities for CGEM-Pak are given in Table 7. It must be noted that trade elasticities such as the value of Armington play a vital role in the relatively disaggregate models. This gives rise to the need for conducting a detailed sensitivity analysis to assess the robustness of the results.

Table 6. Armington Elasticities in selected Countries

Source	**Armington Elasticity**	**Country**
Alaouze et al. (1977)	2	Australia
Vincent (1986)	2	Chile
Vincent (1986)	0.5 to 5.0	Colombia
Vincent (1986)	2	Ivory Coast
Vincent (1986)	0.5 to 5.0	Kenya
Vincent (1986)	0.5 to 5.0	India
Vincent (1986)	0.20 to 2.0	Turkey
Vincent (1986)	Less than 2	South Korea
Kapuscinski and Warr (1992)	2.0	Philippines
Comber (1995)	1.64 to 3.5	New Zealand
Kapuscinski and Warr (1996)	0.04 to 3.8	Philippines

Source: Somaratne, W.G. (1998).

Table 7. Trade Elasticities

Commodities	Armington Elasticity	CET Elasticity
C-AGRI	4.0	4.0
C-MINE	3.0	3.0
C-FMAN	3.5	3.0
C-YARN	3.2	3.0
C-TEXT	3.5	3.0
C-LEAT	3.5	3.0
C-MANF	3.2	3.0
C-ENRG	3.0	3.0
C-SER	2.7	2.0

Source: Ahmad et al (2008)

In essence, the equations of the model describe interrelationship of macro economy while the SAM provides actual values for the coefficients in these equations through the calibration process. The model will be solved primarily for equilibrium to make sure that the base year dataset is reproduced. Afterwards, it would be possible to shock the model with a change in the value of one of the exogenous variables. The model will then be re-solved for equilibrium (as before) and the changes in the values of the endogenous variables. These values will then be compared to those of the base-year equilibrium to establish the impact of the exogenous shock.

5. Welfare Measures

Among all possible welfare measures, Equivalent Variations (EV) is used in the paper to address the winner-loser issue when the policy is executed. EV is a measure of how much more money a consumer would pay before a price increase to avert the effects of the price increase. Otherwise-stated, the amount of money which would have to be given to or taken away from an individual to make them as well-off as they would have been after the prices change (Gravelle, & Rees, 1987). Mathematically it can be written as:

$$EV_h = \left(\frac{CPIH_h^0}{CPIH_h^1} \right) EH_h^1 - EH_h^0$$

6. Inequality measures

There are quite a few methods to measure inequality. The most popular inequality measures (Theil-L, Theil-T, Theil-S and Hoover indices) are used to see the impact of trade policy (abolition of tariff) on household inequality. Moreover, due to the limitation of our data, only inequality between household groups is captured.

To calculate inequality, a variant of the Hoover/Theil-L/Theil-T/Theil-S indices[2] is used. The range of the Hoover index lies between 0 and 1 (0% and 100%). This index is the simplest of all inequality measures. Here, the meaning of the index is easy to explain: The multiplication of the Hoover index with the sum of all resources (income) directly yields the share of all resources, which would have to be redistributed until a state of perfect equality is reached.

The Theil-T index ranges from 0 (lowest inequality) to 'ln (N)' (highest inequality). Conversely, the Theil-L index ranges from 0 to infinity and the higher the value of Theil-L, the higher the inequality is. Simplistically, Let total income of the population is *Y*, Income of subgroup is YH_h, total population is *N*, and the population in the subgroup N_h. And let *TT* represent Theil-T, Theil-T can be written as:

$$TT = \ln\left(\frac{\sum_h N_h}{\sum_h YH_h} \right) - \frac{\sum_h YH_h \ln\left(\frac{N_h}{YH_h} \right)}{\sum_h YH_h},$$

and Theil-L can be written as:

$$TL = \ln\left(\frac{\sum_h YH_h}{\sum_h N_h} \right) - \frac{\sum_h N_h \ln\left(\frac{YH_h}{N_h} \right)}{\sum_h N_h},$$

[2] For brevity, the derivations of inequality measure are not listed here. The full specifications and derivations of the formula are available upon request.

"symmetrized" Theil index can be calculated as:

$$TS = \frac{1}{2}\left[TT - TL\right].$$

Substituting values of *TT* and *TL* in above equation

$$TS = \frac{1}{2}\sum_h \ln\left(\frac{YH_h}{N_h}\right)\left(\frac{YH_h}{\sum_h YH_h} - \frac{N_h}{\sum_h N_h}\right),$$

Hoover's Index can be written as

$$HI = \frac{1}{2}\sum_h \left|\frac{YH_h}{\sum_h YH_h} - \frac{N_h}{\sum_h N_h}\right|$$

7. Experiment: Fiscal strictness to cover revenue losses due to trade liberalization and existing budget deficit

Since trade liberalization worsens the government's fiscal position, the anticipated revenue losses from this and the existing government deficit was replaced in the following simulations. These simulations are constructed in such a way that not only import tariff is reduced to zero but government budget deficit – including the existing deficit and losses from the proposed tariff elimination - is also eliminated.

The budget deficit in the benchmark year (2001-02) was Pak. Rs. 8457 million. Abolition of tariff increased this deficit to Pak. Rs. 58028.38 million. This budget deficit could be eliminated by reducing existing government's consumption expenditures by 14% or increasing government revenues by either increasing existing sales tax by 28% or income tax by 39%. Since this budget deficit is 14% of pre-simulation consumption expenditures of government, 28% of pre-simulation sales tax and 39% of pre-simulation income tax. All these possibilities were dealt with one by one to compensate government's loss of revenues due to abolition of tariff and including the existing budget deficit. Hence policy simulation in this section fulfils the two of the most important conditions (already discussed in the introduction to this chapter) of SAP (1988) (for details see Section 1.7, Chapter 1) at the same time. Our policy simulation experiments are as follows:

- TLFS1 = Fiscal strictness to compensate revenue losses due to trade liberalization and existing budget deficit by increasing pre-simulation sales tax by 28%.

- TLFS2 = Fiscal strictness to compensate revenue losses due to trade liberalization and existing budget deficit by increasing pre-simulation income tax by 39%.

- TLFS3 = Fiscal strictness to compensate revenue losses due to trade liberalization and existing budget deficit by decreasing existing consumption expenditure of government by 14%.

7.1 Simulation results of the experiment

7.1.1 Macro Level

The results at macro levels (Table 8) indicate that there are positive impacts from trade liberalization accompanied by fiscal strictness on the economy of Pakistan. A respective increase in GDP by 0.16% and 0.18% resulted when TLSF1 and TLSF2 are implemented. However, a decrease in GDP by 0.04% is recorded in the case of TLSF3. This is because of government's reduction in consumption expenditure to cover the losses arising out of trade liberalization.

Table 8. Macro effects of trade liberalization & fiscal strictness (%age change from base)

	TLFS1	TLFSS2	TLFS3
GDP	0.16	0.18	-0.04
Government Consumption	0.86	1.69	-13
Investment	2.3	4.6	5.79
Exports	11.3	12.99	14.29
Imports	8.64	10	11
Net Indirect Tax	4.6	-18.07	-17.28
Private Consumption	0.09	-0.34	1.1
Import Price	-23.55	-18.2	-15.9
Export Price	28.8	34.8	36.8
Economy-wide EV	0.09	-0.34	1.104
Economy-wide CV	0.09	-0.343	1.105

A considerable increase in imports was obtained in all the three simulations – TLSF1, TLSF2, and TLSF3 – by 8.64%, 10%, and 11%, respectively. This increase in imports is in-line with the theory and not beyond expectations. This changed trend of increase in imports is an outcome of considerable decrease in import prices as tariff is abolished. The abolition of import tariff may have discouraged import substitution sectors. Hence respective increase in exports by 11.3%, 12.99% and, 14.29% in these three experiments is recorded. An increase in imports in the case of TLFS1 is less than that of other two experiments. This can possibly be explained by the nature of experiment. The government increased sales tax to cover import tariff losses which increased prices of imports in the domestic market. Whereas, in case of the two other experiments, either the government increased direct tax (income tax on non-poor-urban households) or decrease its consumption expenditure to cover import tariff losses.

Investment responds positively to all three policy measures. However, undertaking trade liberalization and compensating its fiscal consequences by sales tax (TLFS1) contributes lesser to the increase in investment compared to the two other experiments, i.e. compensating trade liberalization's fiscal consequences by increase in direct tax or cut in consumption expenditure of the government.

In the case of economy-wide welfare consequences of these policy measures, the most

suitable measure is TLFS3, as economy-wide EV and CV increased by 1.104% and 1.105%, respectively. The implementation of TLFS2 resulted in the fall of economy-wide EV and CV by 0.34% and 0.343%, respectively.

7.1.2 Household welfare

One definition of welfare is the GOVERNMENT handouts to the poor, but Economists use the term to describe the well being of an individual or society. An Economist will mostly suggest tax cuts to improve the overall well being of the country, but most governments will not talk of tax cuts and a handout will be considered a welfare tool like in USA and even in Pakistan.

The concept of efficiency or welfare, serves as a starting point for any policy analysis. Unlike a pure theoretical approach, where only an ordinal measure of alternative states is examined, applied policy analysis employs measures of welfare. This allows the comparison of changes in welfare arising from certain policy changes. Changes in nominal income, consumer price indices of households and equivalent variations (EV) are shown in Table 9.

Table 9. Impact of trade liberalization & fiscal strictness on Household welfare

	TLFS1			TLFS2			TLFS3		
	YH (% change from base)	CPIH (% change from base)	EV	YH (% change from base)	CPIH (% change from base)	EV	YH (% change from base)	CPIH (%change from base)	EV
H-LF	-0.5	0.124	-529	0.6	0.074	431	1.6	0.086	1276
H-MF	-0.47	0.125	-1286	0.6	0.071	1152	1.5	0.08	3166
H-SF	-0.3	-0.171	-723	0.9	-0.154	5427	1.5	-0.091	7747
H-0F	-0.4	-0.292	-66	0.8	-0.279	1124	1.5	-0.231	1727
H-AGW	-0.3	-0.385	79	0.9	-0.345	1207	1.4	-0.274	1619
H-NFNP	0.2	-0.038	807	1.9	-0.059	7033	1.2	-0.041	4399
H-NFP	0.1	-0.353	553	1.8	-0.37	2832	1.4	-0.342	2188
H-URNP	0.3	0.151	2546	1.4	0.163	-33513	0.8	0.119	9744
H-URPR	0.4	-0.262	1318	2.1	-0.245	3965	0.7	-0.238	1696

In response to TLFS1, changes in nominal income of household types H-LF, H-MF, H-SF, H-0F, and H-AGW are found to be negative (Table 10). This resulted from the reduction in nominal wages of the factors and returns from the capital owned by these households. Whereas rest of the household types – HNFNP, H-NFP, H-URNP and H-URPR – recorded increase in their nominal income as income of factors owned by these households increased.

Table 10. Impact of trade liberalization & fiscal strictness on household income (% change from base)

	TLFS1	TLFS2	TLFS3
H-LF	-0.5	0.6	1.6
H-MF	-0.47	0.6	1.5
H-SF	-0.3	0.9	1.5
H-0F	-0.4	0.8	1.5
H-AGW	-0.3	0.9	1.4
H-NFNP	0.2	1.9	1.2
H-NFP	0.1	1.8	1.4
H-URNP	0.3	1	0.8
H-URPR	0.4	2.1	0.7

To identify the net impact of the simulations, the change in nominal income must be compared with the change in consumer price index (now onwards CPIH). Generally, for all three simulations, the change in the consumer price index indicates a fall for all groups, apart from household types H-LF, H-SF, and H-URNP.

By jointly considering the income and price effects, it is possible to capture the welfare impacts through the EV measure. Except for household types HNFNP, H-NFP, and H-URNP the EV is positive for all household types under the simulation TLFS1. This is a manifestation of the rise in income which led to an increase in the consumption expenditure. Together with this, fall in consumer price index of household also plays an important role in this increase of EV. However, household type H-AGW recorded decrease in income which was offset by decrease in their CPIH. Hence this group also recorded increase in EV. Furthermore, the value of the EVs of household type H-MF suggests relatively larger losses when compared with other affected household types. The value of the EVs of household type H-URNP suggests relatively larger gain when compared to other affected household types.

In the case of the TLFS2, the increase in income of household types H-LF and H-SF is substantially larger than the increase in their CPIHs, leading to an increase in their EVs. Apart from H-URNP, rest of household types recorded an increase in their respective EVs. This outcome is due to the rise of their respective income coupled with decline in their CPIHs. The only decline in EV of the household type H-URNP is witnessed in the case of TLSF-2 (as expected). This is a consequence of a substantially larger increase in their CPIH as compared to the increase in their income. This results from the imposition of 39% income tax to compensate the losses of trade liberalization and the budget deficit at the base. This situation led to the reduction of disposable income, leaving less money for consumption expenditure, resulting in the decline in their EV.

In the third simulation – TLSF3, the larger increase in income of household types H-LF, H-MF, and H-URNP out-weighed the increase in their respective CPIHs values, leading to a positive change in consumption and EV values. However, for rest of household types recorded, increase in their respective income together with decrease in their respective CPIHs

led to a rise in consumption and EVs. This is the only simulation out of three which recorded increase in EVs of all types of households. The values of the EVs indicate larger gains for household types H-SF and H-URNP, compared to other households.

7.1.3 Inequality

Is equality related to GROWTH and does it create more or less equality? Do unequal societies grow slowly than equal ones? This has been a debating point for a long time in the economics field. Then is the argument about the equality of outcome (that is, INCOME) or of opportunity. Which one is more relevant and important? Regarding income distribution, Theil Indices – Theil-L, Theil-T and Theil-S – and Hoover index are used as an indicator of inequality. Due to their decomposition properties, it becomes possible to consider their respective contributions of within-group and between-group inequality to the total inequality. Only the inequality between groups was measured in the case of these simulations. This limitation is a direct result of the limitations of the data.

The result of inequality indices in the case of TLFS1, TLFS1 and TLFS1 is presented in Table 11. All indices show that in the case of TLFS1, inequality increases and in the case of TLFS2, inequality between-household types remain unchanged, and in the case of TLFS3, between-households inequality decreases

Table 11. Impact of trade liberalization & fiscal strictness on household inequality

	TLFS1		TLSF2		TLSF3	
	BASE	Experiment	BASE	Experiment	BASE	Experiment
Theil-T	0.318	0.319	0.318	0.318	0.318	0.317
Theil-L	0.326	0.327	0.326	0.326	0.326	0.325
Theil-S	0.322	0.323	0.322	0.322	0.322	0.321
Hoover	0.346	0.347	0.346	0.346	0.346	0.345

8. Sensitivity Analyses

Sensitivity Analysis is done in Simulation Modeling in the field of Quantitative Analysis. In Simulation analysis key quantitative assumptions and computations underlying a decision, estimate, or project are changed systematically to assess their effect on the final outcome of the analysis. In the experiment under discussion, Sensitivity analysis was conducted to determine how the results of CGEM-Pak are affected by changes in the trade elasticities. Experiments involving +50% and -50% changes in the trade elasticities were conducted in different combinations (Table 12). Note that as sigma-q (Armington elasticity) increases the sensitivity of imports to changes in the relative price increases. The same effect holds for sigma-x, the export elasticity. In the results, the effects of changes in trade elasticities are not very significant. The effects on macroeconomic analysis (Table 13), income analysis (Table 14), sectoral prices (Table 15), and sectoral output (Table 16) are very small relative to the change in the elasticities (+50% and - 50%).

Table 12. Sensitivity Experiments

Experiment	Change in trade elasticities
E0	Original values of sigma-q & sigma-x
E1	+50% in sigma-q
E2	+50% in sigma-x
E3	- 50% in sigma-q
E4	- 50% in sigma-x
E5	+50% in sigma-q & sigma-x
E6	- 50% in sigma-q & sigma-x
E7	+50% in sigma-q & -50% in sigma-x
E8	- 50% in sigma-q & +50% in sigma-x

Table 13. Effect of sensitivity experiments on National income Accounts (% change from base)

	E0	E1	E2	E3	E4	E5	E6	E7	E8
GDPFC	1.43	1.50	1.49	1.36	1.3	1.6	1.29	1.4	1.4
GDPGAP	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.05	0.0
GDPMP1	0.03	0.13	0.07	-0.1	0.0	0.2	-0.1	0.05	-0.04
GDPMP2	0.03	1.33	0.07	-0.1	0.0	0.2	-0.1	0.05	-0.05
GOVCON	1.08	1.51	1.08	0.58	1.07	1.5	0.5	1.5	0.6
INVEST	-5.3	-4.9	-5.6	-5.8	-4.9	-5.1	-5.7	-4.5	-6.0
EXP	11.5	15.1	12.3	6.84	10.4	16.6	6.6	12.9	7.0
IMP	8.9	11.6	9.2	5.32	8.47	12.4	5.4	10.5	5.3
NITAX	-18	-18	-19	-19	-18	-19	-19	-17	-19
PRVCON	1.26	1.38	1.28	1.13	1.2	1.4	1.1	1.3	1.1

Table 14. Effect of sensitivity experiments on Household Income (% change from base)

	E0	E1	E2	E3	E4	E5	E6	E7	E8
H-LF	1.267	1.085	1.283	1.51	1.25	1.109	1.508	1.067	1.506
H-MF	1.265	1.094	1.282	1.494	1.244	1.12	1.49	1.072	1.492
H-SF	1.365	1.294	1.383	1.468	1.339	1.321	1.456	1.263	1.473
H-0F	1.321	1.22	1.341	1.465	1.295	1.249	1.454	1.189	1.468
H-AGW	1.338	1.267	1.36	1.445	1.307	1.298	1.43	1.229	1.451
H-NFNP	1.544	1.754	1.579	1.303	1.485	1.8	1.257	1.677	1.332
H-NFP	1.57	1.741	1.598	1.372	1.525	1.778	1.336	1.68	1.396
H-URNP	1.095	1.312	1.099	0.837	1.085	1.319	0.826	1.291	0.845
U-URPR	1.511	1.82	1.565	1.163	1.416	1.889	1.091	1.701	1.206

Table 15. Effect of sensitivity experiments on composite prices (% change from base)

	E0	E1	E2	E3	E4	E5	E6	E7	E8
C-AGRI	0.282	0.016	0.286	0.649	0.284	0.021	0.66	0.032	0.637
C-MINE	3.561	4.644	3.017	2.111	4.498	4.001	2.761	5.667	1.779
C-FMAN	-3.28	-4.41	-3.07	-1.93	-3.54	-4.168	-2.09	-4.709	-1.84
C-YARN	2.959	3.674	2.741	2.021	3.037	3.464	2.177	3.671	1.837
C-TEXT	0.74	0.869	0.848	0.449	0.261	1.048	0.186	0.253	0.485
C-LEAT	0.599	0.856	0.921	0.369	-0.17	1.258	-0.15	-0.062	0.57
C-MANF	0.183	1.099	-0.21	-0.95	0.901	0.595	-0.51	1.924	-1.15
C-ENRG	2.129	2.658	1.997	1.456	2.329	2.501	1.576	2.869	1.393
C-SER	1.076	1.508	1.078	0.578	1.072	1.508	0.557	1.496	0.598

Table 16. Effect of sensitivity experiments on composite quantities (% change from base)

	E0	E1	E2	E3	E4	E5	E6	E7	E8
C-AGRI	0.666	0.833	0.676	0.42	0.637	0.858	0.408	0.777	0.426
C-MINE	-0.84	-0.74	-0.88	-0.90	-0.72	-0.84	-0.902	-0.56	-0.87
C-FMAN	3.535	4.479	3.398	2.446	3.721	4.318	2.552	4.667	2.385
C-YARN	1.53	1.746	1.361	1.132	1.712	1.583	1.324	1.89	0.991
C-TEXT	0.836	0.871	0.733	0.816	1.138	0.738	1.009	1.226	0.757
C-LEAT	1.215	1.393	1.03	0.925	1.567	1.179	1.182	1.78	0.802
C-MANF	-0.71	-0.89	-0.63	-0.47	-0.85	-0.79	-0.572	-1.05	-0.43
C-ENRG	0.151	0.149	0.135	0.144	0.169	0.131	0.156	0.169	0.136
C-SER	-0.46	-0.60	-0.45	-0.30	-0.46	-0.59	-0.293	-0.60	-0.31

9. Conclusion

The objective of this experiment – implementation of SAP - was to analyse and review the existing trade deficit and revenue losses due to the abolition of the tariff. Three avenues were considered in the experiment and evaluation: (1) increase in sales tax (2) increase in income tax and (3) cut in government's consumption expenditures. The research indicated and strongly supported that a cut in government consumption expenditure tends to outperform other two fiscal stances in terms of household and economy-wide welfare indicators.

The results suggest that targeting the government's consumption expenditures tends to be a real and potent tool for reducing government budget deficit and to cover losses arising out of import tariff abolition. It should be observed that the results derived from this study are conditional according to the structure of the model. National Growth was not taken into account in these experiments. The model (CGEM-Pak) is essentially a real-side model. Alleviation of inequality and increment of household welfare indeed require effective synchronization of other instruments such as monetary policy with fiscal policy that could be a good future avenue of research.

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