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External Shocks in a Small Open Economy: A CGE-Microsimulation Analysis

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External Shocks in a Small Open Economy: A CGE-Microsimulation Analysis

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Abstract

This paper studies the impact of changes in the external balance of a developing economy (Pakistan). We explain that the economic growth achieved during the past decade is highly dependent on the improvements in external balance. Between 2001 and 2007 Pakistan has benefited from, an increase in the inflow of remittances, foreign assistance from bilateral and multilateral sources, and a relatively stable exchange rate. This was also complimented by growth in the real sector. The GDP grew at an average of 6 percent from 2001 to 2007. During the same time period the investment to GDP ratio increased from 17 to 23 percent. After 2007 this performance came under pressure due to external price shocks. The increase in import price of petroleum, raw materials and other manufactured goods has the potential of reducing the growth performance, impacting the competitiveness of the economy and thereby threatening the gains achieved during the past years. We integrate a 33 sector CGE model with a detailed microsimulation model to study the effects of changes in foreign savings and import prices faced by Pakistan. A 50 percent increase in foreign savings leads to an increase in imports and a decrease in exports. Main sectors facing a decline in exports are textile, leather, cement and livestock. Changes in prices seem pro-poor as food and oil prices decline. Those factors of production that gain under this change are agricultural wage labor and non-agricultural unskilled wage labor. The later indicating a change in favor of urban poor. The increase in import prices of petroleum or industrial raw material leads to a reduction in exports. The prices impact the crop sector adversely. Return to land and profits to farm owners increase showing a change in favor of agricultural asset owners. Poverty and inequality increase.

Keywords: Microsimulation, Computable General Equilibrium, Poverty, Inequality, Balance of Payments.

JEL Classification: D58, C81, C82, H22, D58, C51, I32

1. INTRODUCTION

The two issues posing a continuous difficulty for the balance of payments position in Pakistan are the expensive structure of foreign savings and terms of trade shocks. Foreign savings also known as the current account deficit usually play a very important role in the infrastructure and social sector needs of the developing countries (see Husain 2007). There are two forms of foreign savings; debt and non-debt. The non-debt sources of foreign savings are usually less of a concern if compared with the short and medium term debt instruments. Under the conventional economic thinking, the developing economies should not solely rely on national savings, but should also put in place mechanism to bring in foreign direct and portfolio investment (See Reisen and Soto 2001). Poverty impact of remittances are mostly favourable, however differ for various tiers in the population. Chimhowu *et al.* (2005) show that increased income in the form of remittances helps in income and consumption smoothing, enhanced household savings that in turn enables asset accumulation.

The short term debt under weak macroeconomic fundamentals is expensive and has been responsible in the past for plunging several developing countries in to a debt trap (see Voyvoda and Yeldan 2005). A persistent current account deficit also puts adverse pressure on the national budgetary targets, bringing about the phenomenon commonly know as the 'twin deficits' (See Aristovnik 2008).

The general equilibrium dynamics of aid and grants are explained in Anderson *et al.* (2003). They bifurcate the effects of aid into: a) diversion of resources, and b) real currency appreciation. The project based aid in fact diverts resources away from the ongoing and existing production activities. Even in the case where projects are totally foreign funded the human capital is taken away from the existing activities. As most of the development projects are publically administered, this implies that resources may be inefficiently allocated as the private sector now faces increased costs of

production due to increases in wages of labour as well as raw materials. This effect seems plausible and can be observed in several developing economies.

The inflow of foreign capital can cause the exchange rate to appreciate which in turn increases real wages and imports. This has implications for exports and future economic growth. Recent literature shows that several Asian economies have defended their (competitive) exchange rates in order to promote growth. This debate is highlighted in Bresser-Pereira and Paulo Gala (2008).

In the wake of trade liberalization the import volumes of developing countries have generally increased. There is evidence that after the liberalization, there has been an increase in economic growth at the cost of rising trade deficit (See Pacheco-López and Thirlwall 2007).The manner in which import prices impact local prices has been studied across literature mainly using two methodologies, namely: a) pass-through approach, b) Armington elasticity approach. Studies focusing on pass-through of exchange rates and import prices to domestic inflation reveal that import price shocks have a much larger impact on domestic inflation in comparison to the exchange rate shocks (see McCarthy 2007). An accommodative monetary policy combined with exchange rate changes may however trigger inflation-depreciation spiral (see Ito and Sato 2008). The Armington approach is commonly used in CGE models where the elasticity of substitution is assumed for import and domestic production of a good. This paper also uses this approach. The elasticities used for 34 sectors in the model can be seen in Table 4. See Warr (2005) for a relationship between pass-through and Armington approach.

Studies focusing on rise in international oil prices indicate a reduction in welfare and economic growth (see Zaouali 2007, Schintke *et al.* 2000). In a general equilibrium framework energy prices faced by households and producers can have varying distributional impacts. Countries which have deregulated energy sector through price reforms provide interesting insight. For Indonesia's case Yusuf and Resosudarmo (2008) show how differentiated prices for domestic and commercial fuel can make the overall reform process (deregulation) progressive. Several countries including Pakistan have tried until recently not to pass-on the impact of rising energy prices by subsidizing the overall price (see Baclajanschi *et al.* 2007).

Pakistan during the 1990s struggled with its debt servicing due to misappropriation of funds, poor fiscal effort and a continuously depreciating exchange rate. The recovery from the twin deficits after 2001 allowed Pakistan to retire its expensive short term debt and until 2007 it only had medium to long term debt commitments under multilateral and bilateral arrangements. Like any other low and middle income country, Pakistan is a price-taker and its current account is exposed to shocks in the global export and import price indices. This issue is of critical importance due to the lack of diversification in the overall export structure of Pakistan. More than 60 per cent of Pakistani exports include raw cotton, yarn, garments and cloth-made ups. Despite the continuous efforts by the government's trade related organizations, exports of other products have been sluggish. Some growth was recently registered in the exports of rice, leather, carpets, chemicals and pharmaceuticals. However the gap between textile and other export categories still remains large. The structure of imports also plays an important role in sustaining the long run development of a country. What is important is that a country should be importing more production/capital goods in comparison to the consumption goods. In the light of the recent growth in large-scale manufacturing sub-sectors the import of machinery and other inputs increased to unprecedented levels. However oil price shocks have been a continuous threat to the overall terms of trade. More recently local food shortages implied importing food (mainly wheat) at high rates.

Our choice for studying these macroeconomic changes in a CGE framework is motivated by the insightful literature on trade reforms in particular and global economic liberalization in general. A CGE model is an economy-wide framework that shows how a specific change in the economy impacts other sectors, markets or institutions. These models are widely used for analysis pertaining to taxation, trade liberalization, environment, natural resource policy, and regional development. The data used for the construction of CGE models is commonly known as a Social Accounting Matrix (SAM). Examples of CGE models developed for Pakistan include McCarthy and Taylor (1980), Labus (1988), Vos (1998), Naqvi (1998), Siddiqui and Kemal (2002), Ahmed and O' Donoghue (2007).

Microsimulation models based on household income and expenditure survey data allow us to simulate changes in tax-benefit structures. Since the seminal work by Orcutt (1957) this methodology has come a long way in being recognised as a viable

tool for impact and incidence analysis. The stand alone microsimulation models are today widely used for studying the micro-level impacts of socio-economic policies. These models allow the explicit incorporation of tax and benefit related rules and regulations. Microsimulation models are made behavioural through the incorporation of expenditure system, wage and occupational choice functions.

The integration of CGE models with microsimulation models has allowed us to obtain the micro impacts of macroeconomic policy change by making use of heterogeneity in household level surveys (see Davies 2004). It is not possible for a single methodology to disentangle the welfare impacts of macroeconomic policies which leads us to using disaggregate CGE models in combination with other partial equilibrium approaches in the quest of reaching the nearest possible answers. See Gunter, Cohen and Lofgren (2005) for a review on analyzing macro-poverty linkages (see also Robinson and Lofgren 2005, Kraev and Akolgo 2005). There remain several challenges in perfecting the general equilibrium exercises for developing countries. The choice of realistic assumptions and parameterization play an important role in determining the direction and magnitude of results. See Ben Hammouda and Osakwe (2008) on the use of trade-focused CGE models in Africa. See Cockburn *et al.* (2008) on the general equilibrium lessons on trade-poverty nexus in African and Asian countries.

In this paper we look at the welfare impact of changes in foreign savings and world import prices. For the later we are particularly interested in import price of petroleum and industrial raw material. The next section describes the recent trends in the socio-economy vis-à-vis the external balance in Pakistan. Section 3 will briefly describe our model framework, data, parameterization, related measurement issues and design of simulations. Section 4 explains the impact of changes in foreign savings and section 5 explains the import price effects. Section 6 then concludes and provides a summary of main findings.

2. GROWTH, TRADE AND WELFARE IN PAKISTAN

Since 1960 Pakistan economy has grown at an average growth rate of 5.6 percent. The 1960s exhibited the highest annual average growth rate of 6.8 percent derived from increase in manufacturing (9.9 %) and agriculture (5.1 %). This was a period were

Pakistan received substantial aid from its bilateral and multilateral development partners. Public sector expenditure was focused on public works and setting up of necessary infrastructure for future growth requirements.

Table 1 Growth, Trade & Welfare: Historic Overview

	1960s	**1970s**	**1980s**	**1990s**	**2000-07**
	Annual Average				
	Real Growth Rates (%)				
GDP	6.8	4.8	6.5	4.6	5.4
Agriculture	5.1	2.4	5.4	4.4	3.4
Manufacturing	9.9	5.5	8.2	4.8	8.6
Commodity Producing Sector	6.8	3.9	6.5	4.6	4.9
Services Sector	6.7	6.3	6.7	4.6	5.8
	As % of GDP				
Total Investment	-	17.1	18.7	18.3	18.6
Fixed Investment	-	15.9	17.0	16.6	17.1
Public Investment	-	10.3	9.2	7.5	4.8
Private Investment	-	5.6	7.8	9.1	12.3
National Savings	-	11.2	14.8	13.8	17.9
Foreign Savings	-	5.8	3.9	4.5	0.8
Domestic Savings	-	7.4	7.7	14.0	16.8
Total Revenue	13.1	16.8	17.3	17.1	14.1
Tax Revenue	-	-	13.8	13.4	10.7
Total Expenditure	11.6	21.5	24.9	24.1	18.1
Current Expenditure	-	-	17.6	19.4	14.9
Development Expenditure	-	-	7.3	4.7	3.3
Overall Deficit	2.1	5.3	7.1	6.9	4.0
Exports (fob)	-	-	9.8	13.0	12.5
Imports (fob)	-	-	18.7	17.4	15.4
Trade Deficit	-	-	8.9	4.4	2.9
	Annual Average				
Gini Coefficient*	0.39	0.38	0.37	0.39	0.34
Poverty Headcount**	42.4	38.6	20.9	27.3	26.9
Unemployed %***	-	2.2	3.5	5.6	7.1

Source: Economic Survey of Pakistan 2007-08. Some figures for 1960s and 1970s are missing on account of the separation of East Pakistan (now Bangladesh). It is challenging to split the statistical values with a fair level of precision.

*Gini estimates from Anwar 2005, For 2005-07 estimates from economic survey.

**Until 1999 from Haq & Bhatti 2001. After that from Economic Survey 2007-08.

***Labour Force Survey.

However Table 1 inidcates that this impressive growth performance could not be sustained in the longer term. The end of Ayub Khan's period (1958-1969) was soon followed by the break-up of the country and Bangladesh (formerly East Pakistan) declaring independence. During the 1970s, Zulfiqar Ali Bhutto tried to implement a model of nationalization that aimed at bringing productive resources (in identified sectors) under the control of the government. This resulted in a mismanaged endeavor where most of the established entrepreneurs left the country along with their moveable assets. The average growth rate during the decade fell to 4.8 percent; the agriculture and manufacturing growth rate fell to 2.4 percent and 5.5 percent respectively. The nationalization experience however resulted in keeping the unemployment level below 3 percent during the 1970s (as shown by average unemployment rate in Table 1). This to some extent resulted in a marginal decline in inequality. The head count ratio declined from an average of 42.4 percent in 1960s to 38.6 percent during 1970s showing a decline of almost 9 percent. During the 1970s, total investment to GDP ratio fell to its lowest averaging around 17 percent. The public investment to GDP ratio stood at 10.3 percent while private investment to GDP ratio was 5.6 percent. The savings requirement for the economy was augmented largely through current account deficit that averaged 5.8 percent of GDP during the decade.

During the Zia regime (1978-1988) there was a partial move towards restoring the elements of private property and free market however the operational control of the government largely existed through a detailed licensing framework. The real GDP growth rate during the 1980s averaged around 6.5 percent with agriculture and manufacturing growing at 5.4 and 8.2 percent respectively. Both the total investment and national savings as a ratio to GDP showed reasonable improvement having an average of 18.7 and 14.8 percent respectively. The entire period of 1980s posed strategic challenges for Pakistan in the wake of former Soviet Union invading Afghanistan and a record influx of Afghan refugees in to Pakistan. This substantially increased the government expenditure on defense, public administration and related activities. Ultimately the increased budgetary expenditure resulted in an increase in average fiscal deficit of 2.1 percent during 1960s to 7.1 percent during 1980s. There was added pressure in the form of high trade deficit of around 9 percent of GDP. This

was attributed to the rise in imports (18.7 percent of GDP) and low levels of export (9.8 percent of GDP).

In 1988, after the demise of Zia-ul-Haq, Pakistan witnessed a return of democratic rule with Pakistan Peoples Party and later Muslim League coming in to power between 1988 and 1999. This period exhibited frequent changes in operational strategy which in most instances resulted in economic policy reversals. However both party heads, Benazir Bhutto and Nawaz Sharif promoted free market policies such as privatization program, trade liberalization and opening up of balance of payments. Multifarious measures were adopted in order to attract foreign direct and portfolio investment. Overseas Pakistanis were encouraged to invest under special incentives. Fiscal incentives were also put in place along with the expansion in private sector credit.

However given the frequent change of governments and a general politico-economic instability during 1990s, the real GDP growth averaged at 4.6 percent with agriculture and manufacturing sectors contributing 4.4 percent and 4.8 percent respectively. Overall investment and national savings as percentage of GDP were 18.3 and 13.8 percent respectively and showed a decrease from the levels witnessed during 1980s. Fiscal deficit remained high at 7 percent of GDP partially due to reduction in tax to GDP ratio, which fell from around 14 percent in 1980s to 13.4 percent in 1990s. The current expenditure of the government as percentage of GDP also increased from 17.6 percent in 1980s to 19.4 percent in 1990s. The deterioration in fiscal position in turn brought down the development spending on infrastructure as well as social sectors such as education and health. As a percentage of GDP, the development expenditure decreased from an average of 7.3 percent in 1980s to 4.7 percent in 1990s.

The process of trade liberalization, which initially included a reduction in tariff rates, was initiated during 1990s. The overall trade performance improved in comparison to the 1980s. Export to GDP ratio increased to 13 percent where as imports as percentage of GDP exhibited a decline and averaged at 17.4 percent. The trade deficit came down to 4.4 percent as ratio of GDP. In 1999 the military rule returned under poor socio-economic circumstances, declining foreign exchange reserves, stalled investment activity and the mounting debt of public sector corporations impairing the

macro economy. During the next two years Pakistan tried to secure short-term stabilization funds at an expensive interest rate term structure.

In the post 9/11 milieu Pakistan become a front line partner in the war against terrorism, which in turn resulted in medium term economic gains. The GDP growth was soon restored. The manufacturing sector took a leading role and grew at an average of 8.6 percent between 2000 and 2007. The investment to GDP ratio was restored to 1980s level averaging 18.6 percent. Only this time being financed by the relatively higher national savings (17.9 percent) of GDP. Rising worker remittances touched record levels. The average growth in remittances during this period was almost 29 percent per annum. The current account deficit, as percentage of GDP was 0.8 percent. The average trade deficit as percentage of GDP was 3 percent lower than the level observed in both previous decades.

Table 2 Structure of Trade

	1970s	**1980s**	**1990s**	**2000-07**
		Annual Average		
% Share in Imports				
Capital goods	35.6	33.6	35.8	31.8
Consumer goods	21.1	15.5	15.2	11.1
Raw material for Capital Goods	8.1	6.6	6.0	6.6
Raw material for Consumer Goods	34.6	44.4	43.0	50.5
% Share in Exports				
Primary Commodities	39.7	33.1	14.6	11.3
Semi-Manufactured Goods	20.9	15.9	21.7	12.4
Manufactured Goods	39.6	51	63.7	76.4

*Source: Economic Survey of Pakistan 2007-08.

Table 2 shows the structure of imports and exports. The share of capital goods in the overall imports has remained more or less constant since 1970s averaging between 31 to 36 percent while the share of consumer goods declined from 21 percent in 1970s to 11 percent during 2000-07. The import of raw material for the production of capital goods has been on the decline while the share of raw material for consumer goods increased and averaged around 51 percent during 2000-07. On the export side the share of primary commodities substantially decreased from 40 percent in 1970s to 11 percent during 2000-07. The encouraging aspect is that the share of manufactured goods increased to 76.4 percent indicating a movement towards achieving value addition in the export structure.

Table 3 Growth in Imports

	1970s	1980s	1990s	2000-07
	Annual Average Growth (%)			
Chemicals*	19.2	36.9	16.8	17.3
Medicines	30.8	18.9	15.1	9.6
Dyes/Colors	5.1	16.8	17.0	11.0
Chemical Fertilizers	82.6	16.0	27.3	13.9
Electrical goods	12.8	12.1	9.1	25.1
Machinery	15.4	20.7	14.1	24.2
Transport Equipment	27.1	15.9	16.6	29.1
Paper/Board	22.4	18.9	8.6	18.8
Tea	22.9	15.6	16.6	2.5
Art-Silk Yarn	206.9	9.8	1.5	29.2
Iron/Steel	17.5	11.7	11.6	24.3
Non-ferrous Metals	60.5	21.4	11.0	25.8
Petroleum	12.1	17.6	16.2	31.1
Edible oils	45.5	17.0	21.2	8.7
Grains	66.8	46.9	24.5	25.5
Other imports	15.1	14.5	16.6	22.2

Source: Economic Survey of Pakistan

*The data for group-wise imports is from 1976 under Statistical Supplement to the economic survey 2006

Table 3 shows the decade-wise percentage growth in imports. In comparison to the 1970s there is a shift away form necessity items towards those used in the production process. The growth in the imports of food items such as edible oil, grains and tea is declining overtime. There is an increase in import of capital goods and those used as industrial inputs namely electric goods, machinery, transport equipment, iron/steel, and petroleum.

Pakistan has remained an agrarian economy for most part of its economic history. Since its independence in 1947 agriculture remained the most important sector in the economy. However with the changes in the global demand, the shift towards industry and services sectors became inevitable. Although agriculture now contributes around 21 percent in the national output, however it employs 44 percent of the employed labour force and provides livelihood to 66 percent of the country's population living in rural areas.

The growth rates of manufacturing and services sectors show relatively less instances of fluctuations whereas the agriculture sector has faced much more volatility. Historically Pakistan has been very slow to modernize its agriculture sector. Almost all federal budgets to-date have: a) exempted agriculture from taxation and b) protected agriculture sector through high tariffs. Retrospectively the climatic conditions in Pakistan have been getting worse for the traditionally harvested crops. The decline in water tables is a major concern. Between 2001 and 2002 the growth

rate of agriculture was in negative due to the drought condition in almost half of the entire farming land.

In 2003 the industrial sector in Pakistan surpassed the agriculture sector in terms of their respective sectoral shares. The services sector shows more or less a constant pattern which is slightly above 50 per cent. The Quantum Index of Manufacturing shows that the move towards the production of more value added products is slow. There is a dire need to cut costs and increase productivity to cater the international demand. Quality control may be another issue to consider for the industrial sectors in the developing economies. Keeping in view the importance of ISO-standards and accreditation processes in a quota-free environment, the government established Pakistan Standards and Quality Control Authority (PSQCA) and the previously operational organizations namely, Pakistan Standards Institution (now SDC), Central Testing Laboratories (now QCC) and Metal Industries Research and Development centre (now TSC) have already been merged in PSQCA to provide one window standardization, quality control and other technical services.

After 2001 sub-sectors such as banking, insurance, communications and transport have grown at an unprecedented rate. However there is a limit to the domestic demand of these services and Pakistan is still lagging behind in the export of services. Pakistan's share in the world's services sector is around 0.1 per cent. The total services exports stood at $1.5 billion in 2004 while the total services imports stood at $2.5 billion for the same year. According to the initial findings from a study conducted in collaboration with International Trade Centre (ITC), Pakistan's services exports in various countries mainly face the problems of quality, acceptance of professional credentials, visa approval difficulties (particularly for exporters), re-certification process, multiple taxation regime, and country's *image* problem after 9/11 (Khan 2005).

The government has been continuously reducing the tariff rates to facilitate cheap import of raw material and to pass on the effects of free trade to the consumers. The maximum tariff has been brought down to 25 per cent in 2003 from 92 per cent in 1993. During the same time period the number of tariff slabs has been reduced from 13 to 4. The role of excise duties in the overall taxation structure has been minimized and will be phased out in near future.

The welfare indicators in Pakistan show a mixed trend (Table 1). The Gini coefficient broadly remained stagnant since 1960s, however poverty headcount ratio has declined from an average of 42.4 percent in 1960s to 27 percent between 2000 and 2007. Unemployment rate is on the rise. During 1970s the percentage of unemployed remained low due to the nationalized regime. However it has increased since then. The average unemployment rate between 2000 and 2007 was 7.1 percent.

3. MODEL, DATA AND SIMULATIONS

CGE-microsimulation Model

The CGE model follows the framework in Lofgren *et al.* (2001) and Dervis *et al.* (1982). The model is tailored for the common specifications of a developing country. Some of the important features of low and middle income countries included in this model are: a) household consumption of non-marketed commodities, b) explicit treatment of transaction costs for marketed commodities, and c) a separation between production activities and commodities (which in fact allows an activity to produce multiple commodities and any commodity can be produced by multiple activities). The overall model specification follows the neo-classical structuralist tradition[3]. This methodology may be seen at length in Dervis *et al.* (1982). Production and consumption decisions are modeled using non linear optimality conditions i.e. production and consumption decisions are based on the maximization of profits and utility respectively (subject to the underlying budget constraints). Production technology at the top of the nest uses a CES specification. If the available production techniques permit the mix between value added and intermediate inputs to vary, then the CES function is preferred (over Leontief function)[4]. The value addition has been treated as a CES function of primary inputs where as the overall intermediate input is

[3] What are Structuralist CGE models? According to Lustig (1988): "Structuralist thought considers that structural characteristics (the repetition is appropriate) of the economy are fundamental to its behaviour. Among the structural factors are the distribution of income and wealth, tenancy relationships on the land, the type and degree of specialization in foreign trade, the density of chains of production, the degree of concentration in markets, control of the means of production by distinct types of actors (the private sector, the state, or transnational capital), the functioning of financial intermediaries, and penetration of technical advance, as well as socio political factors associated with the extent of organization of the working class and other influential sectors and classes, the geographical and sectoral distribution of the population, and its level of skills".

[4] Leontief is a special (limiting) case of CES (with sigma = 0).

a Leontief function of disaggregated intermediate inputs. Fixed yield coefficients determine if an activity produces one or multiple commodities. The aggregate revenue from an activity is then a function of the level of activity, yield and the producer prices of commodities. The factor market follows the microeconomic assumption of employing factors until the point where the marginal revenue product of a particular factor becomes equal to its wage. Factor wages are variable across activities in order to realistically portray the cases where: a) markets are segmented, b) where factors are mobile, and c) where both the abovementioned possibilities exist. The activity specific wage is calculated by multiplying the wage with a distortion value. The distortion value will be different across activities.

The overall domestic output from all activities is allocated between domestic turnover and exports. In this case the assumption of imperfect transformability between exports and domestically sold goods is established using a CET function. Similarly on the import side a CES function is used for modeling imperfect sustainability (also referred to as the Armington assumption).

The households are receiving: a) income from the factors via enterprises, and b) transfers from other institutions such as government and rest of the world. The household's income is exhausted in: a) consumption, b) savings, c) paying income taxes, and d) transfer payments to other institutions. Households are consuming two types of commodities that include the marketed commodities which are accounted at the market price (market price includes indirect taxes and transactions costs), and the home-produced commodities accounted at the producer prices. LES demand function is used to allocate the consumption across commodities.

The income received by enterprises is allocated to savings, payment of corporate (direct) taxes and transfers. Government is receiving taxes at fixed ad valorem rates and has a fixed consumption. Those taxes which are charged on specific basis enter the model after conversion in to ad valorem equivalents. However the transfer payments made by the government to households and enterprises are indexed with the level of CPI. The residual from government's income and consumption is treated as savings. Given that government savings are flexible the direct tax rates are fixed in order to bring about government sector closure in the model. The payments made by *rest of the world* to domestic institutions (government, households and enterprises) and factors are treated fixed. The exchange rate is flexible. Consumer price index is

regarded as numeraire. The model has investment-driven savings where capital formation is fixed (static model assumption) and there is uniform change in marginal propensity to save for selected institutions. Land and labour are fully employed and allowed mobility across sectors. Capital is also fully employed however it is activity-specific i.e. no mobility across sectors.

For the microsimulation model we estimate earning equations and occupational choice model following the convention in Alatas and Bourguignon (2000). Such a specification allows a consistent linkage with a CGE model. Due to its ease of estimation and transparency, this approach has been followed in numerous studies. For general discussion on this micro model, see Bourguignon, Ferreira and Lustig (1998), Bourguignon, Fournier and Gurgand (2001). For applications where this specification is used for linkage with a CGE model, see Robilliard *et al.* (2001), Bussolo and Lay (2003) and Hérault (2006). In this paper we follow the form shown in Bourguignon, Robilliard and Robinson (2003), which is a companion paper of Robilliard *et al.* (2001) however the later provides a much more detailed CGE model to study the impact of financial crises in Indonesia.

Linking macro and micro models has recently gained a lot of attention in the literature. The three channels that affect income distribution are: a) changes in factor returns, b) changes in prices, and c) changes in capital gains (see Bourguignon *et al.* 1991). The micro-macro models in this paper were linked in a top-down fashion shown in Bourguignon, Robilliard and Robinson (2003), which also provides details on how consistency is achieved between the SAM and household data. These data consistency requirements are an essential aspect of this top-down exercise which allows us to link the factor returns, prices and employment in the CGE model with the corresponding household level variables in the micro data. The other two approaches used in the literature for linking the models are: a) integrated approach (Cockburn 2006, Cororaton and Cockburn 2007, Arntz *et al.* 2008) and b) top-down/bottom-up (TD-BU) approach (Savard 2005). The full integration of household observations in a CGE model may be superior in comparison to the other approaches given its grounding in economic theory however it limits the range of microsimulation exercises. In the case of TD-BU, it is difficult at times to achieve complete convergence between the two models. The sequential top-down approach is therefore selected in this paper which has been widely used due to its flexibility in application.

See Bossolo and Lay (2006), Herault (2005), Coady and Harris (2004), Vos and De Jong (2003).

The earnings equations were estimated for various categories namely[5]: a) labor on large farm, b) labor on medium farm in Sindh province[6], c) labor on medium farm in Punjab province, d) labor in medium farm in the rest of Pakistan, e) labor in small farm in Sindh province, f) labor in small farm in Punjab province, g) labor in small farm in the rest of Pakistan, h) wage employment in agriculture, i) non-agricultural unskilled wage earner, and j) non-agricultural skilled wage earner.

We obtained predicted earnings from the above earning regressions and used them (amongst other characteristic variables)[7] as an independent variable in the maximum likelihood multinomial logit regressions, thus allowing individual occupational choice to be influenced by returns in other activities and regions. This possibility in fact translates from the macro model where we explained earlier that the CGE model closure for labor market allows mobility of labor (and land) across activities. The detailed regression results are explained in Ahmed and O' Donoghue (2007).

Data and Measurement Issues

The data for our CGE model has been derived from an existing SAM for 2002 documented in Dorosh, Niazi and Nazli (2004). This SAM has been furnished from five different data sources. First the I-O table that provides information mainly on the activities and commodity accounts. Second the national accounts data is used to compile information about the value addition in fifteen sectors. Third, for disaggregation of consumption, Pakistan Integrated Household Survey is used. Fourth, Pakistan Rural Household Survey 2001 conducted by the Pakistan Institute of Development Economics is used to disaggregate household incomes and finally Pakistan Economic Survey 2001-02, published by the Ministry of Finance provides sector-wise and commodity-wise data on production, prices and trade.

[5] In most case two-step Heckman procedure was adopted. However for profit function instrumental variable regression was estimated.
[6] Administrative structure of Pakistan has four provinces; Punjab, Sindh, North West Frontier Province, and Baluchistan. Islamabad (federal capital city) and Federally Administered Tribal Areas are also accounted for, but separately from provinces.
[7] Other variables include: age, age_squared, province, marital status, number of persons in the household, type of dwelling.

The overall structure of this SAM provides sufficient disaggregation for constructing a detailed CGE model. On the activities side the matrix includes payments and receipts for 12 agriculture sectors, 16 industrial sectors and 6 services sectors. Similar sectoral detail follows in the commodity accounts which makes the mapping between activities and commodities easier. Factor accounts include labour, land and capital with labour disaggregated into 10 different categories. This categorical disaggregation is based on the criterion of farm size, agriculture/non-agriculture wage, and unskilled/skilled labour. Land again is disaggregated according to the farm size (in different provinces). Capital is categorized into livestock, other agriculture, informal and formal capital. The household accounts are distributed into rural and urban with rural households being further classified into 17 categories based on; farm size, rural poor/rural non-poor. Urban households have been classified into poor and non poor. Other institutions in the SAM include enterprises, government and the rest of the world account.

In terms of factor shares in income, 39 percent household income comes from labor, 21 percent from informal capital, 9 percent from agricultural capital, 6 percent each from land and transfers and remaining 19 percent from other sources. The share of rural and urban households in overall income is 44.8 and 55.2 percent respectively.

The main data source for the microsimulation model is Pakistan's Household Income Expenditure Survey 2001-02 and Pakistan Integrated Household Survey 2001-02. Historically both were stand alone surveys, however since 1998-99 they have been merged. A total of 16400 households were interviewed. The sample of household was drawn from 1150 primary sampling units out of which 500 are urban and 650 are rural. According to the FBS this sample size has been found sufficient to produce estimates of key variables (at national and provincial level) at 95 per cent confidence level with 5 to 7 per cent margin of error. In line with the data consistency requirements given in Bourguignon *et al.* (2003) we reconciled the micro data with the available information in our SAM.

The selection of free parameters/elasticities poses a potential problem to the CGE exercises. Some studies that provide trade, production and consumption elasticities for Pakistan economy include Deaton (1997), Kemal (1979), Dorosh *et al.* (2002) and Ahmed *et al.* (2007). However in the case where econometrically estimated elasticities for Pakistan were not available, we have selected our values keeping in

line with studies conducted for comparable developing economies. The trade and production elasticities are given in Table 4 (under section 7). The trade elasticities such as the value of Armington play a more important role in the relatively disaggregate models such as the one used in this study.

Table 4 also provides the structure of value addition. Amongst the main sectors; livestock (cattle and dairy) contributes 10.3 percent, major crops, fruits and vegetables contribute around 12 percent, textiles 3.6 percent, energy 3.4 percent, construction 3.6 percent, transport 12 percent, housing 4.8 percent, wholesale and retail trade contributes 15 percent towards overall value addition. Total share of agriculture sector in exports is around 4 percent, Industry stands at 79 percent with leading sub-sectors being textile, lint and yarn. The services sector contributed 17 percent to exports mainly in transport and communication sub-sectors. Total share of agriculture sector in imports is around 3 percent and Industry's share is 92 percent. The services sector contributed 5 percent to imports mainly in private services sub-sectors.

Simulation Design

In the post-2001 milieu the current account deficit of Pakistan was transformed in to a surplus in one of the shortest periods in economic history. This was largely due to factors such as an increase in remittances, unilateral transfers, and export receipts. However recently the current account deficit (and the composition of this deficit) has once again started to pose problems for the domestic economy. This is attributable to increase in import prices which in turn increases the domestic cost of production and therefore hampers the export competitiveness. Pakistan allowed a subsidy in the wake of rising oil and food prices, however this can only be a short term measure given the substantial size of this transfer payment which if maintained in the medium to long term can increase the budgetary deficit and thereby bringing another spiral of inflation.

In our experiments we study the impacts of two current account shocks that have opposite impact on the economy (at least in the broad macroeconomic terms). First, the inflow of foreign savings, required by developing countries in order to augment the domestic savings and hence finance their infrastructure and social sector requirements in the overall economic development. In times of BoP crises foreign

savings are also used as a stabilization fund that helps in bridging the fiscal and trade deficits. Since 2002 the increased inflow of capital led to appreciation in the value of domestic currency. This in turn has impact on exports and overall economic growth. In our model we will increase the overall foreign savings by 50 percent and see their impact at the macro and micro level. Second, the changes in import prices that in turn impact prices faced by local producers and consumers thereby altering the welfare levels in the economy. We will evaluate the impact of import prices by main commodity groups that have potential backward and forward linkages in the economy. The imported goods that integrate in the production process not only influence the growth and competitiveness, but also impact productivity in the form of spill-over benefits. Coe, Helpman and Hoffmaister (1997) estimate that if import share of machinery and equipment to GDP increases by one percent, total factor productivity increases by 0.3 percent.

An outline of our policy experiments is as follows:

Simulations	Description
Sim-1	50 percent increase in foreign savings
Sim-2	10 percent increase in the import price of petroleum
Sim-3	10 percent increase in import price of industrial raw material

The closure rules remain the same for all simulations. For the factor market we assume labour to be fully employed and mobile across activities. Same closure is retained for land. Capital is fully employed and activity-specific. We have investment-driven savings where marginal propensity to save is allowed to change for selected institutions. Government savings are flexible and direct tax rate is fixed. Consumer price index is treated as numeraire (i.e. fixed) and index of domestic producer prices is flexible. Exchange rate is also flexible.

We have sequenced our results below such that in every simulation macroeconomic results (providing aggregate demand, investment and consumption) are followed by changes in prices and wages. We then see the impact of changed price structure on the disaggregated value addition (in all activities given in SAM), import demand and

export supply. In our case, given the assumption of full employment, macroeconomic changes do not impact the employment levels (however inter-sectoral changes in labour demand are allowed). We continue our analysis and see how changed production patterns impact the household consumption expenditure and overall welfare. Finally we see the impact of simulations on poverty and inequality using the microsimulation model based on household survey data.

4. RESULTS-I: INCREASE IN FOREIGN SAVINGS

Our macroeconomic results for the abovementioned experiments are given in Table 5 (under section 7). In Sim-1, a 50 percent increase in foreign savings leads to an increase in real private consumption by 2.8 percent. Given the greater amount of foreign exchange available, imports increase by 3.7 percent, however exports decline by 6.5 percent. The declining export indicates deterioration in trade balance. We can observe that trade deficit as percent of nominal GDP increases by 1.8 percent. In nominal terms the foreign savings to GDP ratio increased by 2 percent while the investment and private savings to GDP decline by 0.3 and 2.4 percent respectively. Private savings include household and enterprise savings.

Our macroeconomic results shown in Table 5 if seen in the light of economic theory, suggest that foreign savings may not have short term impact on GDP, however these can significantly alter the real exchange rate that in turn causes the trade balance to change. This also implies that production of domestically consumed goods will increase. This happens in our results because, absorption, which is defined as the total domestic spending on a good calculated at the prices paid by the domestic demanders increases by 2.2 percent in real terms. This increase to some extent was made possible through the domestic (non-tradable) price index which is decreasing. We will explain how this in turn impacts the disaggregated welfare levels later in this section.

Whether or not foreign savings have a sustained impact on economic growth depends also on the type of inflows i.e. debt or non-debt sources of foreign savings. The non-debt sources include grants, foreign direct and portfolio investments. These do not carry costs for future and the present generation, however the debt based sources in the past have been blamed for creating chronic flaws in the economic systems of the

developing countries. The debt commitments can be classified in to; public and publically guaranteed debt, private non-guaranteed debt, and the adjustment/stabilization facility from the IMF. Between 1999 and 2005 an encouraging feature in Pakistan's debt profile is that the share of the concessional debt in the overall external debt has increased, thus indicating a lesser burden in the longer run. The pressure on the foreign exchange earnings was reduced as the external debt service to foreign exchange earnings ratio declined from 24 per cent in 1999 to 10.3 per cent in 2005.

The impact of simulations on value added and output price is given in Table 6. We observed from our explanation above that an increase in foreign savings (Sim-1) leads to an appreciation of local currency and also decrease domestic price index. This in turn increases private consumption and ultimately has a positive impact on GDP. We can now see the impact on prices where for a 50 percent increase in foreign savings value-added prices decline mostly for tradable goods. The sectors showing the highest decline in value added prices are; leather (10 percent), cotton lint / yarn (7.1 percent) and manufacturing (6.9 percent). The prices of several large sectors show an increase such as livestock, wheat milling, housing and private services. These are mostly non-tradable sectors. The direction of change is similar for the case of output prices, however the magnitude of these changes is much smaller given the inclusion of other factors in output prices. Such a change seems pro-poor given that the prices of food and oil show a decline. However the price of housing increases by 6.9 percent in case of value added price and 5.5 percent in case of output price. The decreased prices of cotton and textile also indicate towards increasing export competitiveness, however we know from macroeconomic results above, that the overall exports did not increase because of an exchange rate appreciation.

In response to the increase in foreign savings (Sim-1) the returns for labour with farm holding and return for land declines (Table 7). The return to capital does not change given our closure assumptions. Those who gain under this change are agricultural wage labour and non-agricultural unskilled wage labour, whose wages increase by 1.5 and 0.5 respectively. It is broadly recognized that agricultural wage workers are regarded as the poorest of the rural poor (ILO 1996). The overall agriculture incomes are the second most important source, with almost 27 percent of total per capita household income (see Adams 1995). According to the Labour Force Survey around

44 percent of the employed persons (10 years age and above) are working in the agriculture, forestry and fishing sectors. Given this statistics it seems that our simulation results indicate redistribution with-in the agriculture sector, where the returns for farm owners are declining, and the wages for employed labour in agriculture is increasing. The increase in the wages of non-agricultural unskilled labour also indicates a change in favor of urban poor, however we cannot ascertain the magnitude as the SAM data (in its present form) is not divided by urban/rural labor classification.

The return to land declines for all land classifications in the model. The returns for non-irrigated land decline more than the irrigated land, and with in the later the decline is greater for large and medium farms in Punjab province.

The impact on value added can be seen in Table 8. These changes are subject to the price changes and the underlying elasticities reported in Table 4. The value added results are mixed not only across the sectors but also with in the sectors. In most sectors the value addition declines or sees no change. The decline in industrial sector's value-addition is greater than agriculture sector. In case of agriculture there is a marginal increase in value added in wheat, sugar cane, fruits, vegetables and livestock. However there is a decline in rice, forestry and fishing. For industrial sector there is a general decline in value addition except for cement, energy, vegetable oils and wheat milling sectors.

We should also go on to see the sector-wise impact on Pakistani imports and exports. In Table 9 we give the disaggregate changes in quantity of imports. The increase in foreign savings led to an increase in imports for all sectors (except a marginal decline for mining sector). This is primarily due to exchange rate depreciation (see Table 5). The highest increase is in leather, textiles, commerce and livestock (cattle).

The impact on Pakistani exports is shown in

Table 10. The increased foreign savings lead to worsening of exports across all sectors and particularly in textile, leather, cement, transport, rice and livestock. Exports in value terms decline given the increase in output prices which make export relatively uncompetitive abroad.

For evaluating the changes in the welfare we first see how household incomes change for our experiments. These results can be seen in Table 11. We can observe that the

change mimics what we have seen for changes in factor returns (Table 7). When foreign savings increase, large or medium farms are the main losers, while all other household groups gain, most notably rural agricultural workers who are landless and small farm owners. We had explained above that this also represents redistribution in favor of low income households. Household consumption however increases for all groups (Table 12). The increase is greater for rural workers.

Our microsimulation results are given in Table 13. In line with the household welfare impacts explained above, poverty decreases by 3.7 percent when foreign savings increase by 50 percent. Poverty gap and severity both show a decline. Poverty decreases in all provinces with Punjab having the highest decline by almost 3.3 percent followed by Sindh (2.8 percent).

The extent of redistribution can also be seen in the inequality results measured by percentile ratios, generalized entropy, and Atkinson class measures. The Gini coefficient declines by 0.3 percent. If aversion to inequality is taken in to account then we see that Atkinson index shows a larger decline for the top end of the distribution. As the inequality aversion parameter increases beyond 0.5, there is lesser decline in Atkinson index (measured in percentage terms). We also compute the percentile ratios for the distribution of the post-shock incomes. The p90/p10 is the decile ratio, p75/p25 relates to the middle part of the distribution and p90/p50 shows the dispersion at the upper tail. In Table 13 the largest decrease is in p90/p10 ratio, whereas the decrease is less than half of this at the middle part for the distribution.

5. RESULTS-II: INCREASE IN IMPORT PRICES

The next two experiments focus on the increase in import prices. A steady flow of imports (particularly of production/capital goods) is essential to maintain the momentum of economic growth and exports. The imports of the production goods usually take the form of intermediate inputs and raw materials. Imports of finished capital goods also contribute to technology transfer in low and middle income countries. As efforts towards trade liberalization continue we have seen that imports of consumption goods (although viewed as relatively adverse due to less multiplier effects in the economy) contributed to increased consumer welfare in terms of reduced prices.

Going back to theory we understand that the domestic effects of an import price increase will be broadly similar to an increase in tariffs (see Go 1991). Viewed in the context of overall world prices, Stolper-Samuelson theorem suggests that a rise in the relative price of a good will lead to a rise in the return to that factor which is used most intensively in the production of the good (and a fall in the return to the other factors). This theorem has been derived from the basic Heckscher-Ohlin model which is a general equilibrium model of international trade and shows that a country will export products that utilize its abundant factors of production and import products that employ a country's scarce factors and resources. A corollary to the Stolper-Samuelson theorem is the factor price equalization theorem which tells us that regardless of the factor mobility across international borders, factor prices tend to equalize for countries that do not differ in technology[8].

In Sim-2 we evaluate the impact of a 10 percent increase in price of petroleum imports. The rising international energy prices pose a threat to the production costs in the developing economies. As the indigenous energy resources are not well developed hence there is substantial reliance on imported forms of energy. In Pakistan the petroleum imports account for around 24 percent of the overall import bill[9]. This includes petroleum products as well as petroleum crude. Both are intensely used in the industrial process and are also required for consumer needs. As a raw material the rising cost of oil, has been a growing concern lately. However there is little a developing country's government can do in the short-run in order to avoid the exogenous oil price shocks until and unless it has its own oil reserves and also has the capacity to manage these reserves and carry out refining of crude oil. Once the full thrust of rising import prices are faced by the private sector producers, this in turn leads to crippling effects on domestic production, trade and consumption.

We can see in Table 5 that a 10 percent increase in the import price of petroleum (Sim-2), brings about a 0.7 percent decline in GDP. The private consumption declines by 4.3 percent. As a percentage of nominal GDP, investment and private savings increased by 1.1 percent. Current account deficit as percentage of nominal GDP, also increases by 0.2 percent. As expected the direction of change in trade sector decreases

[8] What will be the effect of an increase in the physical endowment of factors? Rybczynski theorem suggests that an increase in one of the two factors of production leads to a relative increase in the production of the good using more of that factor.
[9] Economic Survey of Pakistan 2006-07.

both real imports and exports by 11.2 and 1.8 percent respectively. The overall import price index increases by 11.9 percent. This increase also depends upon the weight of petroleum group in the overall imports. In relative terms domestic (non-tradables) price index decreases by 1.1 percent indicating that domestically produced goods are now cheaper. We need to qualify this result by saying that the prices of only those goods will decrease that do not intensely use petroleum as an input in the production process. The world price index for tradable goods increases by 7.2 percent indicating that Pakistani exports are now relatively expensive. The trade deficit to nominal GDP ratio increases by 0.2 percent. Because of the declining imports there is an impact on tariff revenue and government savings, both decreasing by 0.2 and 0.3 percent of GDP respectively.

The impact that increase in import price of petroleum has on the economy is greater than any other import commodity group. This essentially is due to the intensity with which this good is used in the production process, as well as by the consumers at the household level, and the knock-on effects that petroleum prices have at the intermediate demand stage.

In our next simulation (Sim-3) we increase the price of industrial raw material (excluding petroleum) by 10 percent. This commodity group includes; organic chemicals, inorganic compounds of precious metals, fertilizers, tanning or dyeing extracts, oils, resinoids, perfumery, albuminoidal substances, glues, enzymes, pyrotechnic products, pharmaceutical products and related goods. An increase in the import price of this group decreases GDP by 0.5 percent, where private consumption declines by 2.7 percent. The direction of change in major macroeconomic variables remains the same as in Sim-2. While the decrease in real imports is lower (7.4%) in comparison to Sim-2, the decrease in real exports is slightly higher (1.9%). The nominal exchange rate depreciates by 0.7 percent and import price index increases by 7.1 percent. The firm incomes decline by 2.5 percent. The government savings and tariff revenue as percentage of GDP both decrease by 0.2 percent.

Table 6 gives detail on how import prices affect the domestic prices. In both cases (Sim-2 and Sim-3) we see that external price changes impact the crop sector prices adversely. In both cases there is an above 3 percent increase in the value added prices of; wheat, rice, cotton, sugar cane, fruits and vegetables. Another concern is how these experiments impact the competitiveness of local manufacturing sector. The

output prices increase for cotton lint, yarn, petroleum refining, chemicals, mining, vegetable oil, wood, and other manufacturing. As expected (after our macroeconomic analysis above) the worst impact on domestic prices is for the case of increase in the import price of petroleum products. Apart from the food items, the significant rise in prices is seen for chemicals, vegetable oil, petroleum refining and other manufacturing industries. When relative prices change, there are also shifts in resource usage. We can observe that the sectors relatively insulated from trade shocks see a decline in their prices. The decline is most seen for poultry, rice milling (Irri/basmati), cement, public and private services.

In the import price experiments, agricultural wage, non-agricultural unskilled labour, and agricultural skilled labor become the main losers given that the activity levels are declining on the production side (Table 7). Return to land and profits for farm owners increase, showing a (regressive) change in favor of (agricultural) asset owners. The increase in factor prices is highest for the simulation where import price of petroleum is increased by 10 percent. In this case the returns for labour having small farm, increase the most (6.7 percent) followed by labour having medium size farm (6.3 percent). A similar pattern is observed in case of changes in returns to land. The small land category gains the most (7.9 percent) followed by medium and large size land. In this case one may infer that there is a redistribution taking place within the agricultural asset owners, where those having small to medium ownerships are gaining.

Why should rising import prices increase factor prices of labor and land? The reason is that as imports become expensive relative to domestically produced goods, there is an expansion in production particularly for non-tradable industrial sectors (Table 8). This increases the demand for factor inputs in beneficiary sectors, which in turn increases factor prices (land and labor in our case as they are mobile across sectors). This argument will hold under the full-employment assumption.

In a general equilibrium exercise, experiments with changes in overall import prices give a fair indication of the direction and magnitude of change. External price shocks are better studied in disaggregate models, where impacts of changes in world commodity markets can be seen to translate on the local economy. In our case we can readily see the benefit of using a disaggregate model with 34 sectors, where we are at an ease to alter the import prices by commodity or commodity groups. The value

addition increases for leather, textile, chemicals, other manufacturing, petroleum refining, wood products and vegetable oil (Table 8). In overall terms exporting sectors see a small increase or no change in value addition. However two major exports, cotton and rice decline by 0.6 and 2 percent respectively.

We may also briefly look at the case where we increase the import price of machinery group by 10 percent. This group includes; electrical machinery, appliances, boilers, and related mechanical equipment. The decrease in GDP this time is greater than Sim-3 (decreases by almost 0.7 percent) and the decline in consumption is also greater (3.9 percent). However this decrease is again less than what we have seen for the case of petroleum (Sim-2). The magnitude of change in case of import price shocks for different commodity groups show that a 10 percent increase in import price of petroleum and a 10 percent increase in import price of machinery lead to almost the same level of changes[10].

In line with our expectation the import price changes lead to a decline in imports from all sectors (Table 9). In both simulations for increase in import prices, the manufacturing sector is the worst affected, as this sector is relatively more dependent on imported inputs. The decline in imports is substantial for the case of vegetable oil followed by declining imports in leather, textile, and sugar. Such a change causes concern for the overall production in the country because the imported content (particularly in developing countries) is indispensable for activities having lower Armington elasticities[11]. In case of Pakistan, the exports also embody a high degree of imported content.

The impact of import price increase on the value of exports seems mixed (

Table 10). First the depreciation of nominal exchange rate causes the exports to increase, however exporting sector, particularly those having a high imported content (as inputs) face a decline in their output. These results should be studied keeping under consideration Armington and CET elasticities given in Table 4. We can observe that the manufacturing-oriented export sectors provide varied results depending upon which commodity group is faced with an import price shock. An increase in import price of petroleum has a positive effect on textile exports, while an increase in import

[10] The detailed results of changes in import price of machinery have not been shown in this paper. Interested readers may request for a companion publication still under review.
[11] This is the degree of substitutability between domestic and imported sources of supply. A higher value for Armington implies a higher possibility of substitution and vice versa.

price of industrial raw material has a negative effect. Similar trend is observed for rice, leather and wheat milling.

The redistribution results seen in the previous section are reversed in case of import price shocks (Table 11), where only those households who own large and medium farms see an increase in their incomes. All other groups face a decline. As explained above these change follow what we have seen for changes in factor returns (Table 7). The same pattern evolves in case of household consumption in Table 12. The negative impact of import price increase on middle and low income groups indicates how consumer surplus is sharply reduced via the increase in domestic prices. We had seen earlier that output price of mostly necessity items had increased. This included food and petroleum prices – items intensively used in consumption by the low income group. We can in fact see a one to one mapping of results for household income and expenditure. It cannot be stated with certainty that import price changes act in a manner similar to a regressive tax, because in Table 11 we observe that urban non-poor and rural non-farm non-poor households also witness a decrease in their income level. This result seems logical as only farm owners are the ones who are least using the commodity groups that have seen changes in import prices. Farm owners also have low level of imported inputs in their output compared with industrial producers. In the case of an oil price hike, increase in import price of raw materials (such as chemicals), or import price of machinery, one can expect that farm owners will remain insulated to some extent. In case of Pakistan this in fact exhibits the low level of mechanization in agriculture sector.

The import price increase leads to an increase in poverty level and inequality also worsens (Table 13). In case of a 10 percent increase in import price of petroleum, poverty increases by 4.1 percent and inequality worsens by 0.4 percent. For a 10 percent increase in import price of industrial raw material poverty increases by 3.4 percent and inequality worsens by 0.2 percent. Sindh province is the worst affected where the headcount ratio increases by more than 6 percent under both simulations.

6. CONCLUSION

The future scenario of Pakistan's trade balance depends on two fundamental issues; a) expansion in exports of dynamic goods, b) Reducing reliance on imported raw

material and supplies that have a volatile price trend in international markets. The achievement towards increasing the exports has been hampered in the past due to several reasons that include; decline in unit value of exports, adverse weather conditions (rice), competition with China, India and Bangladesh (textile), poor quality of cotton, increase in import price of prima cotton (used as input), less productive and outdated machinery in production process (manufacturing sector), low investment in research and development towards achieving better economies of scale / higher value addition. Pakistani exports are not well-diversified due to which changes in world prices of cotton, leather, rice and synthetic textiles impacts the current account position.

On the side of imports, there has been an unprecedented increase due to the high economic growth in the post 9/11 period. However increasing unit prices of imported commodities, mainly petroleum and machinery are now challenging the private sector's output. To maintain the imports at the existing level (particularly in case of petroleum requirements) the country has been forced to run a current account deficit. The rise in workers' remittances and overall foreign exchange reserves could not keep pace with the increased world prices of inputs.

In this paper we studied the general equilibrium and micro-level impacts of; a) increase in foreign savings, b) increase in import price of petroleum, and c) increase in import price of industrial raw material.

Our main findings are:

a. A 50 percent increase in foreign savings leads to an increase in imports (3.7%) and a decrease in exports (6.5%). Main sectors facing a decline in exports are textile, leather, cement and livestock. The prices of non-tradeable goods decline. Changes in price seem pro-poor as food and oil prices also decrease. The returns for labour with farm holding and return for land declines. The return for non-irrigated land declines more than the irrigated land. Those factors who gain under this change are agricultural wage labor and non-agricultural unskilled wage labor. The later indicating a change in favor of urban poor. Poverty decreases by 3.7 percent. Punjab and Sindh provinces see a decline in headcount

ratio of 3.3 and 2.8 percent respectively. There is some improvement in income distribution as Gini coefficient declines by 0.3 percent.

b. The increase in import prices of petroleum or industrial raw material leads to a reduction in imports and exports (the magnitude of former being greater). The prices impact the crop sector adversely. The competitiveness of local manufacturing is hurt as output prices increase for cotton lint, yarn, petroleum refining and chemicals. The sectors relatively insulated from import shocks for example rice and poultry see a decline in their prices. In terms of factor returns agricultural wage earners, non-agricultural skilled labor and non-agricultural unskilled labor become the main losers given the decline in production activity. Return to land and profits to farm owners increase showing a change in favor of agricultural asset owners. In case of a 10 percent increase in import price of petroleum, poverty increases by 4.1 percent and for a 10 percent increase in import price of industrial raw material poverty increases by 3.4 percent.

c. Amongst the abovementioned experiments, external oil price shocks have the highest potential to impact the socio-economy.

d. Import price changes in comparison to changes in foreign savings have an opposite effect at both micro and macro levels.

e. External price changes affect the agriculture sector prices relatively more than other sectors.

f. Given the similarity of intensities with which machinery and petroleum are being combined in the production process, both import price of machinery group and petroleum group have very similar potential to change the production and trade patterns.

g. Exports decline under both; increase in foreign savings, and increase in import prices.

h. Increase in foreign savings is pro-poor (at least in the short-term).

7. TABLES (RESULTS AND PARAMETERIZATION)

Table 4 Elasticities and Output Shares

	Armington Elasticity	CET Elasticity	Prod_e*	Share in Value Added	Value added/Output**
Wheat irrigated	4.0	4.0	0.75	1.9	51.6
Wheat non_irrigated	-	-	0.75	0.1	53.0
Paddy IRRI	4.0	4.0	0.75	0.3	59.9
Paddy basmati	4.0	4.0	0.75	0.5	59.6
Cotton	4.0	4.0	0.75	1.4	61.8
Sugarcane	4.0	4.0	0.75	1.0	60.5
Other major crops	4.0	4.0	0.75	2.9	70.8
Fruits_ vegetables	4.0	4.0	0.75	3.6	64.5
Livestock_cattle_dairy	4.0	4.0	0.75	10.3	53.4
Poultry	4.0	4.0	0.75	0.7	49.0
Forestry	4.0	4.0	0.75	0.3	75.3
Fishing Industry	4.0	4.0	0.75	0.5	51.0
Mining	3.0	3.0	0.75	0.6	66.6
Vegetable oil	3.5	3.0	1.50	0.3	8.5
Wheat milling	3.5	3.0	1.50	1.2	21.3
Rice milling IRRI	3.5	3.0	1.50	0.2	27.6
Rice milling Basmati	3.5	3.0	1.50	0.5	27.3
Sugar	3.5	3.0	1.50	1.4	31.5
Other food	3.2	3.0	1.50	1.8	36.1
Cotton lint_yarn	3.2	3.0	1.50	1.5	21.4
Textiles	3.5	3.0	1.50	3.6	22.3
Leather	3.5	3.0	1.50	0.1	9.3
Wood products	3.5	3.0	0.50	0.7	34.5
Chemicals	3.0	3.0	0.50	0.5	27.5
Cement_bricks	3.5	3.0	0.50	1.4	53.0
Petroleum refining	3.0	3.0	0.50	0.6	19.8
Other manufacturing	3.2	3.0	0.50	2.6	25.3
Energy	3.0	3.0	0.50	3.4	60.2
Construction	3.2	3.0	1.50	3.2	41.1
Commerce	3.0	2.0	0.50	15.0	83.4
Transport	3.2	2.0	1.25	11.9	54.2
Housing	3.2	2.0	1.25	4.8	80.4
Private services	2.0	2.0	1.25	12.7	53.5
Public services	2.0	2.0	1.25	8.5	65.8

*Prod_e: Elasticity of substitution between factors - bottom of technology nest.
Prod_e_2: Elasticity of substitution between agg. factor & intermediate - top of tech nest = 0.6
Elasac: output aggregation elasticity = 4
Frisch = - 2
**SAM values from Dorsoh *et al.* (2004).

Table 5 Macroeconomic Changes (% Change over base)

	BASE	Sim-1	Sim-2	Sim-3
GDP (mp)	3645*	0.1	-0.7	-0.5
Private Consumption	3053	2.8	-4.3	-2.7
Real absorption (LCU at base prices)	4001	2.2	-3.3	-2.1
Total real exports (LCU at base prices)	692	-6.5	-1.8	-1.9
Total real imports (LCU at base prices)	1054	3.7	-11.2	-7.4
Enterprise Income	798	-0.8	-3.3	-2.5
PPP real exchange rate (LCUs per FCU)	99	-4.0	8.4	4.5
Nominal exchange rate (LCUs per FCU)	102	-4.1		-0.7
Imports price index (FCU -- 100 for base)	100		11.9	7.1
World (tradables) price index (FCU -- 100 for base)	100		7.2	4.3
Domestic (non-tradables) price index (100 for base)	103	-0.1	-1.1	-0.9
Terms of trade (ratio pwe index & pwm index) (100 for base)	100		-10.7	-6.7
Investment (% of nominal GDP)	14	-0.3	1.1	0.5
Private (household + enterprise) savings (% of nominal GDP)	16	-2.4	1.1	0.6
Foreign savings (% of nominal GDP)	5	2.0	0.2	0.1
Trade deficit (% of nominal GDP)	11	1.8	0.2	
Government savings (% of nominal GDP)	-6	0.1	-0.3	-0.2
Tariff revenue (% of nominal GDP)	1		-0.2	-0.2

*In real rupees billion

**LCU: local currency unit, FCU: foreign currency unit.

***Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 6 Changes in Prices

	Value Added Price (% change over base)			Output Price (% change over base)		
	Sim-1	Sim-2	Sim-3	Sim-1	Sim-2	Sim-3
Wheat irrigated	-1.9	4.0	3.1	-1.8	3.9	2.7
Wheat non_irrigated	-3.0	3.7	2.1			
Paddy IRRI	-2.8	5.8	4.6	-2.3	5.0	3.7
Paddy basmati	-2.6	6.2	5.1	-2.2	5.3	4.0
Cotton	-3.3	6.2	4.9	-3.0	6.5	4.7
Sugarcane	-2.1	5.8	4.8	-2.0	5.5	4.2
Other major crops	-2.6	6.1	4.8	-2.1	4.9	3.8
Fruits_ vegetables	-2.5	7.9	6.7	-1.7	4.9	4.2
Livestock_cattle_dair	4.5	-5.1	-2.7	2.0	-2.3	-1.0
Poultry	5.4	-7.7	-4.5	2.2	-3.0	-1.6
Forestry	-3.9	3.2	1.1	-3.3	2.9	1.1
Fishing Industry	-3.1	-1.4	-1.4	-2.0	-0.8	-0.9
Mining	-5.4	7.2	2.1	-4.0	5.1	1.4
Vegetable oil	0.5	43.9	44.4	-0.8	6.3	6.1
Wheat milling	5.4	-13	-9.1	0.3	-1.4	-1.0
Rice milling IRRI	-3.4	-7.2	-6.0	-2.0	-0.6	-0.7
Rice milling Basmati	-0.7	-9.7	-7.5	-1.2	-1.1	-0.9
Sugar	4.3	-10	-7.0	0.9	-2.9	-1.9
Other food	-5.8	1.3	0.2	-2.7	0.5	0.1
Cotton lint_yarn	-7.1	-4.3	-4.1	-3.5	1.5	0.6
Textiles	-4.7	-3.7	-2.8	-2.5	-0.1	-0.5
Leather	-10	1.8	0.4	-0.5	-1.0	-0.7
Wood products	-4.6	5.1	1.5	-2.7	2.9	0.8
Chemicals	-4.7	12.3	8.3	-2.8	6.3	3.6
Cement_bricks	4.5	-9.7	-6.0	1.9	-4.8	-3.5
Petroleum refining	-3.9	10.9	5.8	-2.6	4.5	1.5
Other manufacturing	-6.9	4.4	1.7	-3.5	4.2	1.7
Energy	0.2	-5.8	-3.9	-0.7	-2.6	-2.3
Construction	-0.2	-4.5	-3.1	-0.6	-1.1	-1.3
Commerce	0.3	-4.2	-2.8	0.4	-4.0	-2.7
Transport	0.9	-6.9	-4.5	-0.5	-1.8	-1.7
Housing	6.9	-12	-7.7	5.5	-9.5	-6.4
Private services	0.8	-4.7	-3.4	0.5	-3.3	-2.5
Public services	-0.8	-4.1	-2.9	-0.8	-2.7	-2.2

*Represents average output price.

** Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 7 Factor Wages / Returns (% Change from Base)

	Sim-1	Sim-2	Sim-3
Labor_large farm	-3.1	4.9	3.5
Labor_medium farm_Sindh	-3.1	6.0	4.5
Labor_medium farm_Punjab	-3.3	6.5	5.0
Labor_medium farm_Other Pakistan	-2.2	3.5	2.4
Labor_small farm_Sindh	-3.1	6.3	4.9
Labor_small farm_Punjab	-2.8	6.7	5.4
Labor_small farm_Other Pakistan	-2.7	6.7	5.1
Labor_agricultural wage	1.5	-1.5	-0.5
Labor_non_agricultural wage unskilled	0.5	-4.9	-3.3
Labor_non_agricultural wage skilled	-0.8	-4.1	-2.9
Land_large farm_Sindh	-2.4	4.5	3.5
Land_large farm_Punjab	-3.0	5.5	4.0
Land_large farm_Other Pakistan	-3.6	2.6	0.8
Land_irrigated_medium farm_Sindh	-2.8	6.6	5.2
Land_irrigated_medium farm_Punjab	-2.9	7.2	5.9
Land_irrigated_medium farm_Other Pakistan	-2.0	4.6	3.6
Land_irrigated_small farm_Sindh	-2.8	7.3	6.0
Land_irrigated_small farm_Punjab	-2.6	7.9	6.7
Land_irrigated_small farm_Other Pakistan	-2.4	7.9	6.5
Land_non_irrigated_small farm_Sindh	-4.4	2.7	0.1
Land_non_irrigated_small farm_Punjab	-4.2	2.7	0.3
Land_non_irrigated_small farm_Other Pakistan	-5.2	2.5	-0.5

Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 8 Quantity of Value Added (% Change from Base)

	BASE	Sim-1	Sim-2	Sim-3
Wheat irrigated	63	0.7	-2.6	-2.3
Wheat non_irrigated	4	2.5	-0.1	1.1
Paddy IRRI	9	-0.8	-0.9	-0.9
Paddy basmati	17	-0.1	-1.9	-1.6
Cotton	49	-2.7	0.1	-0.3
Sugarcane	35	1.8	-2.2	-1.5
Other major crops	96	-0.5	0.4	-0.2
Fruits_ vegetables	123	0.2	2.9	2.9
Livestock_cattle_dair	347	0.3	-0.3	-0.2
Poultry	24	0.4	-0.6	-0.4
Forestry	10	-1.8	-0.7	-1.7
Fishing Industry	18	-1.5	0.0	-0.3
Mining	20	-1.2	2.5	1.2
Vegetable oil	9	0.2	15.8	15.3
Wheat milling	40	2.0	-3.1	-2.2
Rice milling IRRI	8	-1.5	-1.4	-1.4
Rice milling Basmati	16	-0.2	-2.4	-2.0
Sugar	48	2.3	-2.9	-1.9
Other food	60	-1.9	2.0	1.1
Cotton lint_yarn	49	-3.1	0.0	-0.6
Textiles	121	-2.4	0.3	0.1
Leather	4	-6.1	4.2	2.3
Wood products	22	-1.2	2.6	1.3
Chemicals	17	-1.2	4.2	2.9
Cement_bricks	49	0.6	-0.7	-0.4
Petroleum refining	21	-1.2	4.9	2.9
Other manufacturing	86	-2.3	3.0	1.7
Energy	115	0.2	-0.4	-0.2
Construction	106	0.0	0.0	0.0
Commerce	506	0.0	0.6	0.5
Transport	401	0.6	-1.9	-1.1
Private services	426	0.5	0.0	-0.2
Public services	285	0.6	-0.5	-0.3

Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 9 Quantity of Imports (% Change from Base)

	BASE	Sim-1	Sim-2	Sim-3
Wheat Irrigated	2.9	11.9	-13.4	1.4
Other major crop	6.2	8.6	-7.2	7.9
Fruits/Vegetable	17.2	11.3	-64.0	-57.2
Cattle	7.0	28.6	-42.8	-26.3
Forestry	2.9	3.9	-10.3	-1.6
Fishery	0.2	12.9	-28.2	-11.7
Mining	98.3	-0.4	1.0	0.8
Vegetable Oil	32.6	13.1	-68.5	-62.8
Wheat non-irrigated	8.5	20.2	-27.9	-12.0
Sugar	3.4	22.5	-31.4	-14.4
Other food	16.0	10.5	-39.2	-29.3
Cotton Yarn/Lint	7.3	0.2	-13.4	-2.3
Textile	18.2	11.2	-51.8	-42.4
Leather	1.7	20.3	-57.0	-47.4
Wood	6.3	4.1	-11.3	-3.0
Chemical	122.6	4.6	-12.4	-8.4
Petroleum refining	104.6	3.8	-10.1	-5.9
Other manufacturing	571.0	1.8	-6.2	-3.6
Commerce	2.7	14.9	-27.9	-12.7
Private services	52.5	10.4	-18.7	-8.8

Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 10 Quantity of Exports (% Change from Base)

	BASE	Sim-1	Sim-2	Sim-3
Wheat Irrigated	4.9	-8.6	-16.3	-14.3
Other major crop	3.8	-8.4	-17.2	-16.2
Fruits/Vegetable	7.3	-9.2	-15.2	-15.1
Cattle	0.6	-21.8	9.2	1.2
Poultry	0.2	-22.2	12.2	3.3
Forestry	3.1	-5.2	-11.7	-8.3
Fishery	8.2	-9.8	3.2	0.6
Mining	5.2	-1.6	-11.8	-4.9
Vegetable Oil	0.2	-9.6	-3.7	-5.5
Wheat Milling	3.6	-11.0	0.9	-1.1
Rice milling Irri	10.4	-7.9	0.5	-1.3
Rice milling basmati	14.8	-8.9	0.8	-1.4
Sugar	0.3	-12.4	5.9	1.8
Other food	76.1	-6.2	0.5	-1.1
Yarn / Lint	62.8	-4.8	-4.4	-4.1
Textile	217.9	-7.2	0.6	-0.5
Leather	13.6	-16.0	7.3	2.5
Wood	0.4	-5.5	-5.9	-3.0
Chemical	9.4	-5.2	-13.4	-9.4
Cement	0.3	-16.2	15.0	8.5
Other manufacturing	111.7	-4.3	-8.9	-5.3
Commerce	0.6	-8.7	9.2	4.7
Transport	122.2	-6.6	1.8	1.0
Private Services	0.3	-8.5	6.8	3.7

Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 11 Household Income (% Change from Base)

	BASE	Sim-1	Sim-2	Sim-3
Large Farmers_Sindh	23	-1.1	2.4	2.2
Large Farmers_Punjab	68	-0.7	1.3	1.3
Large Farmers_Other	14	-0.1	-0.1	0.1
Medium Farmers_Sindh	48	-0.6	2.0	1.9
Medium Farmers_Punjab	151	-0.3	0.0	0.5
Medium Farmers_Other	39	-0.7	1.5	1.4
Small Farmers_Sindh	61	1.1	-1.1	-0.2
Small Farmers_Punjab	323	0.5	-1.1	-0.2
Small Farmers_Other	129	1.2	-2.6	-1.4
Small Farm Renters_landless_Sindh	47	1.0	-0.8	0.0
Small Farm Renters_landless_Punjab	50	0.4	-1.4	-0.5
Small Farm Renters_landeless_Other	19	1.0	-1.4	-0.5
Rural agricultural workers_landless_Sindh	24	1.7	-3.7	-2.2
Rural agricultural workers_landless_Punjab	72	1.4	-4.0	-2.4
Rural agricultural workers_landess_Other	12	3.0	-4.5	-2.5
Rural non_farm non_poor	423	0.7	-5.1	-3.4
Rural non_farm poor	143	1.0	-5.2	-3.5
Urban non_poor	1830	0.3	-4.2	-3.0
Urban Poor	194	0.4	-4.8	-3.2

Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 12 Household Consumption Expenditure (% Change from Base)

	BASE	Sim-1	Sim-2	Sim-3
Large Farmers_Sindh	20	1.2	1.3	1.5
Large Farmers_Punjab	59	1.6	0.2	0.7
Large Farmers_Other	13	2.3	-1.2	-0.5
Medium Farmers_Sindh	44	1.7	0.9	1.3
Medium Farmers_Punjab	137	1.9	-1.0	-0.1
Medium Farmers_Other	36	1.5	0.4	0.8
Small Farmers_Sindh	55	3.4	-2.2	-0.8
Small Farmers_Punjab	293	2.8	-2.1	-0.8
Small Farmers_Other	117	3.5	-3.6	-2.0
Small Farm Renters_landless_Sindh	42	3.3	-1.9	-0.6
Small Farm Renters_landless_Punjab	46	2.7	-2.4	-1.1
Small Farm Renters_landeless_Other	17	3.3	-2.4	-1.1
Rural agricultural workers_landless_Sindh	22	4.0	-4.8	-2.8
Rural agricultural workers_landless_Punjab	65	3.7	-5.0	-3.0
Rural agricultural workers_landess_Other	11	5.4	-5.5	-3.1
Rural non_farm non_poor	363	3.2	-6.1	-4.0
Rural non_farm poor	130	3.3	-6.2	-4.1
Urban non_poor	1407	2.7	-5.3	-3.6
Urban Poor	176	2.7	-5.8	-3.8

Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

Table 13 Poverty and Inequality Results (% Change from Base)

	Sim-1**	Sim-2	Sim-3
Overall Pakistan			
FGT (0)*	-3.683	4.054	3.426
FGT (1)	-2.955	5.008	4.060
FGT (2)	-2.794	4.597	3.695
Punjab Province			
FGT (0)	-3.258	2.844	2.559
FGT (1)	-1.484	2.613	2.232
FGT (2)	-0.894	1.583	1.341
Sindh Province			
FGT (0)	-2.843	8.250	6.345
FGT (1)	-3.694	6.081	4.177
FGT (2)	-2.908	4.541	3.061
NWFP Province			
FGT (0)	-2.701	1.089	1.031
FGT (1)	-1.214	2.045	1.752
FGT (2)	-0.957	1.504	1.263
Baluchistan Province			
FGT (0)	-0.687	0.558	0.558
FGT (1)	-1.270	1.881	1.458
FGT (2)	-0.512	0.863	0.674
Gini	-0.322	0.382	0.158
p90/p10***	-1.005	0.502	-0.100
p90/p50	-0.220	0.265	0.309
p75/p25	-0.228	0.913	0.639
A(0.5)****	-0.579	0.657	0.258
A(1)	-0.570	0.539	0.164
A(2)	-0.470	-0.130	-0.395

*FGT (0) : Headcount Ratio (proportion poor), FGT(1): average normalized poverty gap, FGT(2): average squared normalized poverty gap.

** Sim-1: 50 percent increase in foreign savings, Sim-2: 10 percent increase in import price of petroleum, Sim-3: 10 percent increase in import price of industrial raw material

***Percentile ratios

****Atkinson measure

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