Sensitivity of Conditionality

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Structural parameters of an economy affect the outcome of any reform process. In many computable general equilibrium models, the elasticity of substitution between final goods is assumed. However, the welfare implications of assuming one or the other substitution elasticity are different. Most importantly, if the reform adopted is part of a Conditionality agreement then the reform outcome is altered depending on whether the loan injections are sequential or simultaneous. This paper investigates the welfare implications of Conditionality within the trade reform framework using two different substitution elasticities between final goods, i.e. low ($\sigma<1$) and high ($\sigma>1$). Free trade is the first best policy in the perfectly competitive environment both in terms of welfare changes and income distribution. However, alternative trade policies (neutral trade, etc.) have different implications depending on the parameters chosen to define the economy.
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1. Introduction

Conditionality is still and perhaps even more an issue today than yesterday. Therefore, especially developing country administrators should be made more aware of the welfare consequences of the implementation. Sustainability of any reform depends on the size and influence of the gainers/losers of that policy. As Alesina and Drazen (1991) have modelled implementation of the stabilisation policies are delayed because gainers/losers want to shift the burden of such policies to each other.

Although previous works discuss the impact of trade reform on welfare and income distribution, the sensitivity of the consequences needs to be addressed more directly. Here, I investigate the sensitivity of Conditionality to elasticity of substitution and to income shares of population subgroups in determining the sustainability of trade reforms using the general equilibrium framework.

In standard general equilibrium models the focus is usually on how the economy is defined and on the outcome of policy changes in consideration. These are important issues and need

considerable attention. However, the outcome of various policies depends on the structure of the economy and on the parameters used to define it. Many authors mention the sensitivity of the results to parameters (see Francois and Reinert, 1997). In this paper, I examine the consequences of various trade reform levels in cases of simultaneous and sequential loan injections into the economy and analyse their sensitivity with respect to elasticity and income shares.

The paper has two main parts. The first part develops the framework for loan introduction using the model in a previous work on welfare consequences of trade reform (see Suna-Kayam, 2002 for more details). The second part uses these findings to analyse the effects of the loan introduced sequentially or simultaneously with the reform measures and the sensitivity of the outcome to elasticity of substitution and to income share parameters. Section 2 gives a brief discussion of the literature. The model is described in section 3. The welfare consequences of trade reform are summarised in section 4. Later section looks at the proportional distribution of the loan obtained from the donor in a lump-sum fashion, i.e. sequential injection. Section 6 considers the case where lump-sum distribution is not possible. There, the same types of welfare effects as in section 4 is examined but in the presence of the loan, i.e. simultaneous injection. Section 7 compares the two cases and concludes.

2. Literature

There are a number of works that study the gainers and losers of reforms such as stabilisation, adjustment policies or Conditionality and examine why the reform processes are delayed and even reversed. Alesina and Drazen (1991) study the politico-economic determinants of delays in the adoption of fiscal adjustment programmes. They describe "the process leading to a stabilisation as a war of attrition between different socio-economic groups with conflicting distributional objectives." Each socio-economic group wants to shift the burden of stabilisation to the other. The war of attrition ends when certain groups concede. Fernandez and Rodrik (1991) explain why ex-ante hostility to reform and ex-post support which are observed in many structural adjustment cases are consistent with each other. They claim that it is the uncertainty regarding the identities of gainers and losers

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from the reform that effects the support of individual's ex-ante. Their model is based on individual's decisions to vote, to incur general investment costs and to switch sectors. With the analysis of myopic voter decisions, they observe a status quo bias. All y-sector individuals will vote for reform if their expected utility from reform is higher than their utility under the status quo. But if the majority of the population remains in the sector that will have lower real wages after reform, in the second period there will be a return to status quo.

The short-run welfare effects of loan tied to a reform, i.e. Conditionality, is examined by various works from different perspectives. For instance, Mosley (1986, 1987) and Mosley et al. (1991) examine the negotiation process and the outcome of World Bank structural adjustment in particular and aid in general.

Others have concentrated on adjustment and its effects on income distribution within a general equilibrium framework. Some of these works are based on the Ricardo-Viner-Jones specific-factors model, which is developed by Jones (1971), Mayer (1974) and Mussa (1974). Devarajan, Lewis and Robinson (1990) incorporate the non-traded good into the analysis of the 1-2-3 model in such a fashion that the producer supplies the export and the domestic goods while the consumer demands the composite commodity made up of domestic and import goods. They extend the Salter (1959) and Swan (1960) specifications of a two-sector model that distinguishes between tradables and non-tradables by accommodating the trade shares of those commodities. The main purpose of these and similar works is to identify the gainers/losers of the reform process.

Adelman and Robinson (1988) look at the impact of a number of alternative macro-adjustment mechanisms on distribution of income for Brazil and Korea using a CGE (Computable General Equilibrium) framework. They employ a number of macro closure rules and make two empirical experiments, i.e. savings-investment and export-led growth. In a later work, Adelman, et al. (1989) investigate the optimal adjustment to trade shocks for the Turkish economy under three different objective functions (growth, stabilisation or equality) and three different strategies (export expansion, agricultural development-led industrialisation or import substitution). Janvry, Sadoulet and Fargeix (1991) investigate the welfare implications of stabilisation policies in Ecuador using again a CGE model. They have not studied the process of trade liberalisation, as they believe that 'it should not be related to stabilisation: it should have occurred before if there were net social gains to be

achieved.' However, by analysing the structural determinants of the economic and social effects of stabilisation they conclude that the structure is very important and it has to be 'managed by state intervention in the process of stabilisation and adjustment'. A similar work by Bourguignon and Morrisson (1992b) find that adjustment widely affects public services and transfers for a number of developing countries. In some countries, adjustment had favourable outcomes and in others poverty increased. The models investigate the implications of cutting public expenditures, monetary contraction, exchange rate devaluation and structural measures (taxation and customs duties). The reduction and equalisation of customs duties and indirect taxes lead to greater disequilibria in the short-term, esp. for Morocco. Bourguignon et al. (1992a) draws conclusions as to the optimal adjustment policies and ranks the policies analysed from superior to less so. The simulations show that 'the choice of a particular adjustment policy should thus be highly specific for the country in question'. The specific characteristics of each country should be the determining component of adjustment policy. Amongst these specific characteristics are international mobility of capital (Indonesia), inflationary environment (Ecuador), debt structure, etc. Adelman and Robinson (1989) argue that the structure of ownership of different forms of wealth determine the pressures on policy processes in developing countries. So the extended functional distribution of income is the most appropriate framework for those countries. The specific factors model identifies the income recipients on the basis of functional distribution of income. Khan (1997) states that distributional outcomes of a more open trade regime 'depends on the initial protection accorded to various groups, their functional role and consumption patterns and …. to the degree of openness examined'.

The outcome of various policies depends on the structure of the economy and on the parameters (esp. elasticities of substitution) used to define it. One of the most comprehensive works is by Harrison (1986). He employs a 'conditional systematic sensitivity analysis' to test the robustness of his findings with regards to unilateral and multilateral tariff reductions. Janvry et al. (1991) employs a sensitivity analysis using different elasticities of substitution between labour categories and between labour and fixed factors. A 10 % wage cut for unskilled and agricultural workers leads to a welfare decrease both in terms of incomes and of utilities obtained by all the social groups apart from large farmers in the inelastic case in the short-run. However, the same policy generates a welfare increase for all the social groups in the short-run for the elastic case.

Adelman and Robinson (1988) find that the size and the extended functional distributions are more sensitive to trade specification than to the macro closure and that the extended functional distributions are more sensitive to closure rules than the size distributions for both countries.

3. Model

In order to differentiate the influence of sensitivity of some structural parameters and of the timing of loan injections, I investigate the welfare consequences of trade reform measures. A more detailed explanation about the model can be found in Suna-Kayam (2002). The model employed here is a 3 sector-4 factor version of the standard Ricardo-Viner-Jones model of specific factors. Three general assumptions are made about the economic agents. First, there are many households of a given type with homothetic preferences and those preferences are common within each household group, but may differ between groups. Second, there are many firms in each sector with identical linearly homogeneous production functions. Last, all the economic units are price takers.

In order to keep the model as general as possible but simple I use CES functions for both consumption and production. There are four types of households with different sources of income, i.e. wage, rent from importables sector, rent from export and non-traded goods and rent from all three sectors. Household type 1 (H1) owns labour and earns wage income from all sectors. Household type 2 (H2) has capital in all sectors and earns rent income. Households type 3 (H3) and type 4 (H4) has capital in export and non-traded goods production and in importables sector, respectively. There are three typical firms, one in each sector, producing the **e**xport-, **d**omestic- and i**m**portable-goods (e-, d- and m-goods). The generalised utility function for a typical consumer is $u_h = \left(a_{hj} x_{j,h}^{\rho_h} + a_{hk} x_{k,i}^{\rho_h}\right)^{1/\rho_h}$ where $h = \{1,..,4\}$ shows the household type, $x_{j,h}, x_{k,h}$ are the quantities consumed of each good (d and m) and a_{hj}, a_{hk} are the share parameters of these goods with $\{j,k\} = \{d,m\}$ and $j \neq k$, ρ_h is the substitution parameter for household h with $-\infty < \rho_i < 1$. The generalised CES production function is $q_i = A_i\left(b_{i1} L_i^{\rho_i} + b_{i2} \overline{K}_i^{\rho_i}\right)^{1/\rho_i}$ where A_i is the scale parameter, $\{b_{i1}, b_{i2}\} > 0$ are the share parameters $L_i, \overline{K}_i$ show the labour and fixed capital used in production and ρ_i is the substitution parameter ($-\infty < \rho_i < 1$) between primary

factors (labour and capital) in each sector $i = \{d, e, m\}$. Labour allocation between the sectors is determined endogenously.

The typical firm is assumed to be a price taker in all markets.. The firms maximise profits:

$\underset{L_i}{Max}\ p_i q_i - wL_i - r_i \overline{K}_i$ for $i = \{d, e, m\}$ where q_i is the quantity produced and w, r_i are the returns on labour and capital. Since the capital is fixed, it is clear that its price is not determined in a capital market but capital in a typical firm receives the residual after payments for labour. The world market price is p_i^w and the home price for one unit of good is $p_i = p_i^w \varepsilon (1 + t_i)$. t_i is the export subsidy or tax for $i = e$ and the ad valorem tariff or tariff equivalent of quota imposed by the government to protect the importables sector for $i = m$ and ε is the exchange rate. For domestic good there is no world price, its price is determined endogenously in the economy. The price of the domestic good is affected from the real exchange rate. If the exchange rate is set to unity then the price of the non-traded good defines the real exchange rate. In order to analyse the welfare effects of any policy instrument, I incorporate the trade balance, the government budget and the national income expressions to close the model. Table 1 lists the general equilibrium equations of the model.

I use a hypothetical economy represented by a social accounting matrix (SAM) to calibrate the parameters and simulate the model. Table 2 defines the hypothetical economy in question using a SAM. In order to solve the model it should be calibrated to the SAM. The calibrations allow only two of the CES function parameters to be determined. The third, elasticity of substitution both in production and consumption, has to be imposed. The elasticities of substitution between primary factors for each sector are the weighted averages of the elasticities given by Grais et al. (1984) and they are within the one standard error range of the averages calculated using the elasticities estimated by Harrison (1986). In the case of consumption elasticities, I choose a wider range (0.2 and 2) than the elasticities of the Varuna model given by Mercenier and Waelbroeck (1986) to include various countries with different development levels. In most of the developing world the trade measures are changed towards freer trade. If both importables and exports sectors are protected by tariffs and subsidies as in this model then the status quo prices are quite distorted with respect to world prices. This also affects the allocation of resources between

activities and thus the welfare of households. The model is simulated for a number of trade reform levels, i.e. free trade, neutral trade policy, low tariff and low subsidy policy, tariff increase policy and subsidy increase policy. I compare the signs of the changes in endogenous variables for the elasticities of substitution considered. The free trade is the first best outcome of trade reform and the second best is the neutral trade policy where the tariff and subsidy rates are set equal to offset the possible effects of distortions. The other two cases are an increase in the tariff and an increase in the subsidy rates. *Free-trade*: I take the distortion variables (tariff and subsidy rates) as exogenous and use values very close to zero for tariff and subsidy rates to demonstrate free trade, i.e. $t_m = 0.01$ and $t_e = 0.001$ respectively. The model sets one of the constraints to zero by changing the endogenous variables. Reforming the trade policy by removing distortions increases the total welfare even with equal weights assigned to the households for both elasticities of substitution, i.e. 0.2 and 2. *Neutral trade policy*: The second-best solution is the neutral trade policy where export subsidy and tariff rates are equal. A model that solves for this equality taking the distortions as endogenous is used for this case. For elasticity of substitution 0.2, there is a welfare loss. Note that in this case the equal distortion is 0.081747, a decrease in tariff. Also for $\sigma = 2$, there is a welfare loss, which is the result of increased tariff and subsidy rates to $t_m = t_e = 0.1921$. *Tariff increase*: The same model as in the free trade case is used in this exercise. The tariff rate is changed to $t_m = 0.2083$, while keeping the original export subsidy of $t_e = 0.0344$. There is a welfare increase for low and a decrease for high elasticity of substitution. Note that this is an increase in tariff not a decrease as normally would be in a trade reform. *Subsidy increase*: The last exercise involves only a change in the export subsidy rate. It is increased to $t_e = 0.0444$ keeping tariff at $t_m = 0.1983$. Again there is a welfare gain.

4. Welfare Implications

Welfare improvement is one of the main concerns of any study on trade reform issues Apart from the welfare changes the other important point is who is taxed for each case. In terms of households we see different results. Examining the government transfers (positive or negative) to households as a result of trade reform reveals some of the gainers/losers of conditionality. Under full trade reform, the government taxes H3 and H4 in the low

Table 1. General Equilibrium Model[1]

Flow Equations

(1) $q_d = \mathrm{f}(w, p_d; \overline{K}_d, \sigma_d, A_d)$

(2) $q_e = \mathrm{g}(w, p_e; \overline{K}_e, \sigma_e, A_e)$

(3) $q_m = \mathrm{h}(w, p_m; \overline{K}_m, \sigma_m, A_m)$

(4) $x_{i,h} = \dfrac{1}{p_i} \dfrac{Y_h^D}{1 + \dfrac{1}{\alpha_h}\left(p_j / p_i\right)^{1-\sigma_h}}, \quad h = \{1,2,3,4\}, \quad \{i, j\} = \{d, m\} \quad i \neq j$

(5) $\pi_i = p_i q_i - w L_i - r_i \overline{K}_i = 0$ for $\forall i = \{d, e, m\}$

(6) $w = p_i \dfrac{\partial q_i}{\partial L_i}$ or $L_i = \beta_{iL} q_i$ for $\forall i = \{d, e, m\}$

(7) $T = (t_m p_m^w q^o - t_e p_e^w q_e)\varepsilon$

(8) $\sum_{h=1}^{4} x_{d,h} = X_d \quad \sum_{h=1}^{4} x_{m,h} = X_m$

(9) $Y^D = w\overline{L} + r_d \overline{K}_d + r_e \overline{K}_e + r_m \overline{K}_m + T$

Prices

(10) $p_e = p_e^w (1 + t_e)\varepsilon$

(11) $p_m = p_m^w (1 + t_m)\varepsilon$ and $\varepsilon \equiv 1$

Equilibrium Conditions

(12) $X_i - q_i = 0$ for $i = \{d, e\}$

(13) $X_m - (q_m + q^o) = 0$

(14) $L_m + L_e + L_d - \overline{L} = 0$

(15) $K_i - \overline{K}_i = 0$ for $\forall i = \{d, e, m\}$

(16) $p_m^w q^o - p_e^w q_e = 0$

Identity

(17) $Y^D \equiv p_d X_d + p_m X_m$

Endogenous Variables: q_d : supply of domestic good; q_e : supply of export good; q_m : supply of import-competing good; p_d : price of domestic good; p_e : price of export good; p_m : price of import-competing good; r_d : return to capital K_d; r_e : return to capital K_e; r_m : return to capital K_m; X_d : demand for domestic good; X_e : demand for export good; X_m : demand for import-competing good; K_d : capital used to produce good d; K_e : capital used to produce good e; K_m : capital used to produce good m; L_d : labour used to produce good d; L_e : labour used to produce good e; L_m : labour used to produce good m; T : government transfer; Y_h^D : household h's disposable income; Y^D : national income; $x_{d,h}$: household h's demand for good d; $x_{m,h}$: household h's demand for good m; w : wage rate; q^o : imports. Exogenous Variables: $\overline{L}$: total labour supply; $\overline{K}_d$: total capital stock for good d; $\overline{K}_e$: total capital stock for good e; $\overline{K}_m$: total capital stock for good m; p_e^w : world price of export good; p_m^w : world price of import-competing good; t_e : export subsidy rate; t_m : tariff rate

Table 2. The SAM (at domestic prices)

	H 1	H 2	H 3	H 4	Sector E	Sector D	Sector M	Govt	ROW	Sums
Sector E					4450			-148	-4302	0.0000
Sector D	-1763.34	-2627.87	-1078.54	-1412.7		6882.45				0.0000
Sector M	-6251.87	-6859.02	-2815.09	-3687.3			14458.28	853	4302	0.0000
Capital E		1920	1343.63		-3263.63					0.0000
Capital D		2466.82	2450			-4916.82				0.0000
Capital M		5000.07		5000			-10000.07			0.0000
Labour	7610.21				-1186.37	-1965.63	-4458.21			0.0000
Government	405	100	100	100				-705		0.0000
Income	8015.21	9486.89	3893.63	5100	4450	6882.45	14458.28			0.0000
Column sums	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

[1] See Suna-Kayam (2002) for more details

elasticity of substitution setting ($\sigma = 0.2$). The second best outcome of neutral trade policy does not generate any excess revenue therefore no one is subsidised or taxed. Neutral trade policy harms all but H3 in terms of disposable incomes. For a tariff increase it is H4 that is taxed however the household is still better off in terms of disposable income. Remember that H4 earns all of its income from capital employed in the import-competing sector. H1 gets taxed as a result of an increase in subsidy rate. It is the wage earner household and it is worse off in terms of disposable income.

Obviously, taxing some households to subsidise others affects their gains from reform. However, this does not necessarily mean that all households that are taxed will lose as a result of reform. In order to determine the gainers/losers of reform, we must look at the welfare changes of individual household.

In this section, the disaggregated (per household) welfare effects of different reform measures are discussed. The table below summarises the equivalent variation (EV) measures obtained from the simulations.

Table 3. Welfare Changes of Households

	Free Trade		*Neutral Trade*		*Tariff Increase*		*Subsidy Increase*		*Low tariff & low subsidy*	
	$\sigma = 0.2$	$\sigma = 2$	$\sigma = 0.2$	$\sigma = 2$	$\sigma = 0.2$	$\sigma = 2$	$\sigma = 0.2$	$\sigma = 2$	$\sigma = 0.2$	$\sigma = 2$
H1	Gain	Gain				Gain		Gain	Gain	Gain
H2	Gain			Gain	Gain		Gain		Gain	
H3		Gain	Gain	Gain	Gain		Gain	Gain		Gain
H4					Gain		Gain			

Source: Suna-Kayam (2002)

A closer look at Table 4 shows that H1 prefers free trade and low tariff & low subsidy to the other proposed policy changes, in that order. This means that the wage-earning household would be willing to pay for other policies not to be implemented. Similarly, H2 prefers all other policies to neutral trade. Remember that the neutral trade policy is achieved under approximately 8% distortion for low elasticity and under approx. 20% distortion for high elasticity. The difference of ranks between neutral and low tariff & low subsidy policies reflect the effect of subsidy on the household's welfare. The latter also has 8% as tariff rate and slightly lower subsidy of 2. Notice that, for low elasticity it is the first best whereas neutral policy decreases welfare.

Table 4. Welfare Changes for Different Policy Measures

Equivalent Variations $\sigma = 0.2$					
	Free Trade	*Neutral Trade*	*Tariff Increase*	*Subsidy Increase*	**Low tariff & low subsidy*
H1	425.70841	-187.55291	-14.847166	-93.362839	264.583
H2	87.678302	-53.200792	18.69944	23.041528	102.86969
H3	-383.41163	252.08975	20.015686	25.45618	-192.39555
H4	-1065.6198	-483.68182	4.0161942	43.466302	-650.87786

Equivalent Variations $\sigma = 2$					
	Free Trade	*Neutral Trade*	*Tariff Increase*	*Subsidy Increase*	**Low tariff & low subsidy*
H1	129130.07	-271.78709	6321.32603	516.524335	95383.912
H2	-1291.8061	144.4934	-19.640681	-5.7293522	-867.83949
H3	1300.3325	132.21815	-43.427649	0.35017967	645.20725
H4	-3475.586	-199.25122	-2307.3215	-460.32772	-3446.7096

Note: ∗ Low tariff means 8% and low subsidy is 2%

However, under high elasticity the welfare effects are all reversed. Neutral trade policy where the distortion rate is 19.2% is the best policy. Neutral trade is also the first best for H3 for low elasticity and for high elasticity it is free trade. Even subsidy and tariff increases, reduce the welfare of H4 under high elasticity of substitution. Nevertheless, they are the only policies that give positive EV's for low elasticity.

The EV values show that there are significant differences in terms of households, which gain/lose from each reform measure depending on the elasticity of substitution. A previous work by Suna-Kayam (2002) has shown that it is the combined influence of heterogeneity of preferences and endowments together with the influence of the elasticity of substitution that generates these outcomes.

5. Loan Injections

In this study, Bergson-Samuelson additive-type social welfare specification is used to represent the government's preferences[2]. Let the government's welfare function be represented by $G = W(V_1,...,V_4)$ where V_h for $h = 1,..,4$ denote the indirect utility of household h. In the pre-reform period the government has maximised that welfare function with respect to the tariff (t_m) and export subsidy (t_e) to find the optimum rates.

The first order conditions from maximisation are:

[2] See Mueller (1989) for a review on social welfare functions.

$$\sum_{h=1}^{4} \frac{\partial W}{\partial V_h} \frac{\partial V_h}{\partial t_e} = 0 \qquad (1)$$

$$\sum_{h=1}^{4} \frac{\partial W}{\partial V_h} \frac{\partial V_h}{\partial t_m} = 0 \qquad (2)$$

Instead of the indirect utilities, I use the equivalent variations (EVs) calculated for tariff increase and subsidy increase cases in the previous part.

Therefore, the first order conditions are written as

$$\sum_{h=1}^{4} \omega_h EV_h(\Delta t_e) = 0 \quad \text{and} \quad \sum_{h=1}^{4} \omega_h EV_h(\Delta t_m) = 0$$

the terms in parentheses denote the policy changes only.

Hence, one can write the first order conditions for high and low elasticities of substitution. For $\sigma = 0.2$ they are

$$-93.3628\omega_1 + 23.04153\omega_2 + 25.45618\omega_3 + 43.4663\omega_4 = 0 \qquad (3)$$

$$-14.8472\omega_1 + 18.69944\omega_2 + 20.0169\omega_3 + 4.016194\omega_4 = 0 \qquad (4)$$

Using the $\sum_{h=1}^{4} \omega_h = 1$ expression together with (3) and (4), we have three equations to solve for four variables. Here, the 'degrees of freedom' method is used to solve for the weights (Sydsaeter and Hammond, 1995). Three variables are determined with respect to the fourth:

$$\begin{bmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \end{bmatrix} = \begin{bmatrix} -0.20528 + 0.86326 \\ 20.64381 - 35.02002 \\ -19.4385 + 33.1568 \end{bmatrix} \omega_4 . \qquad (5)$$

Since the weights need to be between zero and one, it is possible to calculate an interval for each. For $1 \geq \omega_1 \geq 0$, ω_4 has to be $1.39619 \geq \omega_4 \geq 0.23779$. Similarly, for $1 \geq \omega_2 \geq 0$ ω_4 has to be $0.58949 \geq \omega_4 \geq 0.560931$ and for $1 \geq \omega_3 \geq 0$ it has to be $0.61642 \geq \omega_4 \geq 0.58626$.

The intersection of these intervals gives the interval for ω_4, which is then substituted to the equations in (5). The intervals for the weights ($\sigma = 0.2$) are:

$$0.3036 \geq \omega_1 \geq 0.30082$$
$$0.11297 \geq \omega_2 \geq -0.000142$$
$$0.1071 \geq \omega_3 \geq 0.00000557$$
$$0.58949 \geq \omega_4 \geq 0.58626 \ .$$

$$\begin{bmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \end{bmatrix} = \begin{bmatrix} 0.005016 + 0.48499 \\ 0.483493 - 34.59761 \\ 0.511491 + 33.1126 \end{bmatrix} \omega_4$$

Same calculations are done for $\sigma_h = 2$ and the weight intervals are calculated using:

The government in this case must have weighed H4 with $0.013975 \geq \omega_4 \geq 0$ for the policies to be the optimum. In that interval other households are weighed with $0.006776 \geq \omega_1 \geq 0.005016$, $0.483493 \geq \omega_2 \geq 4.9610^{-8}$ and $0.97423 \geq \omega_3 \geq 0.511491$.

Now we have determined the weights for the status quo to be an optimum policy. The next step is to distribute the loan.

Sequential Loan Distribution

If the government has means in place to distribute the loan in a lump-sum fashion, then proportional distribution is the easiest option. However, the loan transfer should compensate losses incurred by the households. *Assuming that the government knows which households suffer from reform and to what extent, it can bargain for a loan level that will make compensation possible.*

Let the government weigh the households with $\omega_1 = 0.0098$, $\omega_2 = 0.1375$, $\omega_3 = 0.8426$ and $\omega_4 = 0.01$ for $\sigma = 2$. The government needs different amounts of loan for different policy reform levels.

If the elasticity of substitution in consumption is $\sigma = 2$ then the total loss in welfare of households calculated by adding up negative EVs (Table 4) is NEV= 4767.4 for free trade. The households that lose have a total weight of 15% approximately ($\omega_2 + \omega_4$).

Proportional distribution means that the government distributes $loan \times weight_h = share_h$ to each household in a lump-sum fashion. Since 15% is at a loss then the loan share of those households needs to compensate for that loss, i.e. $loan = 4767.4 \div 15\% = 31782.67$, that is the loan needs to be at least 31782.67 units. Similarly, we can calculate the minimum amount of loan needed to compensate for the loss of all households. Otherwise the government cannot expect support from them. The table below lists the minimum amounts of loan for different policy reform levels.

In case of lower elasticity of substitution ($\sigma = 0.2$) the weights are different: $\omega_1 = 0.3023$, $\omega_2 = 0.052$, $\omega_3 = 0.0577$, $\omega_4 = 0.588$, the table below also summarises that situation.

Looking at Table 5 we can say, for example, that the government should know the elasticity of substitution between importables and the domestic good to be able to determine the amount of loan it needs to get.

Table 5. Minimum loan needed to compensate the losing households

($\sigma = 0.2$)			
Policy Reform	*Total Loss*	*Total Weight*	*Minimum Loan*
Free Trade	1449.032	64.57 %	2244.126
Neutral Trade	724.4358	94.23 %	768.795
Low Tariff+Subsidy	843.274	64.57 %	1305.984
Tariff Increase	14.8472	30.23 %	49.114
Subsidy Increase	93.3628	30.23 %	308.842

($\sigma = 2$)			
Free Trade	4767.4	15 %	31782.67
Neutral Trade	471.038	2 %	23551.9
Low Tariff+Subsidy*	4314.549	15 %	28763.66
Tariff Increase	2370.388	99 %	2394.33
Subsidy Increase	466.0574	15 %	3107.049

* 8% tariff and 2% subsidy

That information in hand, it can bargain for approx. 29000 if the aimed protection level is 8% tariff and 2% subsidy, i.e. low tariff + subsidy for high elasticity. Also note that, policy changes such as tariff and subsidy increase require less loan compared to the other three even if neutral trade policy implies higher subsidy and tariff levels.

Knowing the amount of loan to be asked for, the government can distribute the loan sequentially according to the weight each household has.

The second option to use in distributing the loan is trade policy measures. Before looking at how the loan distribution between households would be affected from different policy reforms, one needs a framework that includes the loan. The next section gives the details of that framework and shows the simulation results with an outside loan.

Simultaneous Loan Distribution

In this section, it is assumed that proportional distribution is not preferred either because lump-sum transfers are not possible or the government wants to introduce the loan simultaneously with trade reform.

I use the model in the first part with slight modifications on the social accounting matrix (SAM). The new SAM includes the loan. The government has to pay the loan, which is -1000 in the matrix, to ROW. In this SAM, the status quo tariff and subsidy rates are slightly different, i.e. 15.17% and 3.2%, respectively. Since the government transfers increase due to the outside loan, government transfer rates also change, i.e. 41.35% for H1, 17.598% for H2 and H3 and 23.46% for H4. I include the loan level in the simulations by changing the budget equation to

$B = Tariff\ revenue - Subsidy\cos t + Loan$ and thus the transfer equation becomes

$T = GovR(tariff\ revenue - subsidy\cos t) + Loan$. Hence, the government transfers a percentage of T to each household.

In simulations, the loan is taken as an exogenous variable. Therefore, depending on the magnitude of the loan the endogenous variables take different values. In order to see the welfare effects of the loan when introduced simultaneously with trade reform measures, I look at the equivalent variations (EV's) of each household for different reform measures considered above. The table below summarises the EV's under different elasticities of substitution. A closer look at the table shows that H1 is better off under both free trade and low tariff & low subsidy policies for both elasticities. It is possible to say that the labour household would be willing to compensate the loss of others for these policies to be implemented. H2 is better off under all but the tariff increase policy for high elasticity whereas it loses from subsidy increase for the low elasticity case. Since H3 has rent income only from the exportables sector (export and domestic good production) it is natural that it should lose from tariff increase as in the high elasticity case. However, for low elasticity of

substitution it gains as a result of tariff increase. Similarly H4 gains from subsidy increase for low elasticity and loses under all policies but the tariff increase for high elasticity.

Table 6. Welfare Changes for Different Policy Measures with Loan

Equivalent Variations $\sigma = 0.2$					
	Free Trade	*Neutral Trade*	*Tariff Increase*	*Subsidy Increase*	**Low tariff & low subsidy*
H1	405.0372	-83.6254	-37273802	-9.20589	238.4419
H2	467.1718	33.54737	-36.9250185	-17.4083	242.6245
H3	-1733.81	125.4149	9.43528744	-0.29196	-802.059
H4	-498.127	-352.597	107.909206	7.723313	-130.862

Equivalent Variations $\sigma = 2$					
	Free Trade	*Neutral Trade*	*Tariff Increase*	*Subsidy Increase*	**Low tariff & low subsidy*
H1	682.0015	-126.791	-42.611603	-89083	272.5168
H2	1085.934	108.7135	-52.642339	695302	452.8457
H3	-18574	55.62598	-12.323113	-13786	-113.967
H4	-2027.76	-196.966	142.907999	-10.8724	-833.108

Note: ∗ Low tariff means 5% and low subsidy is 2%

In 43 % of the cases considered above the households gain from policy changes. Free trade, neutral trade and low tariff & low subsidy policies benefit half of the households. The tariff increase benefits only 3/8 whereas subsidy increase improves the welfare of only a quarter of the households. Among the policy changes evaluated free trade, neutral trade and low tariff + subsidy seem to be the best policies to adopt.

Although these evaluations give some idea about the gainers and losers of trade reform tied to a loan, they are not sufficient to show the exact picture in terms of welfare effects. Income inequality is the other key issue we need to consider.

Income Inequality

The Gini coefficients are used to determine the income inequality levels of considered trade policy reforms. Since the exact distribution of the population is not available in terms of kind of income earned by the households, the hypothetical settings below are used.

Setting 1: 80% of the population is labour owners. 10% has capital in only importables sector, i.e. H4. H2 and H3 each form 5% of the population.

Setting 2: H1 forms 60% of the population. H4 is 20%. H2 and H3 form the rest.

Table 7. The Gini Coefficients for *Setting1* and *Setting 2*

Setting 1	$\sigma = 0.2$	*Setting 1*	$\sigma = 2$
Free trade	0.47864	Free trade	0.476228
Neutral trade	0.501254	Low tariff + subsidy	0.493808
Status quo	0.506132	Status quo	0.506132
Subsidy increase	0.506341	Subsidy increase	0.506154
Low tariff + subsidy	0.507273	Tariff increase	0.508049
Tariff increase	0.50769	Neutral trade	0.509214

Setting 2	$\sigma = 0.2$	*Setting 2*	$\sigma = 2$
Free trade	0.264096	Free trade	0.364721
Status quo	0.371022	Status quo	0.371022
Subsidy increase	0.371091	Subsidy increase	0.371168
Tariff increase	0.371433	Tariff increase	0.371285
Neutral trade	0.376554	Neutral trade	0.377238
Low tariff + subsidy	0.455867	Low tariff + subsidy	0.555046

When we look at the Gini coefficients for different trade reform levels, we see that for Setting 2 the ranking of policy changes is the same under two different elasticities. In other words, free trade seems to be the best policy to decrease income inequality since its coefficient is the only one less than the status quo coefficient. However, for Setting 1 neutral trade policy improves income equality for the low elasticity case and low tariff and subsidy policy has a similar benefit for high elasticity of substitution. While evaluating the results one must remember that the neutral trade means $t_m = t_e = 0.1445$ for $\sigma = 0.2$ and $t_m = t_e = 0.1406$ for $\sigma = 2$. Comparing these results with those of Bourguignon et al. (1992a) shows that the structural parameters have a significant influence of the determination of better policy. In their study of developing countries, Bourguignon and Morrisson (1992b) find that a reduction in export prices leads to an increase in poverty gap and in the Theil index meaning an increase in income inequality for Cote d'Ivoire. Similarly a 60% increase in import duties increases the Theil index, percentage of poor and poverty gap in the Morocco model. The equality changes as a result of tariff increase of 1 % show that the inequality increases more (by 0.011) for a 60% increase in import duties if the population shares of households are as in *Setting 2* and if the elasticity of substitution is low. The difference between inequality measures for Settings 1 and 2 increases (to 0.099) for high elasticity of substitution in case of 60% increase in duties as in Bourguignon et al. (1992a). However, income is more equally distributed in *Setting 2* compared to *Setting 1* no matter what the policy and the elasticity are.

However, if we assume a set of structural parameters and determine the reform policy according to the results obtained using those parameters then within that framework the choice of policy is influenced by the elasticity of substitution.

Although free trade is the best policy option it is very difficult to achieve. Therefore, the second best options for income equality become more important. Combining the findings of welfare improvement and income equality shows that free trade, neutral trade and low tariff & low subsidy policies together with the status quo are better than the rest. Note that the other options improve competition for only some of the products.

7. Comparison of Sequential and Simultaneous Loan

Assuming that the status quo trade measures are optimal in the sense that they reflect how the government weighs the households, these optimum weights determine the minimum loan required for different trade reform levels. The government has to know the elasticity of substitution in consumption to be able to determine the minimum amount of loan needed. If the government can get the minimum amount of loan required to compensate the loss of households for each trade reform level then proportional distribution ensures that everybody will at least be as well off as the status quo even after the reform. If the government decides to weigh the households differently in the reform period than the status quo, then the minimum loan required will change as well. In order to make use of trade policy measures in loan distribution, the reforms and the loan should be simultaneously introduced to the system. The social accounting matrix has a different structure in terms of parameters and the conditionality has different effects on endogenous variables for different elasticities of substitution. Free trade, neutral trade and low tariff & low subsidy are the best trade reform levels both in terms of welfare (EV) increase and income inequality. If the minimum loan required for proportional distribution can not be obtained or lump-sum transfers are not possible then it is better to distribute the loan via trade measures. This way the total loss will be less than the total loss in proportional distribution. For example, neutral trade policy imposes a loss of 724358 and requires a minimum loan of 1305.984 for proportional distribution. However, with a simultaneous loan injection of 1000 -as in the exercise- the loss is only 277.26013.

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