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Preferential vs. Full Trade Liberalisation:
A Dynamic CGE Model with
Heterogeneous Households for Jordan^{*}

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Abstract

This paper deals with the economic effects and the policy implications of trade liberalisation on the Jordanian economy, with emphasis on welfare, income distribution and real wages of heterogeneous households, by using a neoclassical dynamic computable general equilibrium (CGE) model. Specifically the paper assesses the impacts of preferential trade liberalisation with the European Union (EU) and then compares them with those brought about by broad and non-discriminatory trade liberalisation.

JEL classification: C68, F11, I32, D31

Keywords: Dynamic CGE Models, Heterogeneous households, Trade liberalisation, Jordan

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1. Introduction

The Association Agreement (AA) between Jordan and the European Union (EU) was signed in 1997 and is part of a larger programme, the Euro-Mediterranean Partnership that involves through a network of bilateral relations the EU and countries in the Middle East and North Africa (MENA) region. The AA between Jordan and the EU replaced the 1997 Cooperation Agreement, and entered into force in May 2002. It reduces and eliminates, over a 12-year period, custom duties and charges on importing most EU industrial products to Jordan. Import duties on EU agricultural and food products are only partially eliminated.

The process of trade liberalisation is expected to provide benefits for Jordan in terms of lower import prices of investment and consumption goods that bring about higher consumer welfare. However, trade liberalisation has also a negative impact on government revenue due to reduced import tariff duties. Therefore, a possible decrease in government transfer to households could make welfare impacts ambiguous, particularly for those households who rely heavily on government transfer. Furthermore, low income households will probably fail to exploit the benefits of increased incentives for investment and will therefore fail to make use of the full potential of trade liberalisation. As pointed out by Winters (1996), trade liberalisation generally contributes to poverty alleviation, but trade reforms might create some losers, even in the long-run.

A trade policy issue playing a role in Jordan's trade liberalisation is the debate about global versus regional integration (Winters, 1996). Whereas there is wide empirical evidence that economic growth rates and trade liberalisation are positively related (Sachs and Warner, 1995), there is further evidence supporting the view that non-discriminatory trade openness leads to higher growth than preferential trade liberalisation does (Vamvakidis, 1998). Moreover, preferential trade liberalisation is likely to cause trade diversion, that is a diversion of Jordanian imports from more efficient non-EU countries to more costly EU producers. The policy implications for Jordan therefore suggest that broad and non-discriminatory openness would be more beneficial than regional integration (Hoekman and Djankov, 1997, Ghesquiere, 1998). A multilateral and non-discriminatory trade liberalisation process would also avoid the costs of trade diversion, although it would clearly reduce further government revenues, and hence require additional compensatory measures of public finance, which in turn would make the impact on welfare even more ambiguous than in the case of discriminatory trade liberalisation.

In the debate on the merits of preferential trade agreements (PTAs) as a tool of trade liberalisation, the supporters of such arrangements argue that PTAs move the member countries and the world towards freer trade. Multilateralists (see Panagariya, 1998) argue instead that PTAs actually fragment the global trading system and move away from true liberalisation.

Previous studies by Hosoe (2001) and Lucke (2001) on Jordan's trade liberalisation implemented static CGE models with one representative household and focused on aggregate welfare and fiscal effects. The work by Hosoe (2001) investigates the impacts of two trade policy scenarios for Jordan,

the implementation of the Uruguay Round and the establishment of a free trade area with the EU, by using a static model based on Devarajan et al. (1990). He finds positive welfare effects brought about by the Uruguay Round and an additional welfare gain due to the EU-Jordan preferential trade agreement. The work by Lucke (2001) focuses mainly on fiscal effects of the EU-Jordanian Association Agreement, and discusses fiscal responses aiming at overcoming the loss in government revenue. However, these models do not account for dynamic effects due to capital accumulation and can not analyse income distribution effects.¹

In the general equilibrium analysis of income distribution issues, there are mainly two approaches. One is to use a CGE model with one single representative consumer. The changes in commodity and factor prices generated by a trade liberalisation experiment are applied to household data in order to compute the impacts on poverty and income distribution. This approach has been followed, among others, by Ianchovichina et al. (2001) and by Hertel et al. (2002). The second approach is to embed the household disaggregation within the CGE model. As pointed out by Winters et al. (2004), the latter approach has the advantage of being internally consistent. Simulations help therefore to identify the household classes that are vulnerable even when trade liberalisation is beneficial on average. The model in this paper is based on the latter approach, i.e. the one in which the disaggregated household groups are embedded within the CGE model.

In the context of computable general equilibrium modelling several studies have been conducted to assess aspects of income distribution (see Reimer, 2002 and Winters et al., 2004, for a survey). Theoretical studies by Chatterjee (1994) and Caselli and Ventura (2000) analyse the effects of implementing heterogeneous consumers into a neoclassical framework. However the first approach that analyses income distribution in an applied dynamic neoclassical general equilibrium framework in which heterogeneous households are assumed to have different discount rates has been developed by Feraboli and Trimborn (2006).

This paper addresses therefore the question of how both preferential and non-discriminatory trade liberalisation combined with a parallel process of complementary economic reforms affect welfare of heterogeneous households by implementing a dynamic neoclassical computable general equilibrium (CGE). More specifically, the model builds upon previous work done by Feraboli et al. (2003) and by Feraboli and Trimborn (2006).

Feraboli et al. (2003) implement a dynamic CGE model characterised by the assumption of one representative consumer as used by Ramsey (1928), Cass (1965) and Koopmans (1965). The dynamic CGE model is augmented by introducing heterogeneous households. Households are disaggregated into six different groups ranked by their disposable income. Within each group one representative individual maximizes the sum of discounted utility according to their own budget constraint. Household groups' individual tax rate, wage rate, initial endowment of assets, transfer from

¹ To my knowledge, there is no other study on Jordan's trade liberalisation based on a dynamic CGE model with heterogeneous households.

government and foreign transfer, as well as consumption preferences, are calibrated by using the data from a household survey. Moreover, the time preferences of each different household group are also calibrated from the survey data. The model is solved by means of the mathematical software Gauss and by applying the relaxation algorithm proposed by Trimborn et al. (2008).

The simulation results lead to welfare changes in Jordan between -0.08% and 0.42% , providing therefore evidence that trade liberalisation has different effects across heterogeneous households and can even create some losers. Low-income households gain slightly more from trade liberalisation in terms of welfare, since they can overcome losses in government transfer by an increase in the wage income due to aggregate capital accumulation. However, income inequality increases, since high income households can exploit the benefits of increased incentives for investment. This results in higher capital income and leads therefore to an increase in the income gap. Moreover, whereas preferential trade liberalisation makes one household worse off, non-discriminatory trade liberalisation leads to positive effects on welfare for all household groups. Finally, the behaviour of aggregate variables is qualitatively consistent with the results by Feraboli et al. (2003).

The paper is structured as follows: Section 2 describes briefly the EU-Jordan Association Agreement, Section 3 explains the model, Section 4 deals briefly with the dataset and the calibration procedure, in Section 5 the simulations are analysed and discussed, and finally Section 6 draws the main conclusions. The Appendix presents graphs, which show the long-run dynamic behaviour of some variables.

2. The EU-Jordan Association agreement

Before the start of the Euro-Mediterranean Partnership, relations between the EU and the countries in the MENA region were ruled by the Cooperation Agreements dating from the 1970s. Under the 1977 Cooperation Agreement Jordan was granted duty-free access to the EU markets for most industrial products and preferential access for agricultural commodities. The Cooperation Agreement was unlimited in duration, and it was not reciprocal. In 1979 the Agreement allowed Jordan exports to enter the EU market free of quantitative restrictions.

The relations between Jordan and the European Union are now governed by the Euro-Mediterranean Partnership, which is implemented through the EU-Jordan Association Agreement and the regional dimension of the Barcelona Process. The EU-Jordan Association Agreement is part of the bilateral track of the Euro-Mediterranean Partnership. The final aim is the creation of a free trade area between the EU and Jordan over a period of 12 years, in conformity with the provisions of the General Agreement on Tariffs and Trade (GATT). The Euro-Mediterranean Partnership was launched at the

1995 Barcelona Conference between the European Union and its 12 original Mediterranean Partners.² This Partnership governs the policy of the EU towards the Mediterranean region. It comprises two complementary tracks, the bilateral agenda and the regional agenda. The framework for the bilateral agenda is the Association Agreement. The regional agenda is implemented through a number of regional working groups on a range of policy issues including trade, customs cooperation, and industrial cooperation.

The EU-Jordan Association Agreement was signed in November 1997 and entered into force in May 2002. This agreement provides the gradual reduction of import duties on imports of EU industrial and agricultural products into Jordan over a period of twelve years. Table 1 shows the pre-AA import duty rates and the tariff reduction schedule of the Association Agreement for the eight good sectors.³

Period	Agric.	Mining	Food	Text.	Paper	Chem.	Miner.	Others
Pre-Agreement rates	17.0%	9.4%	29.2%	14.1%	13.2%	2.8%	12.2%	12.2%
Entry into force of the AA	17.0%	5.6%	29.2%	8.5%	7.9%	1.7%	7.3%	7.3%
One year after	17.0%	5.0%	29.2%	7.5%	7.0%	1.5%	6.5%	6.5%
Two years after	17.0%	4.4%	29.2%	6.6%	6.2%	1.3%	5.7%	5.7%
Three years after	17.0%	3.8%	29.2%	5.7%	5.3%	1.1%	4.9%	4.9%
Four years after	15.3%	2.8%	26.3%	4.2%	4.0%	0.8%	3.7%	3.7%
Five years after	13.6%	2.5%	23.4%	3.8%	3.5%	0.8%	3.3%	3.3%
Six years after	11.9%	2.2%	20.4%	3.3%	3.1%	0.7%	2.9%	2.9%
Seven years after	10.2%	1.9%	17.5%	2.8%	2.6%	0.6%	2.4%	2.4%
Eight years after	8.5%	1.6%	14.6%	2.4%	2.2%	0.5%	2.0%	2.0%
Nine years after	8.5%	1.3%	14.6%	1.9%	1.8%	0.4%	1.6%	1.6%
Ten years after	8.5%	0.9%	14.6%	1.4%	1.3%	0.3%	1.2%	1.2%
11 years after	8.5%	0.6%	14.6%	0.9%	0.9%	0.2%	0.8%	0.8%
12 years after	8.5%	0.0%	14.6%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 1. Tariff reduction schedule of the AA with the EU.

Jordan joined the World Trade Organisation (WTO) in April 2000, after starting the process of regional integration with the EU. It could be pointed out that preferential trade agreements (PTAs) depart from the non-discriminatory principle of the WTO and are therefore conflicting with the WTO 'most-favoured nation' (MFN) rule. However, WTO members are allowed, under specific conditions, to set up custom unions and free trade areas. In order to increase regional economic integration Jordan is part of the so-called 'Agadir' process, i.e. the Mediterranean Arab Free Trade, together with Egypt, Morocco and Tunisia, and is member of Arab Free Trade Area Agreement with other 13 countries belonging to the Arab League. Jordan also signed bilateral free trade agreements (FTAs) with other countries in the MENA regions, with the USA and with the European Free Trade Association (EFTA).

² The 12 original partners are: Israel, Morocco, Algeria, Tunisia, Egypt, Jordan, the Palestinian Authority, Lebanon, Syria, Turkey, Cyprus and Malta. Two of them, Cyprus and Malta, joined the EU in 2004. Libya has observer status since 1999.

³ The production sectors are Agriculture, Mining, Food, Textiles, Papers, Chemicals, Minerals, and Others.

Trade liberalisation is expected to provide benefits for Jordan in terms of lower consumption and investment prices, that bring about a rise in welfare. Investment demand plays a key role in the process of trade liberalisation, and is potentially important to the dynamic behaviour of output over the long-run (Francois et al., 1997 and Baldwin, 1993). Since lower investment prices create incentives for investment, the capital stock is expected to rise over the long-run. On the other hand, trade liberalisation has an unpleasant effect for the Jordanian government. There is a clear loss in government revenue, due to foregone import tariff duties. Such an impact is likely to be particularly strong for Jordan, where government revenue relies heavily on custom duties.⁴

The policy implications for Jordan suggest, therefore, that the government should accompany the trade liberalisation process with appropriate measures of economic policy in order to counteract the adverse effects on government revenue due to the reduction in custom duties. Such measures should involve a reform and modernisation of the tax system and broadening of the tax base as well as a reduction in government expenditure (Lucke, 2001).

Economic theory suggests that the positive effects of non-discriminatory trade liberalisation, in terms of lower domestic composite prices, are larger than those brought about by preferential trade liberalisation. However, the unpleasant impacts on the Jordanian economy, i.e. larger decrease in government revenue and subsequent stronger public finance measures, might lead to even more ambiguous welfare effects, and might have a bigger impact on income distribution and therefore widen the gap between the rich and the poor.

The expected decrease in government revenues due to import tariff reduction will likely force government expenditure to decrease. This potential decrease in government expenditure will probably include a reduction of government transfer to households. Since the poorest households rely heavily on these transfer payments, it is likely that trade liberalisation will affect different households asymmetrically.

3. The Model

The Jordanian economy is modelled as a dynamic small open economy. For each of the six different household groups, a representative consumer maximizes discounted intertemporal utility subject to a budget constraint. The domestic economy has nine production sectors, eight of which produce goods and one produces services. Aggregate private consumption, government consumption, and aggregate investment are Cobb-Douglas composites of nine different sectoral outputs, which, in turn, are composites of domestically produced and imported goods (Armington, 1969). Firms produce nine different commodities using a Leontief production technology that employs sectoral goods and a value-added production, which is in turn a constant elasticity of substitution (CES) composite of

⁴ Import duties from EU trade in Jordan in the period 1994-96 averaged 12% of total tax revenue and 2% of GDP, total import duties averaged more than one-third of total tax revenue and about 6% of GDP (Abed, 1998).

capital and six different kinds of labour. Total output can be sold domestically or exported according to a constant elasticity of transformation (CET) specification. The Government raises taxes and collects import tariffs. Government revenues are spent for a fixed amount of government consumption as well as for transfers to households.

The domestic economy is a price-taker in international markets. Perfect competition and full employment are assumed in all sectors. Production factors are perfectly mobile across sectors.

3.1. Households

The representative consumer chooses consumption and new capital so as to maximise their discounted utility, subject to the budget constraint, the motion equation of capital, the equality between savings and investment, and the given initial level of capital stock.

The problem of each representative infinitely-lived household i is therefore to maximize discounted intertemporal utility

$$\int_0^{\infty} \log(C_i) \cdot e^{-\rho_i t} dt, i = 1, \dots, 6$$

subject to

$$\dot{K}_i = SAV_i - \delta K_i = \frac{YD_i - P_C C_i}{P_I} - \delta K_i$$

$$K_i(0) = K_{i,0}$$

where C_i , YD_i , K_i and SAV_i are consumption, disposable income, capital and saving of household i , respectively. Each representative household discounts future utility with discount rate ρ_i , which is specific to each household category. P_C and P_I are the composite prices of private consumption and investment goods and δ is the depreciation rate of capital.

Disposable income of each household group is given by

$$YD_i = (1 - \tau_i)(w_i L_i + r K_i + GT_i + FT_i)$$

where w_i , L_i , K_i , GT_i and FT_i denote the individual wage rate, labour endowment, capital endowment, government transfer and foreign transfers to household i , respectively. The interest rate r is identical for each household since capital is a homogenous good. Each household pays a different income tax τ_i depending on its household group.

The solution to the above dynamic maximisation problem yields the Euler equation

$$\frac{\dot{C}_i}{C_i} = \frac{(1 - \tau_i)r}{P_I} - \rho_i - \delta, i = 1, \dots, 6$$

Consumption of each household group is in turn a Cobb-Douglas composite of sectoral consumption

$$C_i = \Omega_i \prod_{j=1}^9 c_{i,j}^{\theta_{i,j}}, \Omega_i > 0, 0 < \theta_{i,j} < 1, i = 1, \dots, 6; j = 1, \dots, 9$$

where $c_{i,j}$ is household i 's consumption of good j , $\theta_{i,j}$ is the share parameter of good j in consumption of household i , and Ω_i is the shift parameter in the Cobb-Douglas consumption function of household i .

3.2. Firms

Sectoral output in the domestic economy is determined by a two-stage production process, which exhibits at the top tier a Leontief (or fixed-proportions) specification between intermediate input and value-added output. Each representative firm producing commodity j generates total output according to the following production technology

$$Q_i = \min \left[\frac{VA_j}{a_{VA,j}}, \frac{q_{1,j}}{a_{1,j}}, \dots, \frac{q_{9,j}}{a_{9,j}} \right], j = 1, \dots, 9$$

where Q_i and VA_i are sectoral output and value-added output of sector i , respectively; $q_{k,j}$ is intermediate input produced by sector k and used in the production of activity j ; $a_{VA,j}$ and $a_{k,j}$ denote the Leontief coefficients.

At the second tier, intermediate input $q_{i,j}$ is a Cobb-Douglas composite of domestic and foreign intermediate consumption goods.

Value-added production is determined by a technology characterized by a constant elasticity of substitution (CES) between the primary inputs, capital (KD_j) and six different types of labour $LD_{i,j}$, pertaining to each household group i :

$$VA_j = A_j \left[\sum_{i=1}^6 \alpha_{i,j} LD_{i,j}^{\frac{\sigma_j-1}{\sigma_j}} + \left(1 - \sum_{i=1}^6 \alpha_{i,j} \right) KD_j^{\frac{\sigma_j-1}{\sigma_j}} \right]^{\frac{\sigma_j}{\sigma_j-1}}$$

$$\alpha_{i,j} > 0, 0 < \sum_{j=1}^6 \alpha_{i,j} < 1, \sigma_j > 0, \sigma_j \neq 1$$

where A_j is the time-invariant technological parameter, $\alpha_{i,j}$ is the share of labour of household i , and σ_j denotes the constant elasticity of substitution between primary inputs. At the value-added production stage, firms minimize production costs subject to the above technology constraint.

3.3. Government

The government consumes an exogenous amount of goods, raises taxes and tariffs, and provides transfers to consumers. The government is assumed to run a balanced budget. Although at first sight the assumption might look unrealistic, it is actually appropriate and roughly consistent with government fiscal balance data for Jordan provided by the IMF.

Government consumption is determined by a constant elasticity of substitution (CES) Armington specification between domestically-produced goods and imports. Government revenue is generated from the Value-Added Tax, that applies with different rates to domestic and imported goods (VAT^D and VAT^M) the income tax (TY) and import duties (TM) which apply with different rates to the EU and

the rest of the world, and exogenous and fixed foreign grants (FRG). The expenditure is given by an aggregate transfer to households (TR) and an aggregate fixed consumption of goods and services (G).

The government budget is therefore given by

$$VAT^D + VAT^M + TY + TM + FRG = TR + G$$

3.4. Market clearing

The equilibrium in the factors markets requires for each type of labour, aggregate endowment of labour to be equal to aggregate labour demand and aggregate capital stock to be equal to aggregate demand for capital:

$$L_i = \sum_{j=1}^9 LD_{i,j}, i = 1, \dots, 6$$

$$\sum_{i=1}^6 KD_i = \sum_{j=1}^9 KS_j$$

where L_i and K_i are, respectively, labour and capital supplied by household i .

The equilibrium condition on the domestic goods markets is

$$X_j = \sum_{k=1}^9 q_{k,j} + C_j + I_j + G_j, j = 1, \dots, 9$$

where X_j , I_j and G_j are aggregate absorption, investment demand and government consumption.

The equilibrium in the balance of payments is given by:

$$\sum_{j=1}^9 PWM_j M_j = \sum_{j=1}^9 PWE_j E_j + \sum_{i=1}^6 FT_i + FGR$$

where M_j and E_j are, respectively, imports and exports of sector j , PWM_j and PWE_j are the exogenous world prices of, respectively, imports and exports of sector j , FT_i is foreign transfer to household i , and FGR are foreign grants donated to the Jordanian government.

4. Data and Calibration

The calibration procedure is based on the Social Accounting Matrix (SAM) for Jordan constructed for the year 2002.⁵ On the assumption that the dataset represents an equilibrium of the economy, functional parameters in the model, such as share and shift parameters, are calibrated, i.e. they are estimated, such that the SAM represents a solution of the model where all variables are stationary except asset accumulation of individual households. The reason for this is that the fractions of savings and assets are not the same across households, and, therefore, the assumption of a stationary individual capital accumulation would violate the SAM.

Household survey data allows disaggregation into six different groups of households. Each group differs with respect to labour income, capital income, transfers from government and from abroad,

⁵ The SAM was constructed by Feraboli and Kolev.

income-tax payments, and savings, as well as total consumption and the composition of total consumption. Households are taxed with a progressive, general income tax, resulting in different net interest rates. Therefore, each household faces different incentives for saving. Time preference rates are then calibrated so that they exactly offset this effect in the long-run. Table 2 presents size and income composition of the household groups. For convenience household group one (HH1) is denoted as the poorest and household group six (HH6) as the richest household group.⁶

The elasticities of substitution have been taken from the existing literature (Devarajan et al., 1999, Devarajan and Go, 1998, and Lucke, 2001). The domestic interest rate is set to 0.1.

The model is programmed in Gauss and solved with the relaxation procedure as proposed by Trimborn et al. (2008).

Class	Individuals	Labour	Capital	Gov. Transfer	Foreign remit.
HH1	81184	48%	27%	14%	11%
HH2	583420	58%	24%	10%	8%
HH3	970240	58%	27%	8%	7%
HH4	1251301	52%	32%	9%	7%
HH5	1224470	45%	39%	8%	8%
HH6	939704	30%	57%	6%	7%

Table 2. Size and income composition of the household groups.

5. Simulations

Since the dataset available for the calibration procedure represents the Jordanian economy in the year 2002, this is the benchmark year. All variables at their benchmark levels have been normalised to one. Exogenous shocks are then implemented in the model, in order to compute the counterfactual equilibrium determined by the change in the policy regime. The effects of the policy change are assessed by comparison between counterfactual and benchmark equilibria.

The two simulations run in this work have two components: (i) the gradual reduction of import duties given by the EU-Jordan Association Agreement (AA), i.e. the schedule shown in Table 1, and (ii) the domestic counteracting policy response, i.e. the endogenisation of aggregate government transfer to households, which is expected to decrease.⁷

The first simulation applies the gradual reduction of import duties only to the EU imports, i.e. it implements the AA with the EU. In the second simulation the trade liberalisation is non-

⁶ The share of capital income of total income of the poorest household group (HH1) is unexpectedly high. I suspect that households misreported self-employment labour income as capital income. However, richer household groups earn considerably higher capital income per capita. Therefore, I expect the results to be substantially unaffected.

⁷ More precisely, aggregate transfer from the government to households is endogenous, whereas the share of each household's transfer in aggregate transfer is fixed.

discriminatory, that is the gradual reduction of import tariff rates applies to all imports, according to the same time schedule provided by the AA and shown in Table 1.

In the first simulation, the immediate effect of reducing import rates on EU imports is a change in the relative prices in the domestic economy. The price of EU imports falls relatively to the price of imports from the rest of world. The composite import price will also decrease relative to the price of domestically-produced goods. The fall in the import prices boosts domestic demand and increases incentives for investment, which in turn leads to faster capital accumulation. In the long-run equilibrium this leads to a higher value of aggregate capital stock. Output is also expected to increase in the long-run. The loss in government revenue due to reduction in import duties is partially offset by the expansion in the tax base in the long-run. In the short-run government transfer to households is expected to fall to compensate for the immediate drop in government revenue. Consumption is likely to increase in the long-run on aggregate and also for each household class, but in the short-run consumption of specific household groups or even aggregate consumption might fall

The impact on welfare on each household class is therefore ambiguous. On the one hand, consumption is likely to increase in the long-run and this has therefore a positive impact on welfare. On the other hand, the fall in the government revenue brought about by trade liberalisation forces the government to reduce transfers to households, at least in the short-run. This affects negatively disposable income of households, who are forced, *ceteris paribus*, to reduce consumption. Clearly this will affect welfare negatively. Moreover, whereas aggregate consumption might increase in the short-run, the benefits might be distributed unevenly across different households, and some specific household category can be worse off after the trade liberalisation takes place.

The second simulation brings about a bigger negative effect on composite import prices, which is likely to have a larger positive impact on welfare than under the case of discriminatory trade liberalisation. However, full liberalisation has also a larger negative impact on government revenue. This might result in a larger decrease in government transfer to households and therefore in a larger negative impact on welfare. Hence the impact on welfare of individual households might be in principle ambiguous under both scenarios. The overall impact on welfare will depend on the magnitudes of two effects: lower prices brought about by import tariff reduction and lower disposable income determined by the domestic complementary policy measures.

The welfare effects of the simulations are summarised in Table 3. As expected, households are affected differently by trade liberalisation. The results show positive welfare effects for all household groups under the scenario of non-discriminatory trade liberalisation, whereas preferential trade liberalisation is not Pareto improving since one representative household (HH5, the second richest group) is worse off.

Figures 1 and 2 in the Appendix show the dynamic path of private consumption. Under both scenarios the consumption levels of the three richest households (HH4, HH5 and HH6) falls below the initial benchmark level (equal to one) and increases afterwards, implying that these household groups must

give up consumption in the short-run in order to achieve higher future consumption. The common feature of the consumption path of all household groups is the increase in the short-run and the approach to the long-run equilibrium from below.

Scenario	HH1	HH2	HH3	HH4	HH5	HH6
AA with the EU	0.12	0.42	0.18	0.11	-0.08	0.14
Full liberalisation	0.12	0.31	0.21	0.16	0.06	0.11

Table 3. Welfare effects (percent change).

Since welfare gains are higher for poor households, one might expect income inequality to decrease. However, the opposite is the case. The Gini coefficient (Gini, 1912) is used as a measure of income inequality. From the initial value of 0.2763, the Gini coefficient increases slowly to 0.2786 in the scenario of the AA with the EU and to 0.2837 in the scenario of broad and non-discriminatory trade liberalisation. Hence, the process of trade liberalisation leads in both case to larger income gap among household groups.

The reason for this can be seen in Figures 3 and 4. Whereas the capital stocks owned by the richest household increase over time, the two poorest household groups (HH1 and HH2) use their capital assets to smooth consumption and therefore deaccumulate capital. This leads to a widening income gap between rich and poor, as clearly indicated also in Figures 5 and 6.

Figures 7 and 8 show the path of real wages. As expected, the real wage is at all periods above the benchmark level. The poorest household groups experience a slightly larger increase than rich households.

Finally the path of government transfer to households is shown in Figures 9 and 10. Given the decrease in government revenue, government transfer to households is forced to fall. As shown graphically, during the gradual reduction of the EU import tariff rates, the drop in government revenue forces the government to cut transfer to households, which falls below the benchmark value of one, has a decreasing trend until the 12th period, increases very slightly and finally approaches the steady state from below. The path of transfer in the initial 12 years shows ups and downs. This rather unexpected time path characterises also the trend of government revenue and is due to the fact that, whereas time is continuous, the import tariff reduction is a discrete-time process, i.e. it takes place at a specific point in time. This causes a discrete adjustment in government revenue, that fluctuates around the trend. The behaviour of government revenue in turn affects the path of transfer to households

6. Conclusions

In this paper the question of how preferential and non-discriminatory trade liberalisation affect different households has been investigated. The model implemented here is a dynamic, neoclassical computable general equilibrium (CGE) model, augmented by introducing heterogeneous households.

Each of the six household group differs with respect to income, initial endowments of assets, transfers from the government and from abroad, wage rate, income tax rate and individual preferences. Whereas several studies implemented CGE models to address trade liberalisation and income distribution issues in a dynamic framework, this work uses the approach developed by Feraboli and Trimborn (2006), who introduced the fundamental assumption that different household groups are characterised by different discount rates, which are calibrated from the available data.

Trade liberalisation lowers prices for investment and consumption goods in the domestic economy and therefore boosts internal demand and output, which in turn leads to faster capital accumulation. Government transfer to household decreases due to foregone government revenue brought about by the reduction in import duties. The results of the simulations support the fact that welfare effects are different across households groups, and under the scenario of preferential trade liberalisation one household group is even worse off. Therefore trade liberalisation alone is not always Pareto improving for Jordan. Moreover, welfare gains are slightly higher for poor households, who can compensate for the reduction in transfer from the government by an increase in labour income. However, the income gap between rich and poor increases slightly. Whereas rich households' capital income increases sharply in the long-run due to exploitation of investment incentives, low-income households deaccumulate capital over time in order to smooth consumption.

Hence, the introduction of heterogeneous households into a standard dynamic CGE model provides useful results and interesting implications for welfare and income distribution.

Appendix

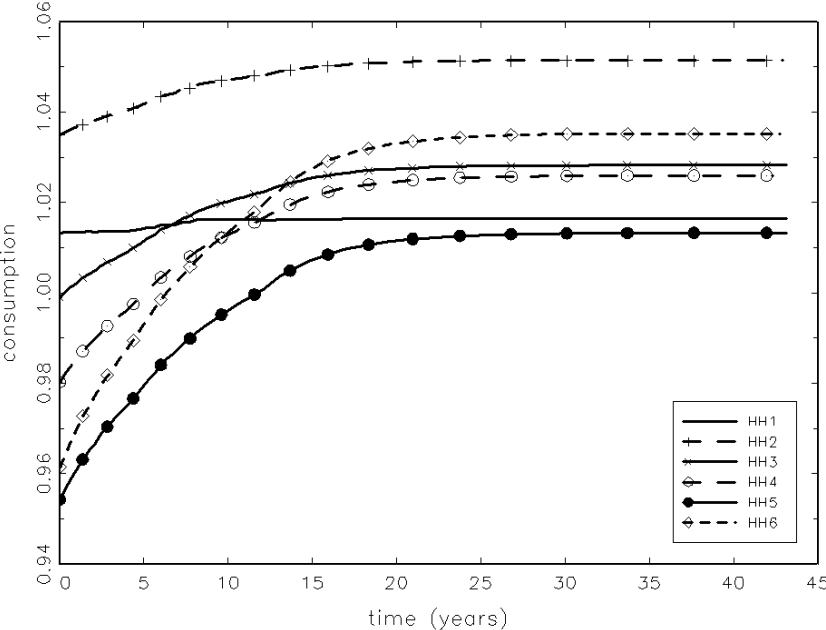


Figure 1. Effects of the AA with the EU on consumption.

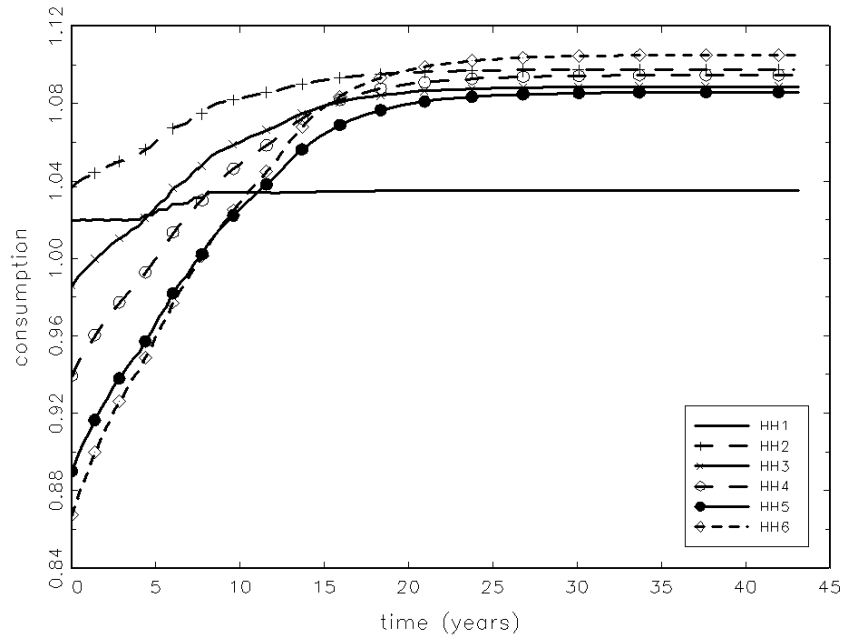


Figure 2. Effects of full liberalisation on consumption.

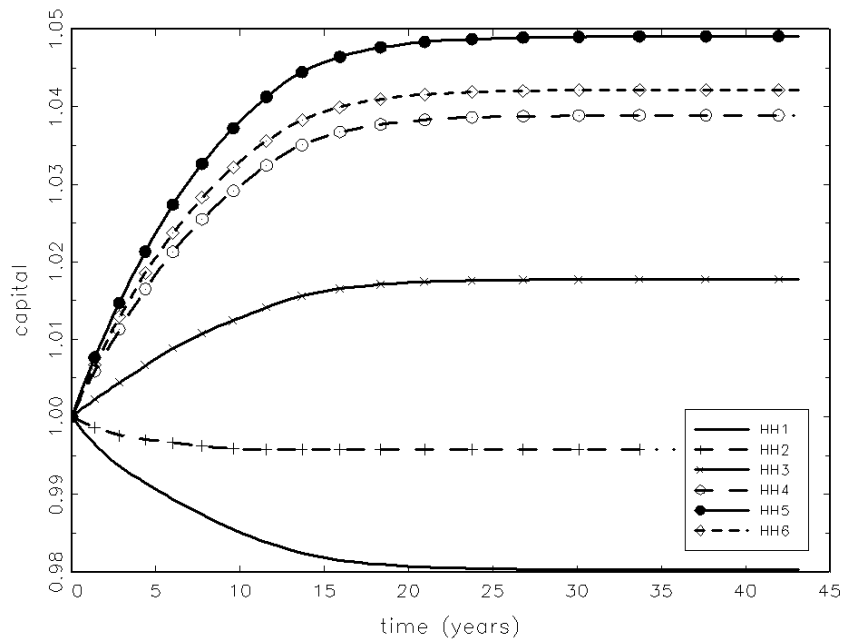


Figure 3. Effects of the AA with the EU on capital.

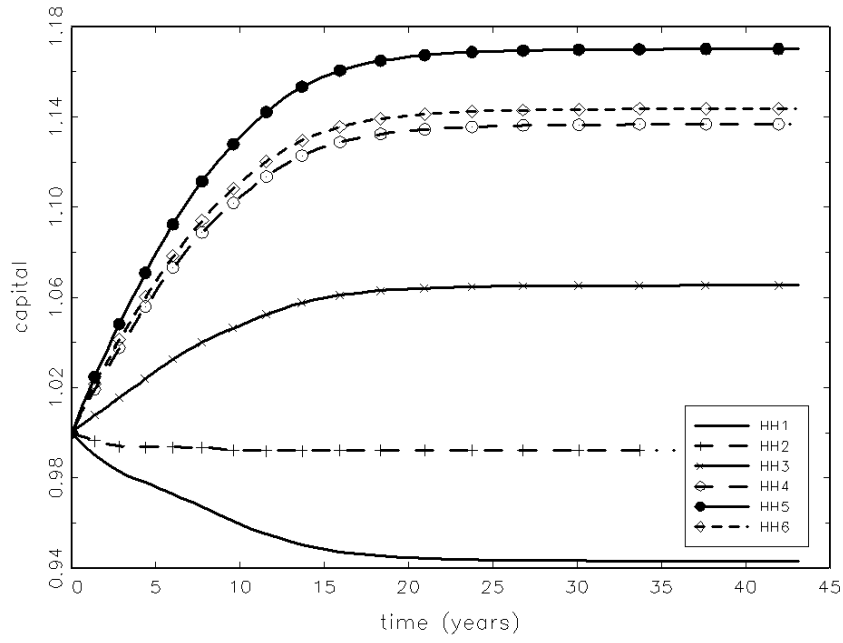


Figure 4. Effects of full liberalisation on capital.

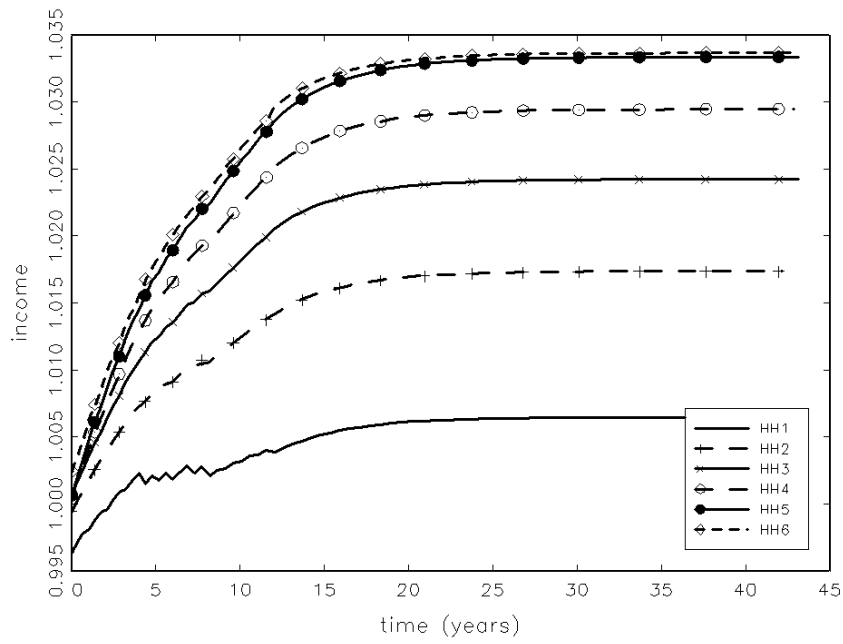


Figure 5. Effects of the AA with the EU on income.

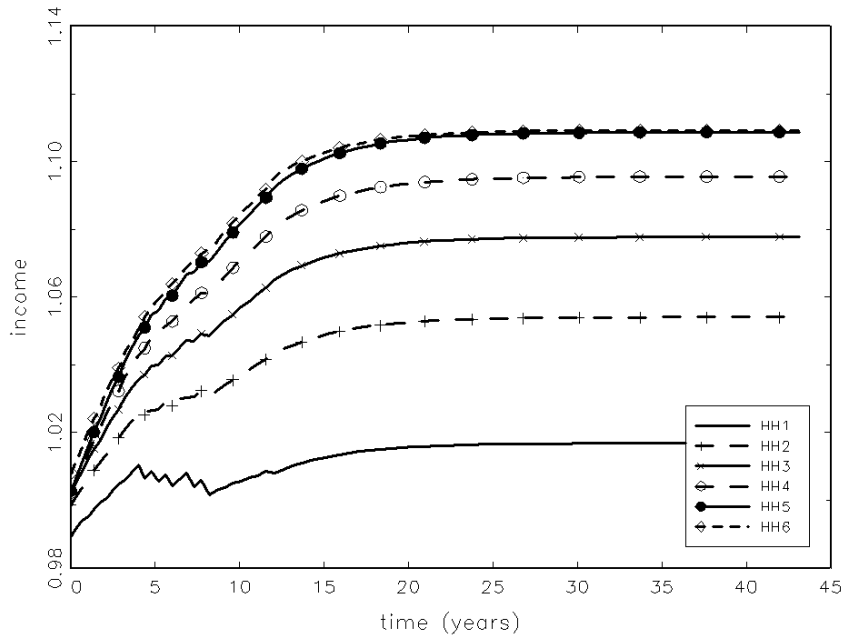


Figure 6. Effects of full liberalisation on income.

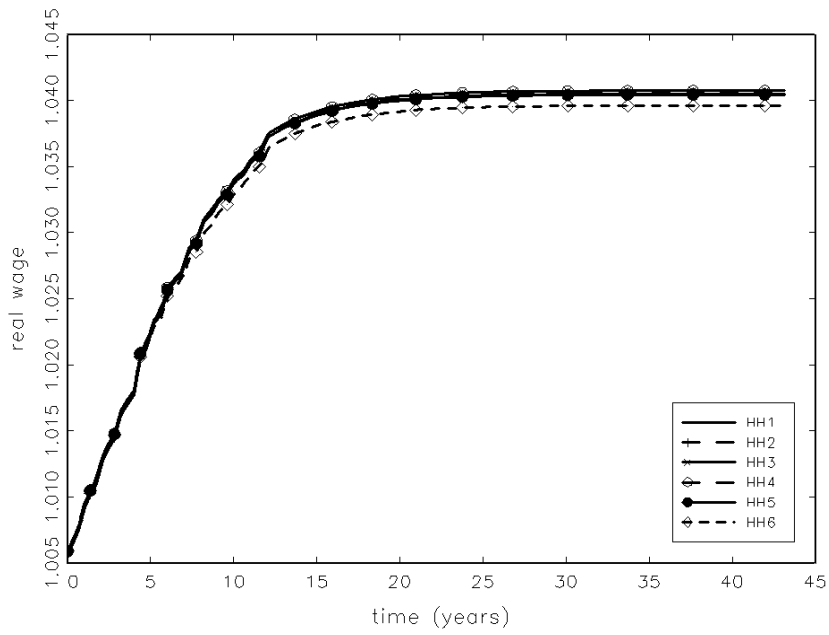


Figure 7. Effects of the AA with the EU on real wages.

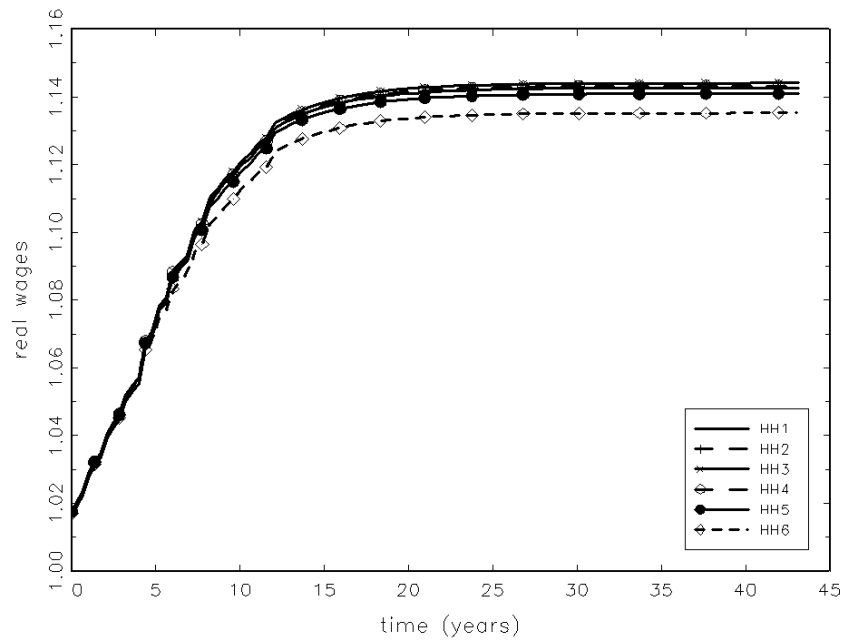


Figure 8. Effects of full liberalisation on real wages.

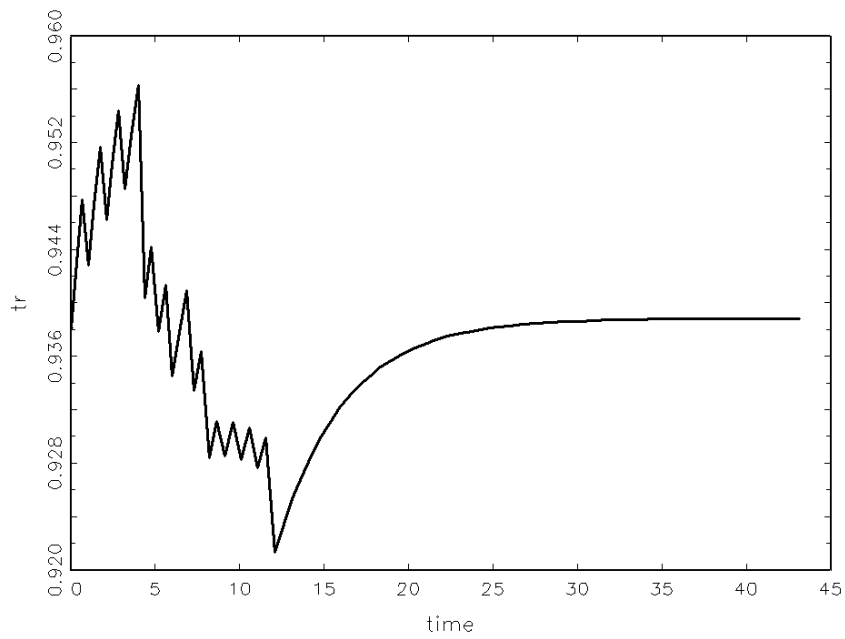


Figure 9. Effects of the AA with the EU on government transfer to households.

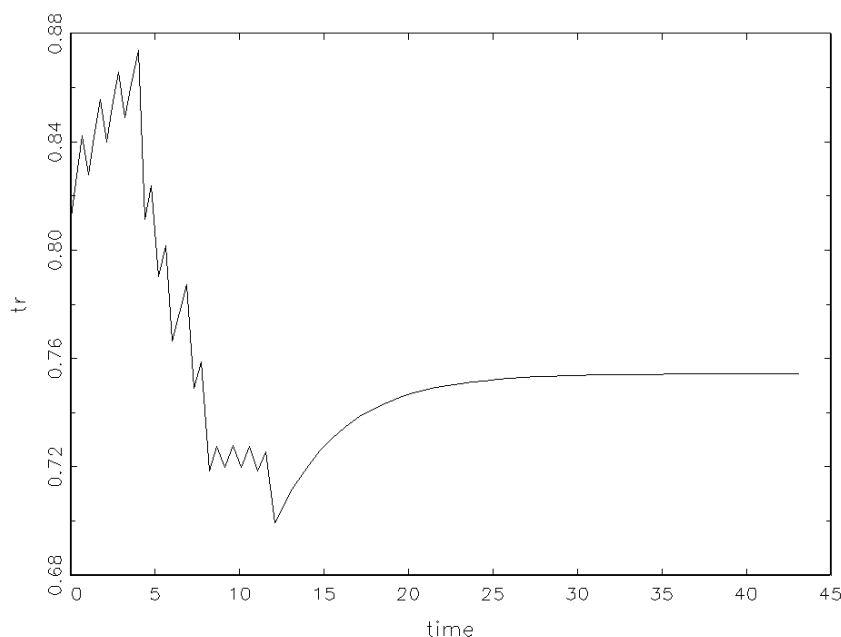


Figure 10. Effects of full liberalisation on government transfer to households.

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