Imperfect labour mobility in a CGE model: Does factor specific productivity matter?

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Abstract:

CGE models usually make extreme assumptions about labour mobility: labour is either perfectly mobile between sectors or fixed to a sector. With perfect mobility of labour, simulations lead to reallocation of labour among different sectors of the economy. The labour productivity can vary strongly between different sectors, reflecting the fact that labour of a specific type, e.g. unskilled workers, may not be homogenous. When labour moves from less to more productive sectors, an economy experiences a de facto increase in labour endowments, this obviously effects the results and becomes interesting when questioning the sector specificity of labour productivity. Separating the impacts of implicit increases in labour endowments from other impacts arising from labour reallocation is therefore important for result interpretation. For this purpose this study uses a CGE model in which labour reallocation is imperfect with a migration function governing the movement between sectors. We thus control the physical flows of labour which is a precondition to allow for depicting factor specific productivity. Two scenarios are run in order to analyse the size and relevance of the productivity, effect: the first scenario causing movement from less productive to more productive industries, the second scenario induces movement of labour from more productive to less productive industries.

1 Introduction

CGE models usually make extreme assumptions about labour mobility: labour is either perfectly mobile between sectors or fixed to a sector. With perfect mobility of labour, simulations lead to reallocation of labour among different sectors of the economy. These sectors can vary strongly in labour productivity; reflecting the fact that labour of a specific type, e.g. unskilled workers, may not be homogenous. A common assumption is that labour employed in the new sector has that sectors' productivity[3], which contains the implicit presumption that all differences in the productivity of each type of labour across sectors is attributable to sector specific attributes and that the specific labour type is homogenous. Given this assumption, when labour moves from less to more productive sectors an economy experiences a *de facto* increase in labour endowments. Separating the impacts of implicit increases in labour endowments from other impacts arising from labour reallocation is therefore important for result interpretation.

The model used in this study is an augmented version of a single country Computable General Equilibrium (CGE) model calibrated with a Social Accounting Matrix (SAM) of Israel that includes a highly disaggregated labour market. Labour reallocation is imperfect with a migration function governing the movement between sectors. With the migration function it is possible to track physical labour movement between sectors, which allows productivity to become factor specific or, in other words, allows holding factor endowment constant. Thus this study compares effects of the common sector specific productivity setup – which increases/decreases factor endowment – and a factor specific setup – which implies constant factor endowment.

Two scenarios are run in order to estimate size and relevance of the productivity, or factor endowment, effect: the first causing movement from less productive to more productive industries, estimating the effects of productivity increasing migration. The second scenario induces movement of labour from more to less productive industries to estimate the effects of decreasing total factor productivity.

2 Factor mobility in simulation modelling and productivity effects from labour reallocation

Factor mobility in CGEs

In applied CGE modelling labour markets are usually differentiated into different groups, where the differentiation should be based on whether wages move in parallel or not (Boeters and Savard, 2011). Imperfect substitutability is thus assumed between different levels of skills, age or gender, but usually not between different sectors. Factors are typically either modelled as perfectly mobile across sectors or sector specific, thus immobile. Perfect mobility or transformability should result in a homogenous market and equalised wages. In the real world, however, there are huge variations between wage rates of different skill classes and among

[3] Naturally, the discussion on productivity becomes relevant, when satellite accounts are used which determine physical labour units and make different wage rates between sectors visible.

sectors (e.g. see Table 1 for Israel). These differences are typically accounted for in CGE-models with sector specific productivity/efficiency factors. But the question remains in how far it is possible for a worker to change between different sectors of work and to adapt the new sector's productivity. Empirical literature on costs of factor reallocation highlights the existence of severe costs of reallocation, mainly caused by non-transferability of skills and losses in skills, which hinders mobility between sectors[4].

Thus there are several reasons to regard the mobility of labour between sectors as imperfect. In CGE modelling imperfect mobility is typically included with a Constant Elasticity of Transformation (CET) function. In several CGE models – e.g. GTAP, Mirage, Linkage and Globe – imperfect mobility of land between agricultural sectors modelled with a CET function is a standard feature (Shutes et al.2012). Several studies address the improvement of the land supply framework in the GTAP model and estimation of the CET parameter. For example Golub et al. (2006) evaluate land use change in response to climate change with different versions of land mobility and find the most restrictive version returning the most realistic outcomes. Ahmed et al. (2008) empirically estimate CET elasticities for different land uses with data for the USA, the estimates according to time horizon differ by land use between constant nearly perfect inelastic for forestry, inelastic values for pastry (below -0.6) and more elastic values for crops (up to -1.6). A recent study on the imperfect land market of Li et al. (2012) focusses on the estimation of CET parameters in a more flexible nesting structure. In a study for Israel and Italy, Palatnik et al. (2011) estimate CET elasticities based on simulations with a regional scale PMP land-use model and apply these estimates to a CGE model in which land supply is modelled with nested CET functions.

Regarding other factors of production than land, imperfect mobility is introduced in the capital market as standard in GTAP-AGR and Globe based on a CET function and in none of the models imperfect mobility is standard in the labour market. Nevertheless there are some studies including imperfect mobility in the labour market. Ivanchovichina and Martin (2004) as well as Zhai and Wang (2002) study possible effects of China's accession to the WTO taking into account barriers to labour mobility between rural and urban regions with a CET function. Both studies conclude that labour market reforms, mainly lifting the barrier for rural-urban migration, would significantly improve efficiency and equality. Intersectoral labour migration – between agricultural and non-agricultural sectors – is considered in a study of Valenzuela et al. (2008) which evaluate the sensitivity of results from global trade liberalisations to different assumptions of factor mobility, closures and trade elasticities with the GTAP model. Agricultural value added is found twice as high in the model with perfect mobility compared to the version with restricted mobility, which highlights the importance of the mobility assumption for the results.

Given the characteristics of a CET function this approach implies a reallocation of labour in some form of efficiency unit, which raises the question of determining the units that define

[4] E.g. Figura and Wascher (2010) find in a study on the US labour market a wage loss for displaced workers who switch industries of 20.8%, while those remaining in their former industries experience a wage loss of 5%. This is supported by Fallick (1996), who finds in a review of the empirical literature workers experiencing 16-20% higher earning losses upon reemployment in other sectors compared to reemployment in the old sector.

the market clearing conditions for labour. Ideally , labour should be defined in 'natural'/physical units,in order to be able to track the actual quantity of workers who move between sectors, what is essential for the purpose of this study. We therefore include imperfect mobility with a migration function, where workers migrate between different sector blocks of production. The migration function is used to depict migration between countries or regions McDonald and Thierfelder (2009). Migration between rural and urban regions can also be comprehended as migration between agricultural and other sectors. This study pursues this approach by deviating fully from the local definition and defining migration bilateral between different sector blocks of the economy. In the migration function of McDonald and Thierfelder (2009) the migration decision is based on the relative wage of the own region relative to the average wage level in all regions, workers migrate thus to a pool and are distributed out of it. In comparison to this approach the origin of a migrating worker is traceable in the adapted version of the migration function used in our study.

Productivity effects from labour reallocation

Productivity studies differentiate economic growth between input driven growth and technical progress. The division of output by joint unit of labour and capital gives Hicks-neutral technical progress which includes, besides others, R&D, technical progress and intersectoral transfer of resources. The growth accounting method following Solow (1957), for example, compares the output of an economy with all its inputs and defines the residual, which cannot be explained by input growth, as productivity growth. Thus it is estimated which part of the economic growth can be attributed to movement along the production function (accumulation of inputs) and which part is caused by shifts in production function (Technical progress). This kind of measurement bears the problem that any errors in measurement appear as productivity changes (Felipe, 1999). In this regard Solow's basic approach has been refined: First inputs were disaggregated and thus differentiated by qualities, improving the measurement of inputs. Second sectoral reallocation – from agriculture to industry, thus to capital intensive sectors and to higher marginal product – is a key factor in productivity growth and needs and is included in the standard accounting measure of total factor productivity (TFP) (e.g. Massell, 1961; Pack, 1993; Poirson, 2001).

Poirson (2001) estimates the impact of labour reallocation on economic growth rates and asks the question to what extend these reallocation effects contribute to faster or slower growth rates by using panel data for 65 countries between the years 1960 to 1990. Her findings confirm the importance of labour reallocation effects in the growth rates of the economies, countries which allocate labour more in sectors with a higher productivity over time grow faster. In addition Poirson shows that missing reallocation, from agriculture to industry and services, accounts fully for the growth gap of African countries relative to other countries. Thus the size of reallocation effects is an important factor in economic growth rates.

3 Modelling framework

3.1 Main features of the model

The model used in this study is an augmented version of the single country Computable General Equilibrium (CGE) model STAGE, developed by McDonald (2009)[5]. STAGE is a Social Accounting Matrix (SAM) based model which has a mix of non-linear and linear relationships which govern the behaviour of the model's agents. Utility maximisation of households is based on preferences which are represented by Stone-Geary utility functions. They consume composite aggregates of domestic and imported commodities that exhibit constant elasticity of substitution (CES), following Armington (1969), where the relative price determines the optimal mix of domestic and imported good consumption. Israel is a classic example of a small country in the world market; therefore world market prices for imports and exports are fixed in the model.

Domestic production is modelled as a two stage production process with either constant elasticity of substitution (CES) or Leontief technologies applied. At the first stage, intermediate input and value added generate the output of each activity based on CES technology. At the second stage the use of intermediate inputs is in fixed proportions using Leontief technology, while the CES technology is used to form value added by primary production factors where the optimal ratio of factors is determined by relative prices.

Commodity demand consists of domestic demand and export demand. The distribution of domestically produced commodities among domestic demand and exports is governed by relative prices on these markets, using constant elasticity of transformation (CET) functions, which reflects imperfect product transformation. The model is solved in General Algebraic Modelling System (GAMS) and adapted to use an Israeli SAM of the year 2004 (Siddig et al. 2011).

The Israeli 2004 SAM used in this study has several distinctive features. First, the SAM differentiates between 43 activities and commodities, i.e., multi product activities can and do exist. Second, there are detailed data on trade and transportation margins. Third, there are 10 (representative) household groups and 36 different labour categories differentiated by profession and ethnicity. For Israeli workers there are eight skill categories, seven profession/occupation categories and one unskilled category, which are further categorized by ethnicity (Jewish and Arab & others) and gender. There are four non-Israeli labour categories; legal and illegal Palestinian cross-border and foreign workers.

The sources of the data used to compile the SAM include the Israeli Central Bureau of Statistics (ICBS), the Central Bank of Israel (BOI), and the Israeli Tax Authority (ITA). In addition, non-Israeli sources were used to fill-in gaps in domestic reports: the World Trade Organization (WTO), the Organisation for Economic Co-operation and Development (OECD), and the World Bank.

[5] Refer to McDonald (2009) for a detailed description of the model.

Two additional data sets are used by the model: a matrix of quantities of labour inputs, hence differences in wage rates in the model are 'real', and a series of elasticities of substitution/transformation for imports and exports, the production nests and the Stone-Geary (LES) demand system.

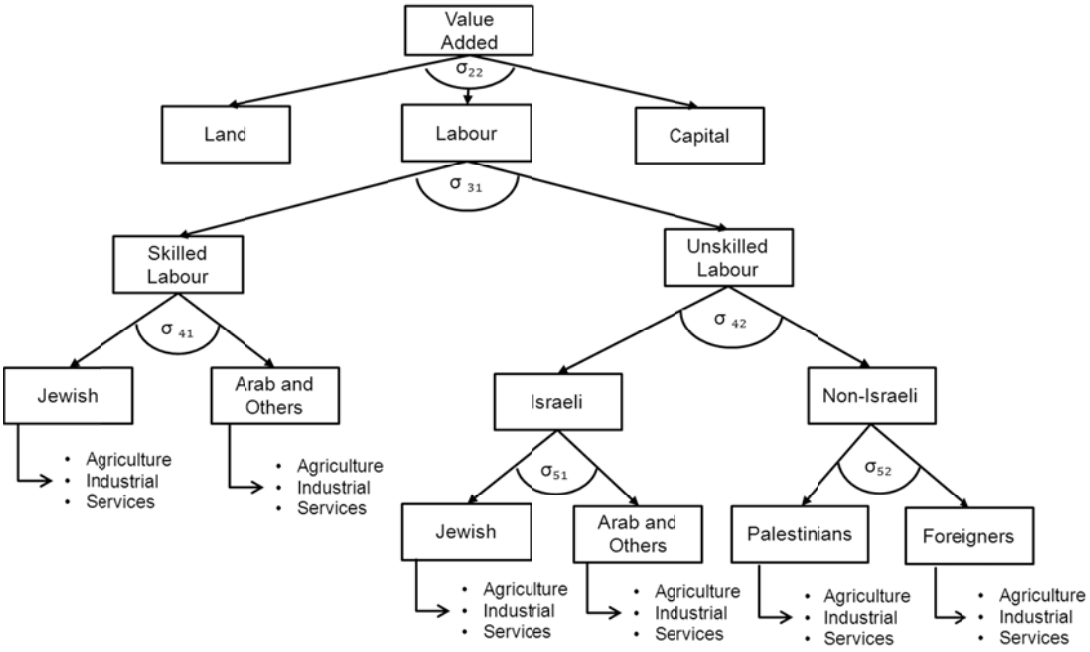


Figure 1: Value added nesting

Table 1: Labour groups

	Wages in sector blocks (NIS/month)		
Labour type	Agriculture	Industrial	Services
Skilled Jewish Israeli	6.188	17.246	14.473
Skilled Arab and Other Israeli	5.766	11.871	11.978
Unskilled Jewish Israeli	4.045	7.548	6.058
Unskilled Arab and Other Israeli	3.948	6.612	5.915
Palestinians	1.560	2.943	2.811
Foreigners from ROW	3.214	5.906	4.948

Domestic production is depicted by a five-level production process. Each level involves CES or Leontief aggregations of primary or aggregated inputs to produce aggregates. In the first level of the production nesting, aggregate intermediate input and aggregate value added are combined to form domestic output in fixed shares. Aggregate intermediate input is a Leontief aggregation of intermediate inputs, while aggregate value added, depicted in Figure 1, is a combination of primary inputs using CES technologies. The CES technology allows for the assumption of imperfect substitution in factor demand between specific factor types, with the substitution elasticity σ[6] determining the substitution possibilities among them.

Labour types have been adjusted for the purpose of this study (Table 1). Labour types, differentiated by skill categories and ethnicity, are allocated to three segmented sector blocks:

[6] σ is set as follows: derived from literature (Hertel, 1997) σ_{22}=0.8, and in the lower nests: σ=1.5;

agricultural, industrial and service sectors. Finally each labour type owns a labour group for each of the sector blocks.

3.2 The migration function

In order to model imperfect inter-sectoral labour reallocation this study develops a migration function based on McDonald and Thierfelder (2009) which allows for bilateral movement between segmented blocks specific labour types (*f*), e.g. 'Agricultural skilled Arab'. The segmented blocks are defined as groups of sectors, e.g. 'Agricultural sectors' (Table 1) within which labour is perfectly mobile. Migration is possible between the sector blocks but only within a specific labour type, e.g. 'Skilled Arab'.

Migration depends on the change in the relative wage, the wage a worker could earn in his old sector compared to the wage he could earn in another sector he could migrate to. Thus the amount of workers who migrate, $FSM_{f,fp}$[7], from one sector block to another is determined by the change in the relative wage and the labour supply in the base situation, $FS0_f$. The responsiveness of migration to wage changes is determined by the migration elasticity $etamig_f$. If the elasticity is high labour is mobile between the sector blocks, if it is zero there is no migration.

$$FSM_{f,fp} = FS0_f * \left[\frac{relative\ wage_{f,fp}}{relative\ wage\ in\ the\ base_{f,fp}}\right]^{etamig_f} - FS0_f$$

If f is not same as fp.

The number of workers who are migrating and the workers who remain in their old sector of work must equal the base labour supply in this labour type.

$$FS0_f = \sum_{fp} FSM_{f,fp}$$

where fp contains all sector blocks a specific labour type is employed in.

The labour supply of all workers which cannot migrate is fixed in the closures. If migration is allowed, labour supply is the sum of all workers of a labour type which migrate to a sector block.

$$FS_f = \sum_{fp} FSM_{fp,f}$$

3.3 Factor specific productivity

The wage a worker of a specific labour type can earn in different sector blocks varies strongly (see Table 1). When assuming that wages reflect the marginal product, the wage differences

[7] Where fp is the alias of f and stands here for the amount of workers migrating from one sector block specific labour type (f) to another (fp).

reflect differences in factor productivity. This productivity varies between labour types as well as inside a labour type.

Wages are defined per productivity unit and are thus equal. Real factors $FD_{f,a}$ are transformed into productivity units by multiplicating with $ADFDF_{f,a}$, the sector specific efficiency factor.

The output of a sector depends on the quantities of inputs used and on their productivity. If one worker is double as productive as a second worker, the output he produces is double as much; the CES production function embodies the productivity unit:

$$QVA_a = ADVA_a * \left[\sum_f \delta_{f,a} * (ADFDF_{f,a} * FD_{f,a})^{-\rho_a} \right]^{\frac{-1}{\rho_a}}$$

Where: QVA_a *= quantity of Value Added ,* $ADVA_a$ *= adjustment parameter;*
$\boldsymbol{\delta}_{f,a}$ *= share parameter,* ρ_a *= elasticity*

And the first order condition for profit maximisation becomes:

$$WFA_{f,a} * (1 + TF_{f,a}) = PVA_a * QVA_a * \left[\sum_f \delta_{f,a} * (ADFDF_{f,a} * FD_{f,a})^{-\rho_a} \right]^{-1} * \delta_{f,a} * (ADFDF_{f,a} * FD_{f,a})^{-\rho_a - 1}$$

Where: PVA_a *= price of Value Added ,* $WFA_{f,a}$ *= wage rate and* $TF_{f,a}$ *= factor tax*

When allowing for migration between sectors, workers are assumed to gain the new sector's productivity. To allow for a scenario in which workers maintain their old productivity level, or a share dependent on it, productivity, which typically is sector specific, is made factor specific.

Productivity is factor specific, when a worker who migrates to a new sector maintains the productivity of his old sector. The average productivity of his new sector adjusts accordingly. The total amount of productivity units a sector uses is determined by the amount of productivity units migrating into it. The migrating productivity unit is the actual worker who migrates (FS_f) times his old efficiency factor (ADF_f), which is the average productivity of a labour type inside a sector block:

$$ADF_{f1} * FS_{f1} = ADF0_{f1} * FSM_{f1,f1} + ADF0_{f2} * FSM_{f2,f1} + ADF0_{f3} * FSM_{f3,f1}$$

The sector specific efficiency factor, $ADFDF_{f,a}$, is determined by its base value $ADFDF0_{f,a}$ and the adjustment variable $ADFDFADJ_f$:

$$ADFDF_{f,a} = ADFDF0_{f,a} * ADFDFADJ_f,$$

with

$$ADFDFADJ_f = \frac{\sum_{fp} ADF0_{fp} * FSM_{fp,f} * adfadj_{fp}}{ADF0_f * FS_f} \quad ,$$

where $adfadj_{fp}$ represents an additional adjustment parameter which allows for variation in the skill transfer. If the adjustment parameter, $adfadj_{fp}$, is set to a value less than 1, the worker cannot maintain his former level of income. When it equals 1 the worker maintains his old productivity; if it is greater than 1, productivity increases.

With this setting, there are three possibilities for productivity or skill transfer of inter-industry labour reallocation:

- Reallocated labour adopts the new sector's productivity.
- Reallocated labour retains the old sector's productivity. Thus the average productivity of each labour type in each sector block will change.
- Reallocated labour adopts a productivity somewhere between that of the old and new sectors. Again the average productivity of each labour type in each sector block will change

4 Simulations and results

4.1 Simulations

The study aims to disentangle and quantify the size of the productivity effects of labour relocation effects from other effects arising from a macroeconomic shock. The model features allows addressing the question whether and to what extent the changes in labour specific productivity among sectors matters for growth and welfare results. For a systematic analysis two different scenarios are implemented:

1. An isolated 20% increase in world market prices of industrial goods, which causes labour migration from sectors with low productivity to sectors with higher productivity; and
2. An isolated 20% increase in world market prices of agricultural goods, which causes labour migration from sectors with high productivity to sectors with lower productivity.

Each of the simulations is implemented for each of the productivity options controlling the productivity of reallocated labour:

(a) Reallocated labour adopts the new sector's productivity.
(b) Reallocated labour retains the old sector's productivity.

Thus there are 4 different situations which differ by effects on the overall amount of productivity units available in the economy and the effects on the labour productivity within sectors, as shown in Table 2. First, the effects from changes in de facto labour endowment

compared to pure labour reallocation are analysed by comparing simulations (1a) and (1b) as well as simulations (2a) and (2b). Second the symmetry of the effects is analysed when comparing simulations (1) and (2).

Table 2 Simulation setup

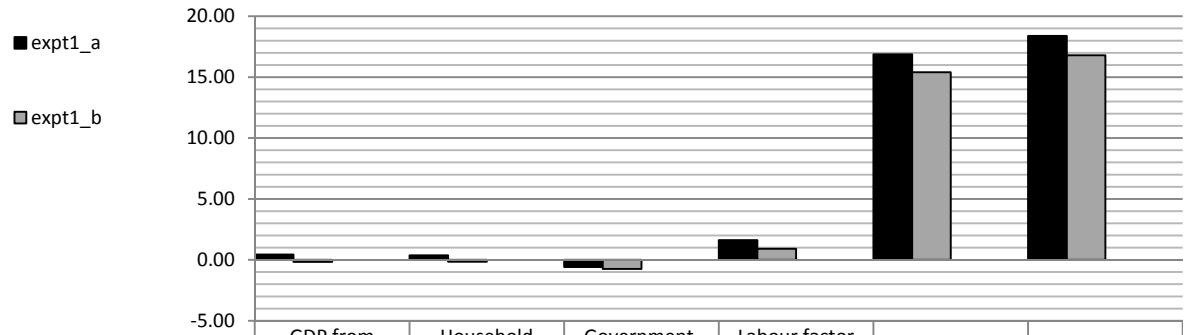
	(a) Sector specific productivity	(b) Factor specific productivity
1. Migration from low to high productivity	*(1a)* Increase in factor endowment/ productivity units Constant average productivity in each sector	*(1b)* Constant factor endowment/ productivity units Decreasing average productivity in sectors
2. Migration from high to low productivity	*(2a)* Decrease in factor endowment/ productivity units Constant average productivity in each sector	*(2b)* Constant factor endowment/ productivity units Increasing average productivity in sectors

The macroeconomic closures are set the following: investment is savings driven, the exchange rate is flexible to clear the balance of payments. The government consumes a fixed value and balances its income with a variable income tax, the CPI serves as numéraire. In the factor market all factors are fully employed and mobile between sectors. Labour is assumed to be perfectly mobile within sector blocks and imperfectly mobile among sector blocks inside labour types. The migration elasticity is chosen elastic with a value of 1.5.

4.2 Results and analysis

Results are presented as percentage deviation from the base situation before the export price changes.

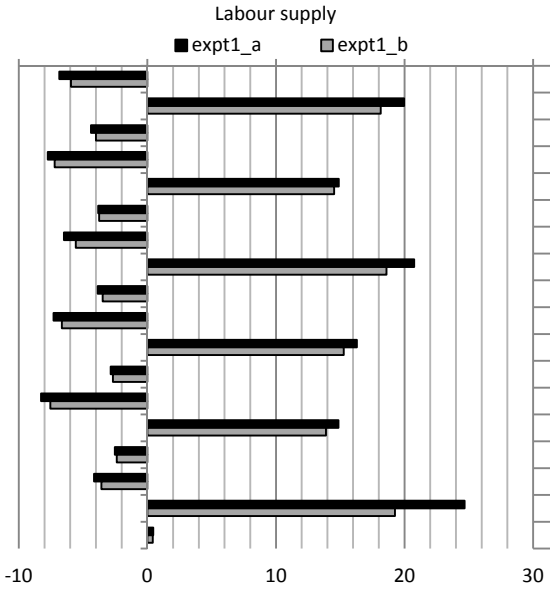
1. Increasing total factor productivity



	GDP from expenditure	Household income	Government income	Labour factor income	Import demand	Export supply
expt1_a	0.43	0.38	-0.59	1.62	16.87	18.39
expt1_b	-0.17	-0.15	-0.75	0.91	15.40	16.80
Diff. in percentage points	-0.60	-0.53	-0.15	-0.71	-1.47	-1.59
Difference in %	-138.14	-140.09	25.73	-43.85	-8.74	-8.64

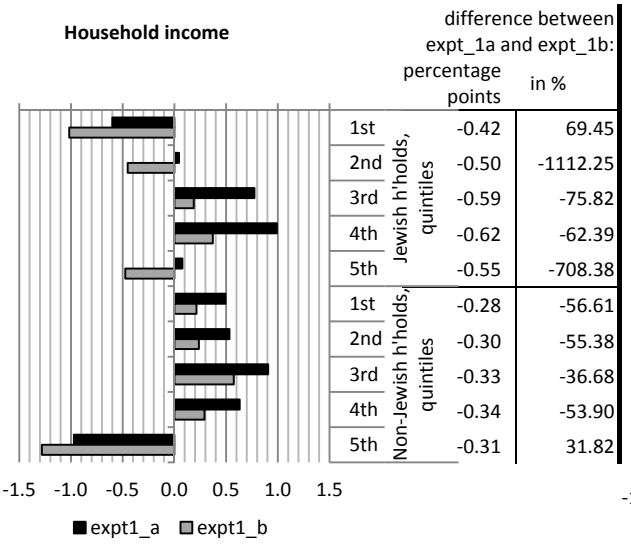
Figure 2: Scenario 1: Macroeconomic effects, % changes, and difference between expt1_a and expt1_b

The first scenario simulates an increase of the world market prices for manufacturing goods by 20%. The increased export price increases manufacturing exports and thus increases domestic production of manufacturing goods. At the same time imports become more expensive and manufacturing imports are reduced which increases demand for domestic produced goods and stimulates, too, domestic industrial production. The value of exports increases strongly, the value of imports is reduced; the domestic currency appreciates strongly, 14.8%, to maintain the balance in the current account. This appreciation in turn decreases import and export prices, resulting in an effective import/export price increase of industrial goods of around only 2.3% and decrease of prices of agricultural and services products by -14.8%. Manufacturing is boosted in this simulation, shifting resources from agriculture and services into the manufacturing sector block (Figure 3). Wages are higher in manufacturing compared to agriculture and services and factor income increases accordingly in *scenario 1a* (Figure 2); household income and GDP increase.

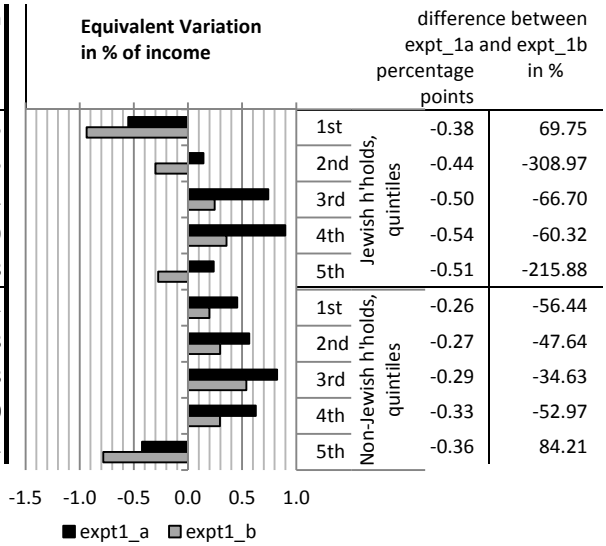


			Wage		Productivity adjustment
			Expt1_a	Expt1_b	Expt1_b
Skilled workers	Jewish Israeli	Agriculture	-0.58	-1.02	
		Manufacturing	3.14	2.26	-2.78
		Services	0.20	-0.40	-0.02
	Non-Jewish Israeli	Agriculture	-0.12	-0.38	
		Manufacturing	3.75	3.28	-0.34
		Services	1.12	0.72	-0.05
Unskilled workers	Jewish Israeli	Agriculture	-0.86	-1.30	
		Manufacturing	2.57	1.68	-3.39
		Services	-0.04	-0.64	-0.02
	Non-Jewish Israeli	Agriculture	-0.55	-0.88	
		Manufacturing	2.86	2.25	-1.87
		Services	0.84	0.36	-0.05
	Foreign from Palestine	Agriculture	0.38	0.00	
		Manufacturing	4.08	3.39	-1.42
		Services	2.17	1.61	-0.12
	Foreign from ROW	Agriculture	-2.52	-2.76	
		Manufacturing	-1.46	-1.92	-7.73
		Services	-0.89	-1.29	-0.14

Figure 3: Scenario 1: Migration and productivity adjustment, % changes



		difference between expt_1a and expt_1b: percentage points	in %
Jewish h'holds, quintiles	1st	-0.42	69.45
	2nd	-0.50	-1112.25
	3rd	-0.59	-75.82
	4th	-0.62	-62.39
	5th	-0.55	-708.38
Non-Jewish h'holds, quintiles	1st	-0.28	-56.61
	2nd	-0.30	-55.38
	3rd	-0.33	-36.68
	4th	-0.34	-53.90
	5th	-0.31	31.82



		difference between expt_1a and expt_1b percentage points	in %
Jewish h'holds, quintiles	1st	-0.38	69.75
	2nd	-0.44	-308.97
	3rd	-0.50	-66.70
	4th	-0.54	-60.32
	5th	-0.51	-215.88
Non-Jewish h'holds, quintiles	1st	-0.26	-56.44
	2nd	-0.27	-47.64
	3rd	-0.29	-34.63
	4th	-0.33	-52.97
	5th	-0.36	84.21

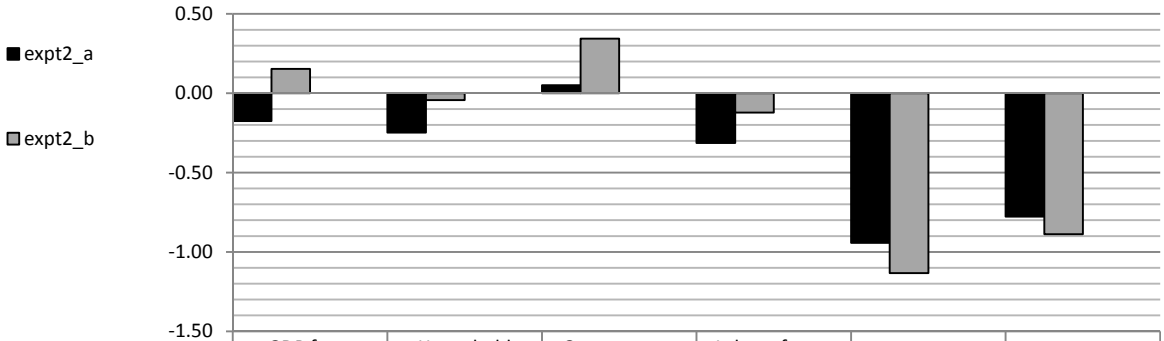
Figure 4 Scenario 1:Effects on household income, % changes, and EV in % of base income

When introducing factor specific productivity in *scenario 1b*, it is assumed that workers keep their level of productivity constant regardless to the industry they are working in. Each worker who migrates changes the productivity in the destination sector of work, and thus the average wage in the destination factor type. In Figure 3 the productivity adjustment is shown in the right column, it depends on the factor type and decreases the productivity unit wage by up to -7.7%. The wage of workers, shown in the left and right column of Figure 3, consists of the productivity unit wage and the productivity adjustment. When comparing the two scenarios *1a* and *1b*, wages in *1b* are lower than in *1a*. This is caused by a decrease in the average productivity of the destination labour types due to migration from less to higher productive labour types and resulting effects on factor demand. Lower wages reduce migration and lower productivity reduces factor demand in manufacturing sectors which decreases production.

Services sectors experience a small inflow of agricultural workers and show similar but clearly smaller effects compared to manufacturing, while agriculture benefits from the reduced outflow of labour, the reduction in production is smaller in scenario *1b* compared to *1a*.

The productivity of a worker is constant in *scenario 1b*, but the revenue per productivity unit can change. Total labour factor income increases in *scenario 1a* and in *1b*, but the increase is 44% lower in the latter. Different in direction is the effect on household income in *scenario 1b* compared to *1a*: Despite the increase in labour income, total household income decreases (Figure 2) in 1b because of decreasing income from capital, -3.7% in *scenario 1a* and 4.0% in *1b*, and land which decreases 11.8% in *scenario 1a* and 11.1% in *1b*.[8]. When looking on effects on households in more detail (Figure 4), differences between the two scenarios are obvious. While in *scenario 1a* 2 households show negative effects in household income and Equivalent Variation, depicted in % of base income, there are 4 in scenario 1b. Income effects decrease by 0.30-0.60 percentage points what mostly more than halves the effects. In the Jewish 2nd and 5th quintile effects become negative. The household groups who are affected negative have large income shares first in transfers from other households (1st and 2nd Jewish) and second in income from capital (5th Jewish and non-Jewish), which both decrease.

2. *Decreasing total factor productivity*



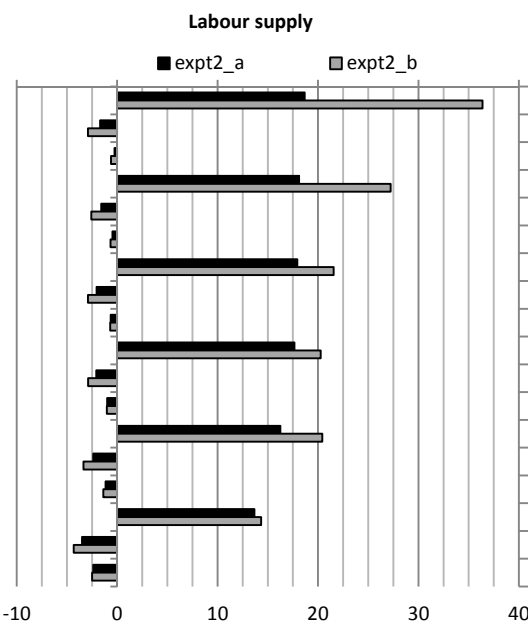
	GDP from expenditure	Household income	Government income	Labour factor income	Import demand	Export supply
expt2_a	-0.18	-0.25	0.05	-0.31	-0.94	-0.78
expt2_b	0.15	-0.04	0.34	-0.12	-1.13	-0.89
Diff. in percentage points	-0.60	-0.53	-0.15	-0.71	-1.47	-1.59
Difference in %	-138.14	-140.09	25.73	-43.85	-8.74	-8.64

Figure 5 Scenario 2: Macroeconomic effects, % changes and difference between expt2_a and expt2_b

Scenario 2 simulates an increase of the world market prices for agricultural goods, which increases agricultural exports – between 42% for milk and 86% for crops (non-cereals) – and stimulates domestic agricultural production (Appendix). At the same time agricultural imports become more expensive, which decreases imports – between 11% for cereals and 36% for

[8] Revenues from land decrease due to less agricultural production which decreases demand for land. The decreasing returns from capital are caused by the higher relative mobility of capital compared to labour, which makes not capital but labour the restricting resource for the expansion of a sector.

fruits and vegetables –, increases demand for domestic produced agricultural goods and further stimulates domestic agricultural production. Labour demand in agricultural sectors increases, which raises the relative wage and leads to migration into agriculture. Wages in agriculture are between 30% and up to 70% lower than in industry and services (Table 1) and the relative wage increase in agriculture is not high enough to close this gap. As a result factor income from labour decreases by -0.31% in *Scenario 2a* (Figure 5). The reduced household income, by -0.25%, reduces expenditures and GDP declines by -0.18%. The domestic currency appreciates by 0.19% to keep the current account balanced which decreases the competitiveness of exports. While agricultural exports experience a boost, but account for only 2.04% of total exports, total exports decrease by -0.78%. Despite the appreciation, total imports decline by -0.94% because of the increased import price of agricultural goods, decreasing demand of households and decreasing intermediate demand (the decrease in imports is mainly triggered by minerals and oil, basic metal and electronic equipment which are mainly used as intermediates in (declining) production).



				Wage		Productivity adjustment in %
				expt2_a	expt2_b	expt2_b
Skilled workers	Jewish Israeli	Agriculture		0.33	1.18	39.78
		Manufacturing		-0.37	-0.07	
		Services		0.05	0.61	0.05
	Non-Jewish Israeli	Agriculture		0.66	1.28	22.92
		Manufacturing		-0.07	0.12	
		Services		0.25	0.68	0.00
Unskilled workers	Jewish Israeli	Agriculture		0.81	1.21	10.81
		Manufacturing		-0.13	-0.06	
		Services		0.29	0.61	0.05
	Non-Jewish Israeli	Agriculture		1.32	1.69	9.18
		Manufacturing		0.26	0.32	
		Services		0.59	0.88	0.02
	Foreign from Palestine	Agriculture		1.61	2.23	13.98
		Manufacturing		0.38	0.57	
		Services		0.74	1.16	0.01
	Foreign from ROW	Agriculture		3.14	3.56	6.83
		Manufacturing		1.16	1.26	
		Services		1.53	1.87	0.00

Figure 6 Scenario 2: Factor supply change and productivity adjustment, % changes

When assuming factor-specific productivity in *scenario 2b*, average productivity increases in agricultural labour types by 7%-40% (Figure 6, right column). This boost in productivity implies that the average worker in agriculture accounts for more productivity units and thus the supply of productivity units in agriculture increases, which decreases the return to productivity units. The wage of workers, which is a combination of the number of productivity units per worker and the wage per productivity unit, is higher or declines less in *scenario 2b* for all labour types. However, total labour factor income develops still negative in *scenario 2b* , -0.12%, and same does household income, -0.04%, but compared to *scenario 2a* the effects are clearly less negative. A relative wage increase leads to more migration into agriculture. Agriculture has more productivity units available to a lower price compared to *scenario 2a*, agricultural production increases stronger than before. Decreasing production costs in agriculture increases competitiveness in the world market, agricultural exports

increase and agricultural imports decrease. The GDP consists of private expenditures, government expenditures, investment, and the trade balance. Imports decrease more than exports and government income develops positive due to an increase in income from the capital tax and land prices – returns from capital and land increase; in Israel, all land is state owned. As result, and in contrast to *scenario 2a,* GDP increases in *scenario 2b*.

Regarding the distributional effects, there are negative effects in *scenario 2a* for all households (Figure 7). Incomes of Jewish households are affected stronger than non-Jewish households because their wage gap between agriculture and manufacturing, the main direction of migration, is larger (72% versus 59%). When workers are assumed to keep their productivity in *scenario 2b*, income effects are positive in all non-Jewish households and less negative in Jewish households. Jews are more heavily employed in non-agricultural-sectors, even after migration, and the manufacturing labour types experience decreasing wages. An exemption is the 5th Jewish quintile who receives a large income share from returns from enterprises, which increase by 0.8%. Comparing income and welfare effects, the latter depicted by the Equivalent Variation (EV) in % of base income, show differences, the reason are prices. The increase of world market prices in agricultural goods increases prices of imported goods, the domestic production increases simultaneously, and in sum total supply of agricultural goods increases and prices decrease, except for wheat and cereals which are mainly imported (Appendix). The production of non-agricultural goods decreases and its prices slightly increase. The expenditure share spent on food decreases with increasing income, thus, when regarding welfare with the EV, the higher income quintiles are more negative affected by the world-price increase. In *scenario 2b* average food and agricultural prices decline stronger and prices of other goods increase more (Appendix), all household groups are better off, compared to *scenario 2a*, and poor more than rich.

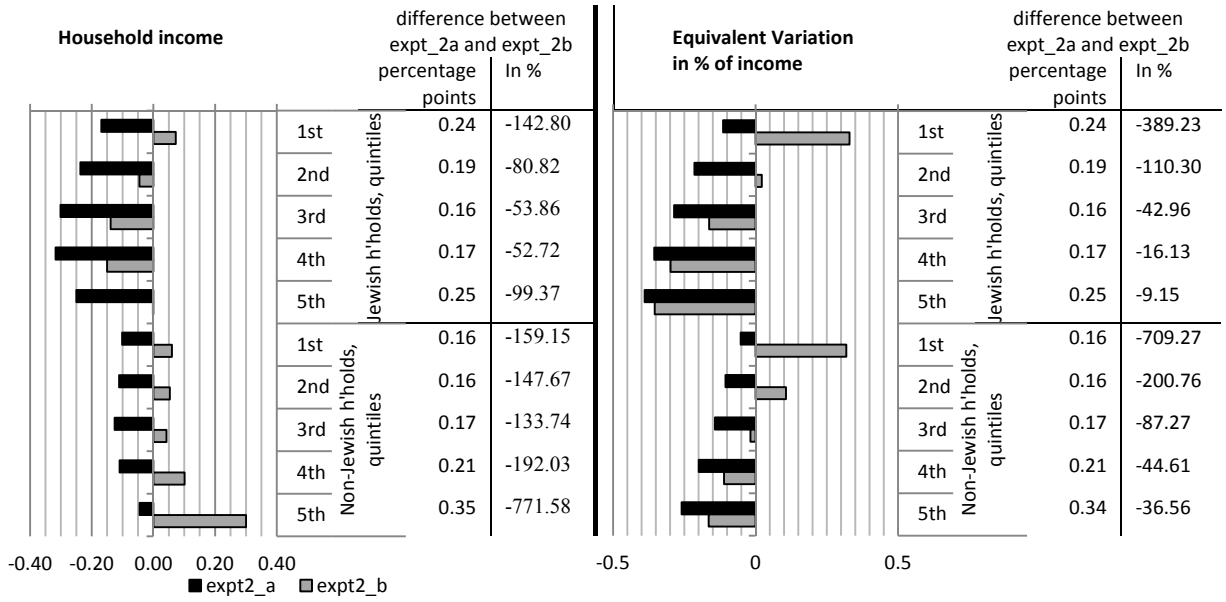
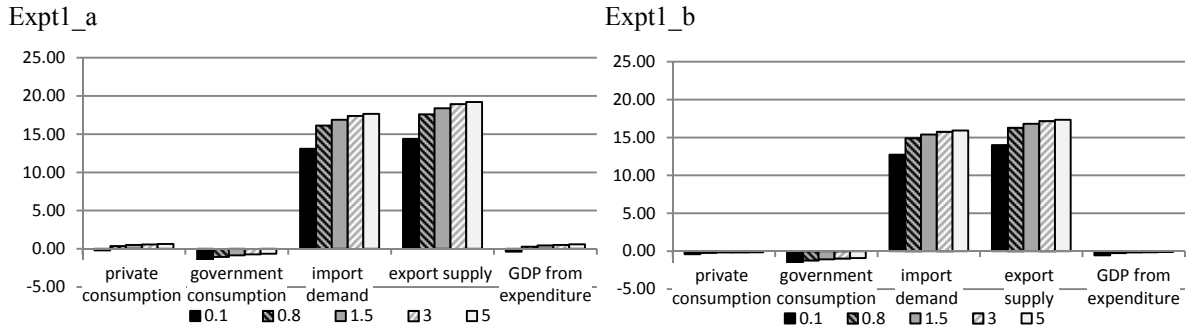


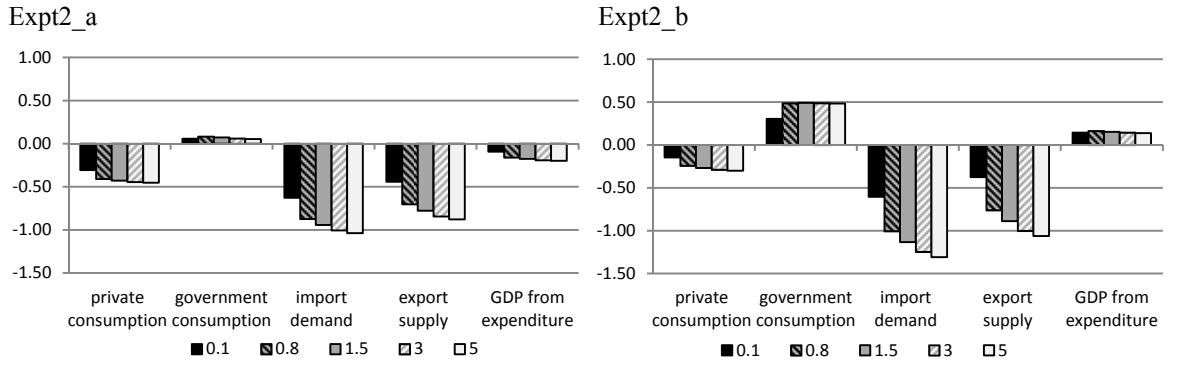
Figure 7 Scenario 2:Effects on household income, % changes, and EV in % of base income

4.3 Sensitivity analysis

The value chosen for the migration elasticity seems crucial for the strength of the adjustment effects in the labour market and thus the estimation of the productivity effects. A detailed analysis of the migration elasticity with values between very inelastic (0.1) and very elastic (5) shows, that unsurprisingly the effects discussed in the previous chapter are stronger with increasing migration elasticity which results in stronger migration (Figure 8, shown exemplary on the macro variables). Consistently, also the differences between the simulations with sector specific and factor specific productivity become larger the more elastic the migration elasticity is set. Results are macro based and stable and no change in signs occurs.



	difference in percentage points					difference in %				
Value migration elasticity	0.1	0.8	1.5	3	5	0.1	0.8	1.5	3	5
private consumption	-0.19	-0.58	-0.68	-0.74	-0.77	-87.36	-153.16	-133.73	-125.47	-122.65
government consumption	-0.04	-0.18	-0.22	-0.25	-0.26	-2.45	-17.28	-25.73	-34.93	-40.52
import demand	-0.36	-1.24	-1.47	-1.65	-1.73	-2.73	-7.68	-8.74	-9.49	-9.83
export supply	-0.39	-1.34	-1.59	-1.78	-1.87	-2.70	-7.59	-8.64	-9.39	-9.73
GDP from expenditure	-0.16	-0.51	-0.60	-0.66	-0.69	-43.38	-178.13	-138.14	-123.29	-118.42



	difference in percentage points					difference in %				
Value migration elasticity	0.1	0.8	1.5	3	5	0.1	0.8	1.5	3	5
private consumption	0.16	0.16	0.16	0.15	0.15	52.31	40.27	37.15	34.61	33.32
government consumption	0.25	0.40	0.42	0.43	0.43	428.05	482.94	574.92	704.22	803.55
import demand	0.02	-0.14	-0.19	-0.24	-0.27	3.58	-15.51	-20.31	-24.19	-26.13
export supply	0.07	-0.06	-0.11	-0.16	-0.19	15.03	-8.53	-14.29	-18.86	-21.12
GDP from expenditure	0.24	0.32	0.33	0.33	0.34	257.15	201.91	187.29	175.50	169.68

Figure 8 Macroeconomic results with different values of the migration elasticity

A second set of elasticities which affects the factor market, or more specifically affects the response to productivity changes, are the CES-elasticities in the nested production function. A systematic analysis shows the particular role of the substitution elasticity in combination with

the feature of factor specific productivity, because the substitution is not only driven by the wage rate but influenced in addition by the productivity effects. The reason for this is the factor demand, which is not only determined by gradually changing wages, but additionally by quite serious jumps in productivity. The model has difficulties to solve with high substitution elasticities, when there are large productivity differences between the branches of a nest, in a test run with smaller productivity differences the model runs smoothly also with high substitution elasticities. In the Israeli model mainly two substitution elasticities are highly sensitive (Figure 9): σ_{31} in Figure 1 governing the substitution between skilled and unskilled workers and σ_{41} governing the substitution between skilled Jewish and non-Jewish Israelis. There a high elasticity leads to very strong substitution effects and the less productive workers are pushed out of the market.

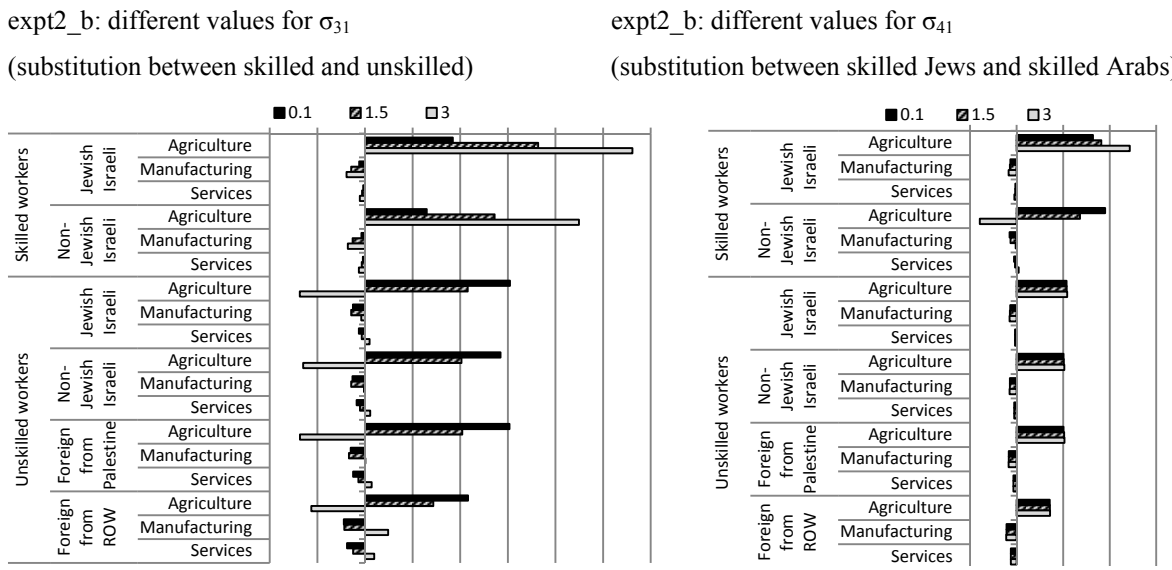


Figure 9 Sensitivity of results from expt2_b to substitution elasticities σ_{31} and σ_{41}

5 Conclusions

Labour reallocation, typically from less to more efficient sectors, is an important part in the explanation of economic growth. Furthermore neglecting factor reallocation costs and factor specific productivity in CGE-modelling might overestimate the size of adjustment which is possible in the labour market and thus affects outcomes of simulations. This study aims to estimate size and relevance of these productivity effects from factor reallocation. For this purpose two scenarios of world market price changes are run in a model where imperfect factor mobility is introduced with a migration function: the first causing labour moving from agriculture to manufacturing and by this simulates a movement to a productivity increasing labour allocation with increasing total factor productivity. The second scenario causes movement from manufacturing to agriculture, leading thus to decreasing total factor productivity. Both scenarios are run two times, first in the "normal" run labour productivity can change and in the second labour productivity is held constant.

In scenario 1, which simulates a productivity increasing allocation, the GDP effect is 138% smaller when excluding the productivity effect and productivity is held constant. This means

that the GDP growth of 0.43% becomes a decline of -0.17% when the productivity effect is excluded. All agents of the economy experience an effect in this direction and benefit from the increased productivity; when the productivity effect falls away households and the government experience clear losses. Adjustment effects which lead to a lower total factor productivity, i.e. movement into agriculture, are simulated in scenario 2. The losses connected with this factor reallocation are quantified by comparing the first "normal" run with the second, when productivity is held constant. GDP effects are 187% higher when total factor productivity does not decrease. In scenario 2, too, there is a switch in the direction of the effect: from a negative growth of -0.18 to a growth situation of 0.15 in the second run. The other agents in the economy experience similar effects, regarding distributional effects all household groups are less negatively affected when assuming constant productivity, the poor are even positively affected.

The results show the importance of productivity effects from factor reallocation on model outcomes. The size of the productivity effect depends on the size of labour reallocation. The results of a simulation which induces a strong reallocation of labour between the sectors of the economy are clearly influenced by the productivity effect. Though, it doesn't seem to matter in which direction the reallocation goes, to a more efficient or more inefficient situation. This study shows that the definition of the labour market matters in regard to a fully sector specific productivity or fully factor specific productivity. Nevertheless both setups are extremes which both do not resemble a realistic description of the world. This study uses these extremes to show magnitude and relevance, for a realistic depiction the true setup lies somewhere in between the extremes and depends besides others on who migrates first, which part of the productivity is sector specific or the time horizon.

Literature

Ahmed, S. A., Hertel, T. W. and Lubowski, R. (2008). Calibration of a Land Cover Supply Function Using Transition Probabilities. GTAP Research Memorandum No. 14.

Boeters, S. and Savard, L. (2011). The labour market in CGE models. ZEW Discussion Papers 11-079, ZEW - Zentrum für Europäische Wirtschaftsforschung / Center for European Economic Research.

Fallick, B.C. (1996). A review of the recent empirical literature on displaced workers. *Industrial and Labor Relations Review*, 50(1), 5-16.

Felipe, J. (1999): Total factor productivity growth in East Asia: A critical survey. *The Journal of Development Studies*, 35(4), 1-41.

Figura, A. and Wascher, W. (2010). The Causes and Consequences of Sectoral Reallocation: Evidence from the Early Twenty-First Century. *Business Economics*, 45(1), 49-68.

Golub, A., Hertel, T. W., Lee, H.-L. and Ramankutty, N. (2006). Modeling Land Supply and Demand in the Long Run. Paper presented at the Ninth Annual Conference on Global Economic Analysis Addis Ababa, Ethiopia, June 15 - 17, 2006.

Hertel, T.W. (Ed.) (1997). Global Trade Analysis: Modeling and Applications. Cambridge University Press.

Ivanchovichina, E. and Martin, W. (2004). Impacts of China's accession to the World Trade Organization. *World Bank Economic Review,* 18(1), 3-27.

Li, L., Taheripour, F., Preckel, P. and Tyner, W. E. (2012). Improvement of GTAP Cropland Constant Elasticity of Transformation Nesting Structure. Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012.

Massell, B. F. (1969). Price Stabilization and Welfare. *Quarterly Journal of Economics,* 83, 284-298

McDonald, S. (2009). STAGE Version 1: July 2007. Course documentation.

McDonald, S. and Thierfelder, K. (2009). STAGE_LAB: An Applied General Equilibrium Model with Enhanced Labour Markets. Mimeo.

Pack, H. (1993). Productivity and Industrial Development in Sub-Saharan Africa. *World Development,* 21(1), 1-16.

Palatnik, R. R.; Eboli, F., Ghermandi, A., Kan, I., Rapaport-Rom, M. and Shechter, M. (2011). Integration of General and Partial Equilibrium Agricultural Land-Use Transformation for the Analysis of Climate Change in the Mediterranean. *Climate Change Economics*, 2(4), 275–299.

Poirson, H. (2001). The Impact of Intersectoral Labour Reallocation on Economic Growth. *Journal of African Economies*, 10(1), 37-63.

Shutes, L., Rothe, A., and Banse, M. (2012). Factor Markets in Applied Equilibrium Models The current state and planned extensions towards an improved presentation of factor markets in agriculture. FACTOR MARKETS working paper No. 23, February 2012.

Solow, R.M. (1957). Technical Change and the aggregate production function. *Review of Economics and Statistics*, 39(3), 312-320.

Valenzuela, E., Anderson, K. and Hertel, T. (2008). Impacts of trade reform: Sensitivity of model results to key assumptions. *International Economics and Economic Policy,* 4(4), 395-420.

Zhai, F. and Wang, Z. (2002). WTO Accession, Rural Labour Migration and Urban Unemployment in China. *Urban Studies, 39*(12), 2199–2217.

Appendix: Effects on the sectors of the economy, % changes

Scenario 1

	Production quantity				Supply of composite commodity				Purchaser price			
	expt1_a	expt1_b	difference in percentage points	difference in %	expt1_a	expt1_b	difference in percentage points	difference in %	expt2_a	expt2_b	difference in percentage points	difference in %
Wheat	-16.06	-14.86	-7.49	1.20	5.40	5.95	10.27	0.55	13.97	12.27	-12.19	-1.70
Cereals	-17.42	-15.86	-9.01	1.57	4.92	5.52	12.17	0.60	14.18	13.95	-1.62	-0.23
Other crops	-20.34	-19.56	-3.85	0.78	-1.73	-1.63	-5.83	0.10	-4.25	-14.26	236.02	-10.02
Milk	0.52	0.93	77.85	0.41	1.55	1.95	25.47	0.40	0.59	-7.24	-1320.12	-7.83
Bovine cattle, sheep, goats, and horses	-6.64	-5.64	-15.11	1.00	2.03	2.54	25.05	0.51	3.25	0.87	-73.21	-2.38
Other animal farming	-4.14	-3.56	-13.98	0.58	0.15	0.56	285.89	0.42	-1.67	-8.78	425.17	-7.11
Fruits and vegetables	-7.83	-7.57	-3.35	0.26	0.30	0.24	-21.45	-0.06	-4.88	-9.89	102.54	-5.01
Fishing	-2.50	-1.84	-26.29	0.66	2.84	3.29	15.85	0.45	-3.90	-5.35	37.14	-1.45
Gardening, and mixed and unclassified farming	-3.29	-3.94	19.99	-0.66	-1.56	-2.31	47.88	-0.75	0.68	-10.07	-1579.84	-10.75
Coal, oil, and gas	3.20	3.60	12.38	0.40	-0.09	-0.56	518.07	-0.47	-0.18	0.08	-142.54	0.25
Minerals nec	80.32	78.62	-2.12	-1.70	69.19	62.20	-10.09	-6.98	-0.18	0.08	-144.64	0.26
Meat products nec	0.75	0.65	-13.48	-0.10	0.15	-0.02	-109.96	-0.17	-0.35	-2.74	693.80	-2.40
Processing of fruit, vegetables and fish	4.68	5.27	12.45	0.58	0.99	0.77	-21.98	-0.22	-0.24	-0.94	297.89	-0.70
Manufacture of edible oils, margarine and oil products	5.09	5.44	6.98	0.36	3.06	3.24	5.71	0.18	-0.65	-2.21	238.21	-1.56
Dairy Products	1.40	1.23	-12.46	-0.17	0.90	0.67	-25.61	-0.23	0.34	-2.98	-968.24	-3.32
Manufacture of grain-mill products	5.34	5.66	5.99	0.32	-0.03	0.04	-213.40	0.07	5.65	5.75	1.85	0.10
Other food products	2.21	2.20	-0.28	-0.01	0.48	0.25	-48.59	-0.23	0.21	-0.07	-133.68	-0.28
Beverages and tobacco manufacturing	0.91	0.96	5.85	0.05	0.24	0.04	-81.31	-0.19	-0.02	0.15	-979.09	0.16
Textiles	9.55	10.74	12.42	1.19	3.83	3.77	-1.47	-0.06	0.00	0.30	-6907.75	0.30
Wearing apparel	0.62	0.40	-34.95	-0.22	-0.21	-0.83	299.89	-0.62	0.07	0.43	526.85	0.36

Leather products	2.09	2.88	37.32	0.78	-0.15	-0.67	337.82	-0.52	0.01	0.35	2959.91	0.34
Wood products	34.48	31.21	-9.48	-3.27	32.07	28.65	-10.67	-3.42	0.06	0.41	565.57	0.35
Paper products and publishing	-0.16	-0.32	100.79	-0.16	-1.07	-1.25	16.46	-0.18	0.04	0.41	964.08	0.37
Petroleum and coal products	0.57	0.21	-62.88	-0.36	0.02	-0.49	-2476.89	-0.51	-0.09	0.20	-319.70	0.30
Chemical, rubber, and plastic products	21.63	22.47	3.89	0.84	8.52	8.50	-0.18	-0.02	0.10	0.47	370.99	0.37
Mineral non-metallic products	2.87	1.78	-38.12	-1.09	1.11	-0.03	-102.61	-1.14	0.05	0.44	705.55	0.38
Basic metal	19.08	18.38	-3.65	-0.70	15.64	14.49	-7.36	-1.15	-0.11	0.19	-269.25	0.30
Metal products (excl. machinery and equipment)	7.98	6.68	-16.31	-1.30	6.17	5.08	-17.66	-1.09	0.09	0.50	435.23	0.40
Motor vehicles and parts	0.65	0.58	-11.42	-0.07	-0.74	-1.72	131.34	-0.98	-0.08	0.22	-385.96	0.30
Electronic equipment	33.86	29.03	-14.26	-4.83	7.66	6.14	-19.81	-1.52	0.05	0.44	768.89	0.39
Machinery and equipment nec	12.76	10.85	-15.02	-1.92	3.80	2.71	-28.66	-1.09	0.03	0.41	1283.40	0.38
Manufactures nec	78.29	69.71	-10.96	-8.58	42.94	37.88	-11.77	-5.05	0.04	0.41	978.43	0.37
Electricity	0.30	-0.09	-129.06	-0.38	1.79	1.35	-24.56	-0.44	0.01	0.41	4259.46	0.40
Water	-4.51	-4.80	6.47	-0.29	-3.31	-3.64	10.03	-0.33	0.04	0.41	1065.30	0.38
Construction	-1.67	-2.49	49.30	-0.82	-1.62	-2.44	51.05	-0.82	0.17	0.51	203.31	0.34
Trade services	5.41	5.20	-3.89	-0.21	9.46	9.03	-4.59	-0.43	0.12	0.50	302.09	0.37
Transport and business services nec.	-13.91	-13.70	-1.52	0.21	-1.53	-1.99	29.74	-0.46	0.17	0.73	334.74	0.56
Communication	-4.54	-4.97	9.39	-0.43	-2.02	-2.60	29.07	-0.59	0.08	0.59	606.92	0.51
Public Administration, Defense, Education, and Health	-2.38	-2.47	4.05	-0.10	-0.30	-0.53	73.92	-0.22	0.07	0.49	578.92	0.42
Recreational and other services	-8.11	-8.27	1.97	-0.16	-1.77	-2.32	31.45	-0.56	0.07	0.52	600.07	0.44
Dwellings	1.80	1.41	-21.52	-0.39	2.65	2.20	-16.77	-0.44	0.11	0.75	593.02	0.64

Scenario 2

	Production quantity				Supply of composite commodity				Purchaser price			
	expt2_a	expt2_b	difference in percentage points	difference in %	expt2_a	expt2_b	difference in percentage points	difference in %	expt2_a	expt2_b	difference in percentage points	difference in %
Wheat	23.46	31.57	34.56	8.11	-2.54	-3.68	44.85	-1.14	13.97	12.27	-12.19	-1.70
Cereals	28.75	31.40	9.22	2.65	-2.02	-2.34	15.77	-0.32	14.18	13.95	-1.62	-0.23
Other crops	59.05	101.87	72.53	42.83	6.85	7.57	10.55	0.72	-4.25	-14.26	236.02	-10.02
Milk	0.37	5.50	1367.89	5.13	-0.26	2.91	-1198.34	3.17	0.59	-7.24	-1320.12	-7.83
Bovine cattle, sheep, goats, and horses	14.76	22.11	49.83	7.35	0.15	3.42	2253.21	3.28	3.25	0.87	-73.21	-2.38
Other animal farming	10.85	17.79	64.07	6.95	2.26	4.16	84.27	1.90	-1.67	-8.78	425.17	-7.11
Fruits and vegetables	17.85	25.27	41.53	7.41	0.79	2.04	159.17	1.25	-4.88	-9.89	102.54	-5.01
Fishing	11.37	14.08	23.82	2.71	0.01	1.32	25960.66	1.31	-3.90	-5.35	37.14	-1.45
Gardening, and mixed and unclassified farming	1.90	4.28	125.62	2.38	-0.11	0.89	-896.28	1.00	0.68	-10.07	-1579.84	-10.75
Coal, oil, and gas	-0.15	-0.33	123.81	-0.18	0.35	0.46	31.74	0.11	-0.18	0.08	-142.54	0.25
Minerals nec	-6.64	-9.81	47.64	-3.16	-5.59	-8.18	46.12	-2.58	-0.18	0.08	-144.64	0.26
Meat products nec	0.05	2.04	3806.99	1.99	-0.01	1.09	-10321.96	1.10	-0.35	-2.74	693.80	-2.40
Processing of fruit, vegetables and fish	-0.07	1.96	-2915.72	2.03	0.01	0.39	2819.57	0.37	-0.24	-0.94	297.89	-0.70
Manufacture of edible oils, margarine and oil products	-2.33	-1.55	-33.42	0.78	-0.93	-0.53	-42.98	0.40	-0.65	-2.21	238.21	-1.56
Dairy Products	-0.30	1.32	-544.34	1.61	-0.20	0.72	-462.03	0.92	0.34	-2.98	-968.24	-3.32
Manufacture of grain-mill products	-2.58	-3.51	36.04	-0.93	1.69	0.72	-57.65	-0.98	5.65	5.75	1.85	0.10
Other food products	-0.74	-0.11	-85.04	0.63	-0.17	0.12	-167.59	0.29	0.21	-0.07	-133.68	-0.28
Beverages and tobacco manufacturing	-0.18	-0.10	-45.51	0.08	-0.10	0.01	-105.51	0.11	-0.02	0.15	-979.09	0.16
Textiles	-1.36	-1.59	16.86	-0.23	-0.49	-0.49	-1.57	0.01	0.00	0.30	-6907.75	0.30
Wearing apparel	-0.55	-0.56	2.92	-0.02	-0.31	-0.19	-37.99	0.12	0.07	0.43	526.85	0.36
Leather products	-0.75	-0.84	11.20	-0.08	-0.31	-0.19	-39.80	0.12	0.01	0.35	2959.91	0.34
Wood products	-2.61	-3.78	45.18	-1.18	-2.32	-3.39	46.41	-1.08	0.06	0.41	565.57	0.35
Paper products and publishing	0.07	-0.07	-196.87	-0.13	0.20	0.15	-26.02	-0.05	0.04	0.41	964.08	0.37
Petroleum and coal products	-0.30	-0.37	25.16	-0.07	-0.20	-0.22	11.73	-0.02	-0.09	0.20	-319.70	0.30

Chemical, rubber, and plastic products	-1.55	-2.53	62.85	-0.98	0.10	-0.16	-257.58	-0.26	0.10	0.47	370.99	0.37
Mineral non-metallic products	-0.62	-0.64	2.16	-0.01	-0.36	-0.23	-35.29	0.13	0.05	0.44	705.55	0.38
Basic metal	-1.83	-2.67	46.12	-0.84	-1.43	-2.02	41.34	-0.59	-0.11	0.19	-269.25	0.30
Metal products (excl. machinery and equipment)	-0.69	-0.87	26.02	-0.18	-0.45	-0.50	10.64	-0.05	0.09	0.50	435.23	0.40
Motor vehicles and parts	-0.58	-0.56	-2.83	0.02	-0.20	0.00	-97.93	0.20	-0.08	0.22	-385.96	0.30
Electronic equipment	-4.00	-5.95	48.56	-1.94	-1.29	-1.68	30.52	-0.39	0.05	0.44	768.89	0.39
Machinery and equipment nec	-1.70	-2.44	43.01	-0.73	-0.63	-0.73	14.73	-0.09	0.03	0.41	1283.40	0.38
Manufactures nec	-6.38	-9.30	45.86	-2.93	-3.74	-5.29	41.36	-1.55	0.04	0.41	978.43	0.37
Electricity	-0.01	0.07	-1048.40	0.08	0.01	0.11	675.37	0.09	0.01	0.41	4259.46	0.40
Water	6.41	7.49	16.79	1.08	6.43	7.52	16.93	1.09	0.04	0.41	1065.30	0.38
Construction	-0.28	-0.10	-64.01	0.18	-0.28	-0.10	-64.49	0.18	0.17	0.51	203.31	0.34
Trade services	-0.08	-0.36	383.23	-0.29	0.00	-0.25	-6090.96	-0.26	0.12	0.50	302.09	0.37
Transport and business services nec.	-0.68	-1.05	54.44	-0.37	-0.38	-0.49	29.06	-0.11	0.17	0.73	334.74	0.56
Communication	-0.63	-0.71	11.64	-0.07	-0.58	-0.61	4.73	-0.03	0.08	0.59	606.92	0.51
Public Administration, Defense, Education, and Health	-0.14	-0.11	-21.89	0.03	-0.11	-0.06	-48.77	0.05	0.07	0.49	578.92	0.42
Recreational and other services	-0.55	-0.70	27.53	-0.15	-0.43	-0.49	13.96	-0.06	0.07	0.52	600.07	0.44
Dwellings	-0.65	-0.81	23.45	-0.15	-0.63	-0.76	19.90	-0.13	0.11	0.75	593.02	0.64