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## Article

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## Labor exports from Palestine to Israel: a boon or bane for the West Bank economy?

### Abstract

This article analyzes the effects on the West Bank economy of temporary Palestinian employment in Israel, using a new database and a computable general equilibrium model. The results show that Palestinian employment in Israel increases household incomes but distorts the operation of the West Bank labor market and increases domestic wages. Employment in Israel increases the real exchange rate of the West Bank leading to “Dutch disease” effects that inhibit the development of the West Bank economy. A decrease in the number of Palestinian workers in Israel reduces household welfare, and constraints on the West Bank economy restrict domestic absorption of the extra labor. Hence, the Palestinian National Authority may seek more labor exports to Israel. This article contributes to the broader discussion on the effects of migration policies on labor-sending economies by demonstrating the nontrivial benefits from labor migrations, but that these benefits come with costs. This article explores policy options for offsetting those costs.

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## 1 Introduction

Migration policies have gained considerable attention in recent years (Healy, 2017; Martin, 2017; Scipioni, 2018). From the host country's perspective, migration policies enable richer economies to attract labor with specific skills and abilities to supplement their stock of human capital (Boubtane et al., 2016), and fill jobs at the bottom of the social hierarchy in which the natives are less interested (Gheasi and Nijkamp, 2017). From the source country's perspective, remittances by the labor force employed abroad are an important source of income for households, raising not only their current consumption but also their investment capacity with long-run economic growth effects (Donou-Adonsou and Lim, 2016; Lim and Basnet, 2017). While this situation may be beneficial to both the labor-sending and receiving economies, unpredictability of labor mobility policies, especially in the context of political conflict between the two parties, and the attraction of skilled labor into low skill employment may have negative implications for the labor-sending economy. This article investigates using the case of the Israeli labor policies on the West Bank economy.

The labor market in the West Bank is strongly affected by employment opportunities for Palestinians in Israel. In 2018, some 18% of the employed persons in the West Bank were employed in Israel and accounted for some 33% of all labor income (PCBS, 2019); but estimates indicate that wages for West Bank workers in Israel are 20–40% lower than those of Israeli workers for the same jobs (Arnon and Banya, 2007). Hence, West Bank workers are a relatively cheap source of labor to the Israeli economy. Competition between West Bank and Israeli labor is limited by constraining employment opportunities to sectors offering low-skilled-jobs, especially construction (Miaari and Sauer, 2011) where supplies of Israeli labor are limited (Rosenhek, 2006). However, despite the relatively low wages, employment in Israel is attractive because average wages in the West Bank are even lower (Angrist, 1996).

The labor market in Israel for West Bank workers is an administered market controlled by political decisions taken in Israel. Individual work permits control access to the Israeli labor market. The permits are issued in response to requests from Israeli employers and are conditional upon a security clearance. Thus, the West Bank labor market and economy experience substantial fluctuations when access to the Israeli labor market is changed by legislative fiat. Nevertheless, West Bank workers enjoy a preference in the Israeli labor market over other foreign workers because they have a longer employment history with Israeli employers and are considered more experienced (Arnon and Weinblatt, 2001).

This article explores the implications for the West Bank economy consequent upon changes in the size and composition of Palestinian labor employed in Israel. This article uses a new database (Social Accounting Matrix) (Agbahey et al., 2016) with a detailed representation of labor and the linkages between the Israeli and West Bank labor markets. A computable general equilibrium (CGE) model is employed to assess the complex interactions between multiple agents in many markets and capture the economy-wide effects of changes in Palestinian labor flows to Israel. The model for the West Bank closes a research gap as previous studies either did not account for the multiplier effects of the additional labor income earned in Israel (Bulmer, 2003; Etkes, 2012; Mansour, 2010) or addressed the effects of Palestinian employment in Israel only from the perspective of the Israeli economy (Flaig et al., 2013).

This article is organized as follows. Section 2 reviews the evolution and operation of the Israeli restrictions affecting the access of Palestinian labor to Israel and identifies the

role of Palestinian workers in the Israeli economy. Section 3 provides an overview of the West Bank economy in terms of its development, the structure of the economy, and the labor market. Section 4 provides the details about the model and the database, while Section 5 describes the simulations. Section 6 reports and discusses the results, which also includes a subsection on a sensitivity analysis. Section 7 covers the policy implications of this article.

## 2 The Israeli closure policy and work permit system

In the aftermath of the Six-Day war in 1967, the Palestinian territories were declared closed military areas with restricted mobility of goods and persons. Later in 1972, the Israeli administration issued general exit orders, allowing free mobility into Israel, East Jerusalem, and between the West Bank and Gaza (Akkaya et al., 2008). This policy of free mobility within the geographical area comprising the Israeli and Palestinian territories was halted in the advent of the first Palestinian uprising in 1987. From 1989 onward, the closure policy was progressively enforced by a series of checkpoints and roadblocks.

For nearly all movement outside their greater area of residence, Palestinians are required to obtain permits to cross the checkpoints. For movements within the West Bank, permit requirements are lower than for movements between the West Bank and Gaza, and from the Palestinian territories into Israel, and East Jerusalem. Requirements for the permits change frequently without prior notice according to Israeli political objectives and perceived security risks (Fischer et al., 2001). Permits for Palestinians are issued for purposes of work, trade, or medical treatment.

The work permit system was first introduced in 1991 during the Gulf war. It requires every Palestinian wanting to work in Israel to have a permit. Work permits are granted to Palestinians who get a security clearance and have in advance a request for employment from an Israeli employer. The conditions for the security clearance are bound to personal status criteria. At the height of the second Palestinian uprising (2001–2004), the criteria required the Palestinian worker to be married with children, and aged more than 35 years (Etkes, 2012). As of 2014, the main criteria became to be married and aged more than 24 years (CoGAT, 2014). During the violent episodes of the conflict, Israel imposed at times complete closures (Rubin and Ihle, 2016).

The work permits also restrict the number of Palestinian workers in the Israeli economy and limit their employment opportunities to specific sectors through a quota system. Most Palestinians employed in Israel are confined to low-skill sectors (Miaari and Sauer, 2011). Between 2010 and 2016, on average 56% of Palestinians working in Israel were employed in the construction sector (PCBS, 2011, 2012a, 2013, 2014, 2015, 2016a, 2017). The number of work permits issued is based neither on the supply nor on demand for Palestinian labor in the Israeli economy. As a result, a black market for Palestinian labor in Israel developed mostly in the West Bank. Between 2005 and 2015, on average 38% of Palestinian workers in Israel were unpermitted (PCBS, 2016b).

## 3 Developments of the Palestinian economy, trade and labor markets over time

Between 1972 and 1987, Israel implemented a customs union and a free trade policy within the geographical area comprising Israel, the West Bank, and Gaza (Missaglia and Valensisi, 2014).

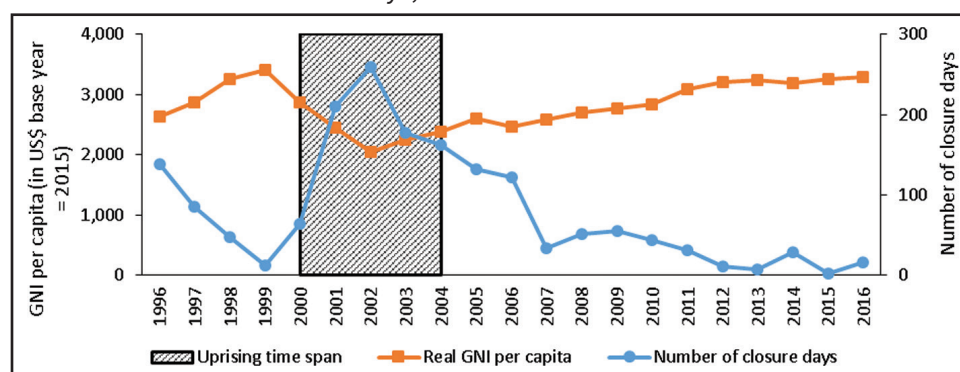
Moreover, Palestinian labor was granted free access to the Israeli market. Nearly one-third of Palestinian workers were employed in Israel through the 1970s and 1980s (UNCTAD, 2012). This economic integration was asymmetric; all decisions were made by Israel and predominantly designed to serve Israeli interests (Dessus, 2004).

While Israeli products benefitted from free access to the Palestinian markets, Palestinian exports to Israeli markets were subject to strict regulations. The development of productive capacity in the Palestinian economy was held back by restrictions and regulations of different sorts (Botta, 2010). Palestinian entrepreneurs were confronted with uncertainty in legal and tax frameworks as well as with limitations on the use of water and other natural resources (Dessus, 2004). Israeli authorities also discouraged Palestinian initiatives that could compete in the Israeli market with existing Israeli firms (UNCTAD, 2009). Moreover, Palestinian production for the domestic market was undercut by economies of scale realized by advanced Israeli manufacturers (Naqib, 2003). Subsequently, the Palestinian economy evolved into a captive market for Israeli products and developed structural trade deficits with Israel.

The Palestinian trade deficit in goods amounts on average to 34% of GDP over the period 2008–2018 (PCBS, 2020). A large part of that deficit is with respect to Israel and is primarily financed by Palestinian labor income in Israel (UNCTAD, 2009). Therefore, the Palestinian economy developed a high dependency on Israeli labor markets. Palestinian employment in Israel has improved household income as most of the income earned in Israel has been repatriated and consumed domestically (UNCTAD, 2016).

The dependency of the Palestinian territories on Israel is illustrated by the evolution of the real Gross National Income (GNI) per capita and the unemployment rate over different periods of the conflict. Figure 1 shows a correlation between the real GNI per capita in the Palestinian territories and the number of closure days over time. While the Israeli closures are not the only factor affecting the development of the Palestinian GNI per capita over that period, there is a statistically significant (at 1%) negative correlation ( $-0.88$ )<sup>1</sup> between the GNI per capita and the number of closure days. With the outbreak of the second Palestinian uprising in late 2000, the conflict reached new heights with intensified closures. The economic recovery of the late 1990s was halted. Although the uprising ended officially in 2004, the number of closure days

**Figure 1** Evolution of Palestinian real GNI per capita (in constant 2015 US\$) and the number of closure days, 1996–2016.



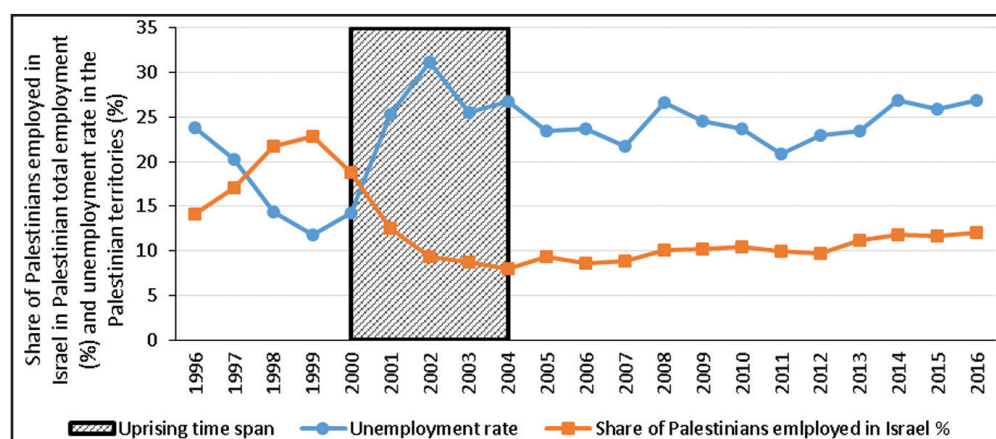
Source: B'Tselem, 2017; PCBS, 2020; UNCTAD, 2009.

<sup>1</sup> The (Pearson) correlation coefficient ( $r$ ) is  $-0.88$  and the  $p$ -value is  $1.09e-07$ .

decreased substantially only from 2006 onward with a subsequent improvement in the Palestinian real GNI per capita.

There is also a significant (at 1%) and negative correlation ( $-0.82$ ) between the share of Palestinian employment in Israel and the unemployment rate in the West Bank (see Figure 2).<sup>2</sup> At the height of the uprising, between 2001 and 2004, the share of Palestinians employed in Israel was less than half the level in 1999 before the uprising. Over the same period, the unemployment rate in the Palestinian territories more than doubled the level of 1999. Following the end of the uprising, employment of Palestinian labor in Israel resumed progressively but has never reached the pre-intifada level of 1999 again. Likewise, the unemployment rate has remained high at around 25%, well above its pre-intifada level.

**Figure 2** Evolution of the share of Palestinians employed in Israel in Palestinian total employment and the unemployment rate in the Palestinian territories, 1996–2016.



Source: PCBS, 2017, 2000.

The high unemployment rate in the Palestinian territories since the tightening of the Israeli restrictions pinpoints the limitation of the domestic market to absorb the growing labor force. In response to this problem, the PNA evolved into a fast-growing public sector with employment in the public sector serving as a safety net to fill the vacuum left by reduced employment opportunities in and the slow development of the private sector (World Bank, 2011). As the payroll and activities of the public sector are largely supported by the international aid, the Palestinian economy developed a new dependency on international aid.

## 4 Method

### 4.1 Model description

This article uses a single country CGE model, STAGE-2,<sup>3</sup> programmed in the General Algebraic Modelling System software. The STAGE family of models is a member of the class of CGE models that are neoclassical in origin. The agents in the model optimize their utility

<sup>2</sup> The (Pearson) correlation coefficient ( $r$ ) is  $-0.82$  and the  $p$ -value is  $5.75e-06$

<sup>3</sup> The model code and all relevant equations are documented in McDonald (2015). The full set of the equations including all model modifications described in section 4.2 can be found in Annex 1.

and profit subject to technology and factor supply constraints. The models are designed to encompass a variety of macroeconomic closures, for example, fixed exchange rates and government budget constraints, factor market clearing conditions and structural rigidities that impose constraints on the range of responses available to the model agents (De Melo, 2015, is a collection of papers from the early years of this class of CGE models).

The behavioral relationships in this model are a mix of nonlinear and linear relationships that govern how the model's agents respond to exogenous shocks. A social accounting matrix (SAM) provides the database to which the model is calibrated. Domestic agents—activities, households, (incorporated business) enterprises, government, and investment—consume composite aggregates of domestic and imported commodities based on a constant elasticity of substitution (CES) formulation (Armington, 1969). The distribution of domestically produced commodities among domestic demand and exports is governed by relative prices on these markets, using constant elasticity of transformation functions, which reflects imperfect product transformation. Household demand is specified as a linear expenditure system.

For this article, the STAGE-2 model is extended to depict particular features of the West Bank economy. First, a multiple trade partner specification is added to separate Israel from other trade partners to capture and simulate the interactions between the West Bank and Israeli labor markets and the economic links between the two economies: Israel is the main trade partner of the West Bank. Second, the domestic production module is extended from a three-stage production process to a seven-level production process that reflects the composition of the labor force in the West Bank. At the first level, aggregate intermediate inputs and value-added generate the outputs using CES technology. At the second level, aggregate intermediate inputs are produced using Leontief technology, while the CES technology is used to form aggregate value-added from aggregate labor, capital, and land. At the third level, and below, CES technologies are used to combine different categories of labor. The model modifications are documented in the model code (Annex 1) and an illustration of the extended production nest is presented in Annex 2.

## 4.2 Labor market specification and factor market clearing conditions

In this article, the labor force is defined as consisting of those individuals willing to make their labor available for producing goods and services that are destined for the market, whether for sale or barter (ISWGNA, 2009). Hence, the labor force comprises the employed and the unemployed. The Palestinian Central Bureau of Statistics (PCBS) estimates the unemployment rate for 2011 (the reference year of the study) at 17%. In the model, a surplus labor surplus specification<sup>4</sup> is assumed to reflect the high unemployment rate. This specification is likely to produce upper bounds estimates of welfare gains and absorption and GDP changes because it assumes the opportunity cost of transferring labor across the production boundary (from unemployment to employment) is zero. Despite this limitation, the surplus labor specification does capture the existence of involuntary unemployment in the West Bank by presuming that unemployed persons will take employment at current (real) wage rates if

<sup>4</sup> See Agbahey et al. (2020) for a review of labor market specifications.

employment opportunities were available. This argument is supported by the evidence that many West Bank workers who were previously employed in Israel, when laid off do not find employment in the West Bank and are ready to queue for jobs; implying that the opportunity cost of crossing the production boundary is low.

The factor market equilibrium condition in the model (equation (1)) identifies the two groups in the labor force, that is, the employed and the unemployed. The employed are further mapped to the place of work, reflecting the participation of West Bank labor in both the domestic and Israeli labor markets.

$$FS_f = \sum_a FD_{f,a} + \sum_w fd_{-w_{f,w}} + UNEMP_f \quad (1)$$

where  $FS_f$  is the total supply of factor  $f$  and is fixed.  $FD_{f,a}$  is endogenous and stands for the demand of factor  $f$  by activity  $a$  in the domestic market.  $fd_{-w_{f,w}}$  is exogenous and captures the demand for factor  $f$  in foreign region  $w$ .  $UNEMP_f$  is endogenous and stands for the size of unemployed factor  $f$ .

The size of unemployed labor in each market segment is determined based on official data from the PCBS (2012b). A surplus labor specification with a switching regime is chosen. Accordingly, the labor supply function has two segments, a perfectly elastic (horizontal) one implying that additional workers can move into production at fixed real wages as long as there is unemployed labor, and a perfectly inelastic (vertical) one reflecting full employment once the pool of unemployed labor is empty. Equation (2) allows variable  $UNEMP_{insw,f}$  to change subject to the condition that unemployment cannot be negative.

$$UNEMP_{insw,f} > 0 \quad (2)$$

The factor markets are segmented among sectoral groups (see Annex 2): this accounts for labor heterogeneity and ensures that workers with notionally identical characteristics can earn different wages depending on their sector of employment. Moreover, the segmentation approach implies that workers can respond to wage changes and move between activities within a market segment, but they cannot move across segments. This approach reflects short to medium-term adjustment processes in the West Bank's labor markets.

### 4.3 Macroeconomic closure conditions

Macroeconomic closures are set up to reflect the economy of the West Bank. For trade, the small country assumption of fixed import and export prices is adopted; Israel is the West Bank's main trading partner. A balanced macro closure is imposed; this is a "neutral" assumption that fixes the shares of private and government consumption and investment in total absorption. The saving and investment account is cleared by equiproportionate changes in household and enterprise savings rates. The government deficit (saving) is fixed, and the account is cleared by equal multiplicative changes in direct tax rates. The CPI is the numéraire, meaning that transfers and wages are in real terms.

The exchange rate has been fixed because the currency used in the West Bank is the Israeli Shekel. The exchange rate is overwhelmingly determined by events in the Israeli economy and is exogenous to the West Bank economy. The current account is fixed to reflect the fact that



the West Bank's trade deficit is exogenous and that the West Bank is dependent on foreign transfers that reflect a sustainable deficit of the current account. The rest of the world account is cleared by equal multiplicative changes in the VAT rates, which requires that total absorption adjusts. This is not a common closure setting but reflects the "reality" that absorption in the West Bank economy adjusts in response to exogenous factors.

#### 4.4 Data

The analysis of interactions between the Palestinian and Israeli economies requires a database with a detailed representation of labor that captures physical labor quantities and wages per labor type and labor market because of the complexity of the labor movements between the two economies. Other elements of the database that need to be represented to investigate the distributional effects of changes in labor mobility are disaggregated household groups, production sectors, and commodity groups.

The SAM compiled for this article meets these requirements and is unique in various aspects. The SAM uses the most recent official data available, mainly from the PCBS, and reflects the West Bank economy in 2011.<sup>5</sup> The SAM, data sources, data processing procedures, and statistics on the structure of the West Bank economy are documented in Agbahey et al. (2016). The SAM has 182 accounts (see Annex 4 for an overview of the SAM accounts), among which there are 33 factor accounts: 31 labor groups and accounts for capital and land. Foreign labor is separated from domestic labor, which is further disaggregated based on skill level, gender, and labor market segment. For male workers, four segments are considered: agriculture, manufacturing, construction, and services. As less than 1% of female workers are employed in the construction sector, only three female segments are considered: agriculture, manufacturing, and services. Male workers, the majority of Palestinian labor in Israel, are further classified based on their eligibility for a work permit in Israel. Three levels of eligibility are considered according to social characteristics such as age and marital status: ineligible, weakly, and highly eligible.

There are 20 household groups classified based on income quintile (measured by expenditure per adult equivalent) and socioeconomic characteristics of their economically active members. Finally, the SAM has a multi-product-activity setup with 47 commodity groups produced by 36 activities. The SAM focuses exclusively on the West Bank economy, which is currently the only Palestinian territory with workers employed in Israel.

## 5 Simulations

A counterfactual scenario returning the Palestinian employment in Israel to its pre-intifada level of 1999 ("*PreInti*") is assessed in this article and compared to the base situation with the constant employment of Palestinians in Israel ("*Base*"). In 1999, the number of Palestinians from the West Bank employed in Israel amounted to 99,974 workers. This number is simulated because it is unlikely that the number of Palestinians allowed to work in Israel in the future exceeds the pre-2000 levels (Aix Group, 2004).

<sup>5</sup> The sectoral composition of GDP in the West Bank economy in 2011 is presented in Annex 3.

The scenario assumes that the structure of Palestinian labor in Israel is unchanged regarding its skill composition and permission status compared to the base period. The assumption of unchanged composition regarding the permission status is justified by the positive correlation between the number of work permits issued by the Israeli administration and the number of unpermitted Palestinian workers in Israel (PCBS, 2016b). This positive correlation can be substantiated by the fact that an increase in the number of work permits is correlated with lower conflict and relaxed security controls allowing the unpermitted workers to take employment opportunities in the Israeli market. The assumption of unchanged skill composition is justified by the demand for West Bank labor in Israel being predominantly in low-skill occupations (Miaari and Sauer, 2011).

The shock is implemented through the exogenous parameter  $fd_{w_{f,w}}$  (equation (1)). This mechanism reflects the empirical evidence that Palestinian employment in Israel is demand-driven. In addition to the change in the number of workers, the factor income from Israel to each labor group is increased in the same proportions as their numbers. Table 1 summarizes the number of Palestinian workers in Israel in the base period in physical units and in the scenario as percentage change compared to the base.

In the sensitivity analysis section of the results, five variants of the counterfactual scenario are discussed. The first one assesses the effect of the same shock with the only difference being that the additional workers entering the Israeli market are all eligible for a work permit (“*AllEleg*”); that is, the composition of the Palestinian labor in Israel regarding the permission status is changed compared to the base period. The second variant also assumes a change in the skill composition of Palestinian employment in Israel with all additional demand being met

**Table 1** Number of Palestinian workers in Israel in the base (physical units) and in the scenarios (% change as compared to the base)

	Core scenarios		Sensitivity analyses				
	Base (unit = 8 hours)	PreInti (%)	AllEleg (%)	AllUnsk (%)	MoreSk (%)	Plus5% (%)	LessMob (%)
Low-skilled ineligible males	17,364	+35.7%	–	+39.4%	+26.4%	+35.7%	–35.7%
Low-skilled weakly eligible males	19,065	+35.7%	+49.7%	+39.4%	+26.4%	+35.7%	–35.7%
Low-skilled highly eligible males	29,128	+35.7%	+49.7%	+39.4%	+26.4%	+35.7%	–35.7%
Low-skilled females	1,162	+35.7%	+35.7%	+39.4%	+26.4%	+35.7%	–35.7%
High-skilled ineligible males	3,123	+35.7%	–	–	+124.5%	+35.7%	–35.7%
High-skilled weakly eligible males	1,254	+35.7%	+49.7%	–	+124.5%	+35.7%	–35.7%
High-skilled highly eligible males	2,559	+35.7%	+49.7%	–	+124.5%	+35.7%	–35.7%
High-skilled females	32	+35.7%	+35.7%	–	+124.5%	+35.7%	–35.7%
Total Palestinian workers in Israel	73,687	+35.7%	+35.7%	+35.7%	+35.7%	+35.7%	–35.7%
Total Palestinian labor force	717,855	–	–	–	–	+5.0%	–

only with low-skilled Palestinian workers (“*AllUnsk*”). The third variant considers an increase in the proportion of skilled Palestinian workers employed in Israel (“*MoreSk*”). In that variant, two-thirds of the new permits are allocated to unskilled workers and one-third to skilled workers. This corresponds to more than doubling the number of skilled Palestinian workers in Israel (Table 1). The fourth variant simulates the same shock as in the counterfactual scenario but assumes an increase in the total labor force<sup>6</sup> by an exemplary amount of 5% (“*Plus5%*”). Finally, a symmetric scenario of the counterfactual is simulated by reducing the number of Palestinian workers employed in Israel by 35.7% (“*LessMob*”). This implies a further tightening of the conditions for Palestinian access to the Israeli market by reducing the number of permits and reinforcing controls of unpermitted workers.

## 6 Results and Discussion

The increased demand of Palestinian labor in the Israeli economy has implications not only in the West Bank labor markets but also in other parts of the economy. This result section starts by discussing the effects of the *PreInti* scenario compared to the *Base* on factor markets, domestic output, and consumption. Afterward, the macroeconomic and welfare effects are discussed. The section ends with a discussion of the results of the sensitivity analyses. Results will be mostly displayed in an aggregated manner where sectors are aggregated to agriculture, manufacturing, construction, and services. The presentation of household-specific results is limited to the five income quintiles, and labor accounts are presented in different ways according to the context. More detailed results can be provided upon request.

### 6.1 Effects of increased demand for Palestinian labor in Israel on West Bank’s factor markets

The increased demand for Palestinian labor in Israel triggers four effects. The first is a movement of labor out of unemployment within the West Bank into Israeli labor markets. The second is a switch from employment in the West Bank domestic market into employment in Israel. The third is a replacement of workers who left the domestic market to work in Israel by labor previously unemployed in the West Bank. The fourth is an increase in domestic employment due to the feedback effects of increased labor income from Israel. The additional income allows households to demand more goods and services, which translates into increased import demand as well as increased demand for domestically produced commodities. The latter stimulates domestic production leading domestic activities to absorb more labor out of unemployment.

The results show that out of the 26.3 thousand Palestinians who start working in Israel, 25.8 thousand, corresponding to 98%, were previously unemployed. About 500 workers, corresponding to 2% of the additional demand in Israel, switch between the domestic

<sup>6</sup> There is a consensus among experts from the Palestinian Central Bureau of Statistics (PCBS) that an increase in the number of Palestinians working in Israel will incentivise people outside the labor force to start looking for employment. This assessment is supported by the low participation rate in the labor force, which stands at 46% in 2011 for the West Bank. This rate is especially low among women (19%) as compared to men (71%) (PCBS, 2012a). Evidence for a growth in the Palestinian labor force in case Israel grants more work permits for Palestinians is also found in Etkes (2012), who shows that part of new permit holders come from outside the labor force.

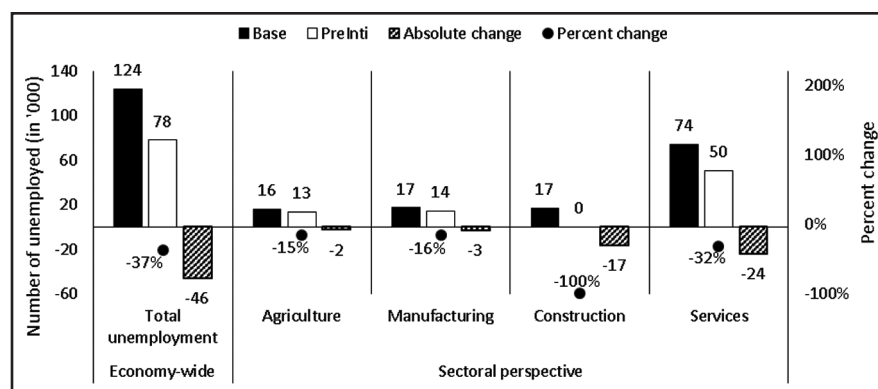
market and the Israeli market. The feedback effects of increased labor income from Israel on the domestic activity take 20.0 thousand more Palestinians out of unemployment to join the domestic labor market, hence overcompensating those who switch from employment in the domestic market to working in Israel.

The finding that some workers exit the domestic market to start employment in Israel indicates that the pool of unemployment in some market segments is emptied. Figure 3 shows that this is the case only in the market segment associated with the construction sector. This finding needs to be put into perspective with the construction employing more than half (56%) of all Palestinians employed in Israel. As the shock keeps the composition of Palestinian labor in Israel the same as in the base period, the extra demand of construction workers is larger than the pool of unemployed labor in that market segment in the West Bank. Consequently, wage rates in the construction sector rose by 10%.

Figure 3 also shows that the total pool of unemployed labor is reduced by 37%, compared to its initial level. This means a drop in the unemployment rate in the West Bank from the initial 17% to 11% of the labor force. Percentage change results are depicted on the right-hand axis.

Table 2 shows that from the 46.0 thousand unemployed getting into employment, 56% start working in Israel, and 44% start working in the domestic economy. From a gender perspective, more men move out of unemployment to join the Israeli market, while most women moving out of unemployment finds a job in the domestic market. Similarly, while most low-skilled workers,

**Figure 3** Number of unemployed (thousands, absolute and percentage changes) in the Base and the PreInti scenarios.



**Table 2** Changes in employment status (worker and percentage) among labor categories

	Moving out of unemployment to employment in Israel	Moving out of unemployment to employment in the domestic market	Total moving out of unemployment
Aggregate labor	25,778 (56%)	20,009 (44%)	45,787 (100%)
<i>Gender perspective</i>			
Male population	25,352 (63%)	15,038 (37%)	40,390 (100%)
Female population	426 (8%)	4,971 (92%)	5,397 (100%)
<i>Skill perspective</i>			
Low-skilled	23,452 (69%)	10,415 (31%)	33,866 (100%)
High skilled	2,327 (20%)	9,594 (80%)	11,921 (100%)

who move out of unemployment start working in Israel, most high-skilled workers moving out of unemployment start working in the domestic market. These findings are consistent with the empirical evidence that the domestic market offers more suitable employment opportunities for high-skilled workers and for women (Etkes, 2012). These results are driven by the composition of the Palestinian labor employed in Israel in the base period, which is dominated by men working in low-skill sectors.

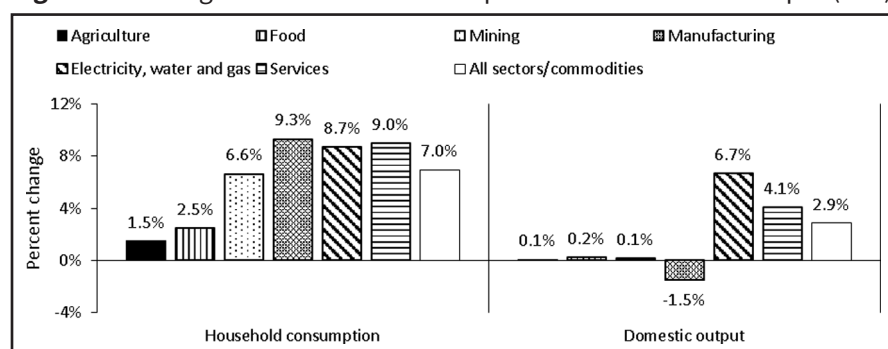
## 6.2 Effects of increased demand for Palestinian labor in Israel on consumption and domestic output in the West Bank

The increased labor from Israel and the additional income generated in the domestic market by workers who were previously unemployed results in household income increasing by 9.4% on average. Due to their higher income, households demand more goods and services, with household consumption increasing by 7.0% on average (Figure 4). Household consumption increases more for manufacturing products, utilities, and services because these commodities have a higher income elasticity of demand.

The increased household demand is met by increasing imports and domestic production. Domestic output increases in all sectors, except manufacturing (Figure 4). This de-industrialization is related to the “Dutch disease” effects of Palestinian employment in Israel. The increased employment in Israel and the subsequent large inflow of income from Israel causes a real appreciation of the domestic currency. Consequently, the West Bank export industry is negatively affected, as it loses competitiveness in international markets. This leads to a decline in manufacturing output, as the manufacturing sector is the leading export sector in the West Bank. In the base period, manufacturing contributed 63% to the total export of goods and services and is the most export-oriented sector with 72% of the domestic output being exported (Annex 5 presents shares of commodity groups in total exports and shares of exports in domestic output in the West Bank). A collateral effect is the increase in factor prices with wages, capital rent, and land rent rising respectively by 2.5%, 5.6%, and 0.7% on average.

“Dutch disease” symptoms and de-industrialization in connection with inflows of labor income from abroad/remittances were also reported in Asian developing countries by Hien et al. (2019), in Latin American countries by Amuedo-Dorantes and Pozo (2004) and in South Pacific countries by Laplagne and Brazys (1997). The mechanism at play is the expansion

**Figure 4** Change in household consumption and in domestic output (in%).



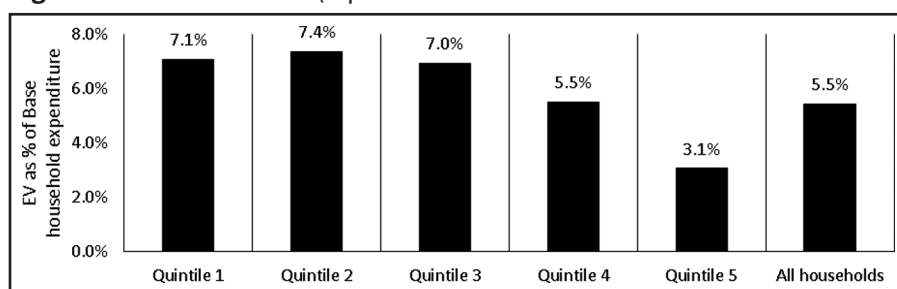
of the economy resulting from large inflows of foreign currency. This mechanism was first described for the natural resource boom in the Netherlands. Whether the cause of the Dutch disease symptoms is the discovery of natural resources or the sharp increase in natural resource prices, foreign assistance, foreign direct investment, or workers' remittances, the adverse macroeconomic effects are similar (Rabbi et al., 2013). The theoretical paradigm to explain how financial capital inflows put an upward pressure on the real exchange rate goes back to the Salter model of a dependent economy producing tradable and nontradable goods (Corden and Neary, 1982). According to this paradigm, there are two impact channels. First, the *spending (consumption) effect*, by which the increase in wealth following higher capital inflows leads to a rise in the aggregate demand for both tradable and nontradable goods and services. This causes the prices of nontradable goods and services to rise, while the prices for tradable goods and services are fixed exogenously in the world market. Subsequently, the local currency appreciates as the price of nontradables increases relative to the price of tradables. The second impact channel, the *resource movement (factor allocation) effect*, reflects the movement of resources toward the nontradable sector due to the increase in prices of the nontradable goods and services. As the nontradable sector usually uses labor more intensively, the reallocation of labor toward the nontradable sector at the expense of the tradable sector increases the reservation wages of recipients and puts an upward pressure on wages in the tradable sector. Subsequently, production costs in the tradable sector rise, while prices of tradable goods and services are fixed exogenously. Subsequently, the tradable sector shrinks. When this contraction occurs in the manufacturing sector, it may be described as de-industrialization. The expansion of the nontradable sector at the expense of the tradable sector puts an additional upward pressure on the local currency and reduces the competitiveness of the tradable sector in international markets.

A factor affecting the Dutch disease symptoms in labor-sending economies is the level of exports. Hien et al. (2019) show that overshooting of the real exchange rate and declining competitiveness of the tradable sectors are particularly observed in countries with low ratios of exports to GDP. This factor also plays a role in the West Bank where the ratio of exports to GDP is low (19.9% in 2018) compared to the world average (30.1% in 2018) (World Bank, 2020). Finally, Acosta et al. (2009) showed that countries where labor income from abroad and remittances are poured into final consumption instead of investment, experience more damaging effects of the Dutch disease. This is the case of the West Bank where the unresolved situation of conflict creates a high degree of uncertainty discouraging investments (Missaglia and Valensisi, 2014; Botta, 2010).

### 6.3 Effects of increased demand for Palestinian labor in Israel on welfare and macroeconomic aggregates in the West bank

Household income increases by 9.8% on average and household expenditure increases by 7.0% with the difference between household income and expenditure being saved or transferred. As a measure of household welfare, the equivalent variation<sup>7</sup> as a share of initial household

<sup>7</sup> The equivalent variation is defined as the amount of compensation, that must be added (subtracted) to (from) the household's initial income, to leave it as well off as under the combined price and income changes. The formula for the equivalent variation is derived from Blonigen et al. (1997) and is presented in Annex 6.

**Figure 5** Welfare effects (Equivalent Variation as a share of Base household expenditure).

expenditure shows that household net welfare improves on average by an amount being equivalent to 5.5% of base household income (Figure 5). Hence, the benefits resulting from higher income overcompensate the burden of higher consumer prices. Distributional effects at the quintile level show that welfare improves more for low-income households (quintiles 1–3) than for high-income households (quintiles 4 and 5) with welfare in the top quintile increasing the least. This is because low-income households derive a higher share of their income from labor and have a higher share of their economically active members employed in Israel than richer households.

Changes in the macroeconomic aggregates show that export supply decreases by 4.8% at constant domestic prices, while import demand increases by 5.9%. The decline in the real value of export supply is due to the increased cost of production in the domestic economy and the real appreciation of the domestic currency by 2.5%. Subsequently, Palestinian exports become less competitive in international markets. Moreover, a higher share of domestic output is now sold in the domestic market as the consumer price in the domestic market increases relative to the export price. This finding is in line with Astrup and Dessus (2005) who suggested the existence of a trade-off in the Palestinian economy between exporting more labor and more goods. The increase in the real value of import demand stems from the increased household income driving overall demand up.

Increasing household demand leads to absorption in the West Bank to increase by 6.0% in real terms. The combined effects of the various changes in the economy are reflected in a GDP increase by 3.6% at constant domestic prices. This means that an increase in Palestinian employment in Israel positively affects the West Bank economy. This finding is consistent with Bulmer (2003), who suggests that an increase in labor income from Israel leads to welfare gains and positive growth for the West Bank economy.

#### 6.4 Sensitivity analysis

The results of the first three sensitivity analyses where the composition of the Palestinian labor in Israel is modified, show only very small differences in macroeconomic variables as compared to the scenario *PreInti* (Table 3). Moreover, the differences in labor force indicators are small. The change in the number of unemployed who start working (either in Israel or in the domestic West Bank market) is similar to that in the main scenario. This finding indicates that changing the structure of the Palestinian labor employed in Israel with respect to skill composition and permission status leads to symmetric changes in domestic labor markets. Allowing only those who are eligible for a work permit to join

**Table 3** Changes in macroeconomic, household and labor force indicators compared to the Base under the sensitivity analyses and the scenario PreInti

Indicators		Core Scenario	Sensitivity analyses				
		<i>PreInti</i>	<i>Alleleg</i>	<i>AllUnk</i>	<i>MoreSk</i>	<i>Plus5%</i>	<i>LessMob</i>
Macroeconomic indicators	Change in real GDP	+3.63%	+3.51%	+3.58%	+3.64%	+3.91%	-3.98%
	Change in domestic output	+2.85%	+2.80%	+2.81%	+2.90%	+3.02%	-2.92%
	Change in import demand	+5.76%	+5.83%	+5.68%	+5.94%	+5.84%	-5.62%
	Change in export supply	-5.07%	-5.37%	-5.05%	-5.21%	-4.81%	+5.36%
Household indicators	Change in household consumption	+6.53%	+6.81%	+6.43%	+6.82%	+6.32%	-6.26%
	Change in household income	+9.76%	+9.29%	+9.62%	+10.20%	+9.44%	-9.23%
	Change in household welfare	+5.45%	+5.68%	+5.37%	+5.72%	+5.27%	-5.35%
Labor force indicators	Change in the number of unemployed	-36.96%	-37.08%	-36.79%	-37.44%	-30.08%	+38.09%
	Change in the number of employed in the domestic West Bank market	+3.76%	+3.78%	+3.72%	+3.87%	+4.26%	-4.03%

the Israeli market (*Alleleg*) opens opportunities for the ineligible in the domestic market, which would have otherwise been taken by the eligible workers. Similarly, the vacuum created by the drain of more skilled Palestinian labor into Israel (*MoreSk*) is filled by the low-skilled and vice versa (*AllUnsk*). This finding is supported by Mansour (2010) who shows that high- and low-skilled workers compete for the same jobs (mostly low-skill jobs) in the West Bank domestic market.

The assumption that improved access to the Israeli market stimulates labor force participation in the West Bank with an increase in labor supply by 5% (*Plus5%*) adds 35.9 thousand people to the labor force. In this case, the scale of unemployment is large enough to meet the extra demand in Israel, while employment in the domestic market also grows (bottom row of Table 3). At the macroeconomic level, domestic output and real GDP increase compared to the main scenario, indicating that a potential increase in the labor force participation will magnify the effects of easing access of Palestinian labor to Israel.

Finally, the results of the scenario with reduced Palestinian labor demand in Israel are opposite to those of the main scenario. The most affected sector is the construction sector where the scale of unemployment more than doubles. This result reflects the inability of the domestic West Bank market to absorb the labor no longer employed in Israel. The loss in factor income from Israel triggers a reduction in household incomes, reducing import demand and domestic output. As domestic demand for domestically produced commodities decreases and the domestic currency experiences a real depreciation, export supply increases, but household welfare decreases, and the economy shrinks by 4.0% in real terms.



## 7 Conclusions and policy implications

### 7.1 Conclusions

This article contributes to the understanding of the economic implications of temporary migration where migrant labor from low-income economies is employed in “low-skill” jobs in high-income economies. The article uses a CGE model calibrated to a new SAM for the West Bank to examine the operation of dual labor markets. The scenarios investigate the effects of changes in the size and composition of Palestinian labor employed in Israel on the West Bank economy. From the analyses, specific conclusions regarding the situation in the West Bank case are derived as well as general conclusions.

Specifically, a return of Palestinian employment in Israel to its *pre-intifada* levels may improve household welfare by some 5.5% and increase GDP by 3.6%: labor opportunities for Palestinian workers in the Israeli market have positive effects for the West Bank. The absolute magnitude of the gains depends on the extent of surplus labor in the West Bank. The income flows from labor employed in Israel generate the symptoms of “Dutch disease” in the West Bank: the local currency appreciates in real terms, which reduces the competitiveness of Palestinian products in international markets. Manufacturing, the most export-oriented sector in the West Bank, is the most negatively affected, which is consistent with de-industrialization. Reducing the number of Palestinians working in Israel, mitigates the “Dutch disease” effects but at the cost of lower welfare and GDP benefits. Changing the structure of the Palestinian labor employed in Israel with respect to skill composition and permission status has limited effects on macroeconomic indicators and in domestic labor markets.

The limited development options for the West Bank, and its relative isolation due to Israeli control over the external borders and the Israeli restrictions in place, may make seeking increased employment options for West Bank labor in Israel attractive to the PNA, but will come at the cost of “de-industrialization” and reduced exports of manufactured goods.

While the magnitude of the results is specific to the implications of Israeli labor market policies on the West Bank economy, the insights into the implications of labor policies in host countries on the economies of source countries are general and have a wider applicability. Exporting more labor may result in nontrivial benefits for labor-sending households and economies. However, achieving those benefits may involve costs, as substantial inflows of remittances can trigger a real appreciation of the domestic currency and negatively affect the competitiveness of the export sector.

### 7.2 Policy implications

While the PNA may find attractive to seek increased employment of West Bank labor in Israel, it needs policy instruments to counter the “Dutch disease” effects of the labor income inflows. In the absence of control over monetary policies, the PNA may resort to fiscal policy instruments to direct the labor income from Israel to investments instead of final consumption. For example, the PNA may levy a tax on West Bank workers employed in Israel. This tax policy may be administered at feasible costs, as most of the West Bank workers in Israel commute daily through checkpoints between the West Bank and Israel. The tax would generate revenue for the PNA that could be invested to support domestic enterprises in developing their

productive capacity and upgrading production technologies to improve their competitiveness in the international markets. Further research would be needed to investigate the effects of such a taxation scheme on the West Bank economy and labor market dynamics.

In countries where such a taxation scheme cannot be implemented, policymakers may apply other monetary or fiscal policies to counter the “Dutch disease” effects, depending on the specific features of their economies and labor market.

### **Declarations**

#### **Availability of data and materials**

Both the database and model used in this article are clearly documented and readily available to any researcher for purposes of replication. The database documentation is available at <https://ideas.repec.org/p/ags/huiawp/245157.html> and the base model at <http://www.cgemod.org.uk/stage.html>. The data and the extended model used specifically for this article are available from the corresponding author upon request.

### **Competing interests**

The authors declare that they have no competing interests.

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### **Authors' contributions**

AJ: conception of the study, database development, extension of the model, implementation of the scenarios, analysis and interpretation of the results, writing the original draft, master revision for the second draft. KS: conception of the study, contribution to method development, analysis and interpretation of the results, review and editing the first draft, revision of the second draft. HG: conception of the study, contribution to method development, supervision, validation of the results, review and editing of the first draft, revision and editing the second draft. SD: conception of the study, contribution to method development, validation of the results, review and editing the first draft, revision and editing the second draft. All authors read and approved the final manuscript.

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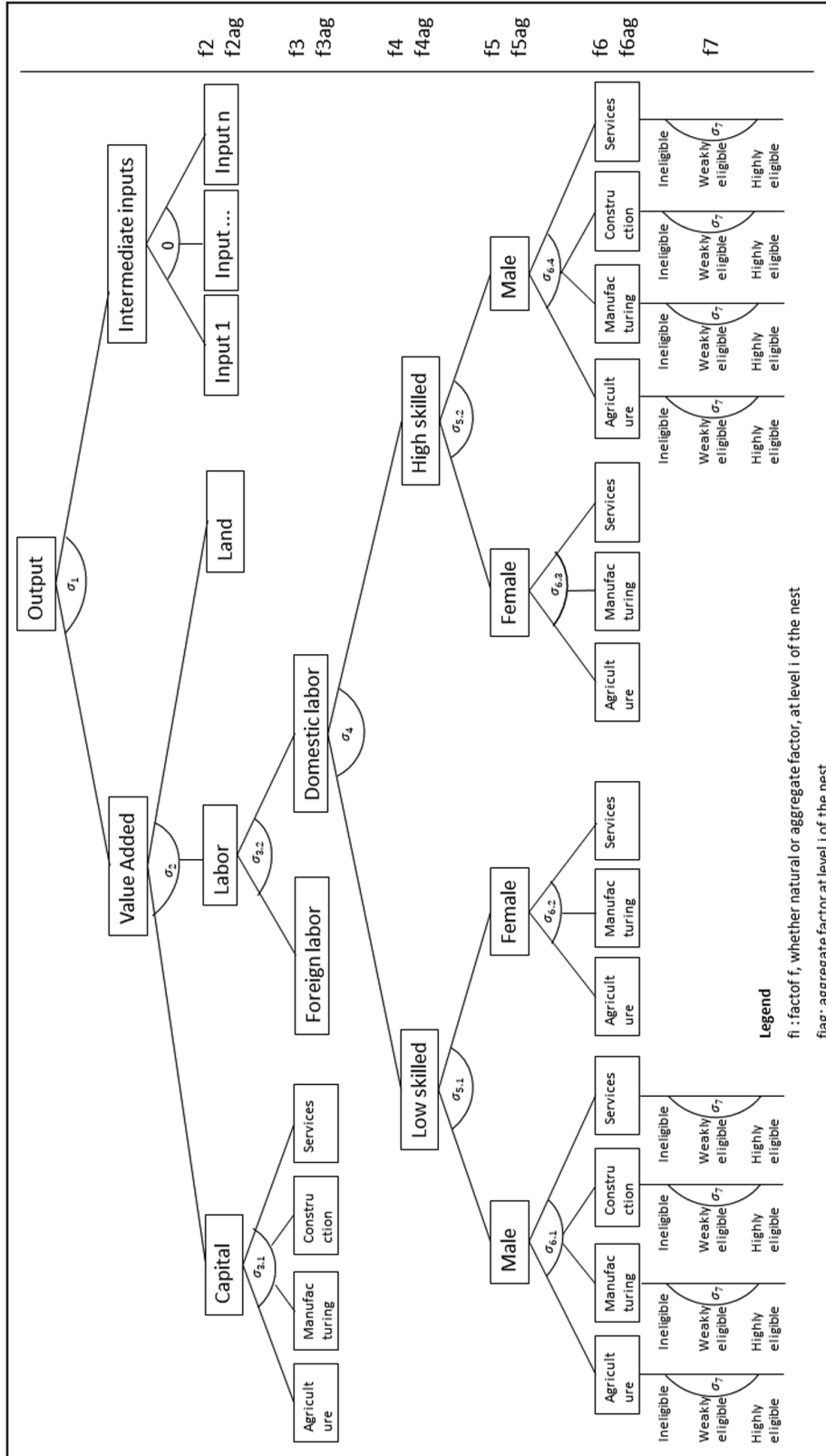
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## Annexes

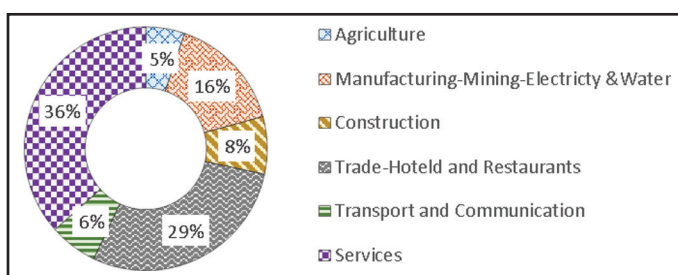
**Annex 1.** Model documentation (see supplementary material).

**Annex 2.** Production module nesting.



Source: The author.

**Annex 3.** Composition of GDP in 2011 in the West Bank.



Source: Social accounting matrix used for this study

**Annex 4.** List of accounts in the social accounting matrix

No	Commodity (c)	No	Commodity (c) – contd.
1	Olives	25	Cars and lorries
2	Cereals, other crops	26	Machinery, and equipment
3	Fruits, nuts and flowers	27	Furniture
4	Vegetables, horticultural specialties	28	Other manufacturing
5	Animals	29	Electricity, gas and water
6	Milk	30	Construction
7	Forestry products	31	Maintenance and repair of motor vehicles
8	Fishery products	32	Repair of personal and household goods
9	Stone, sand, clay and other minerals	33	Other retail sale
10	Meat, meat products	34	Other wholesale
11	Fish, fish products	35	Hotels and restaurants
12	Processed fruits, vegetables	36	Freight transport by road
13	Olive oil	37	Passenger land transport
14	Oils, fats	38	Other transport, storage, travel agencies
15	Grain mills, starches	39	National post activities
16	Bakery products	40	Remaining communication
17	Other food	41	Finance, insurance and auxiliary services
18	Beverages	42	Real estate, and renting activities
19	Textiles and wearing apparel and leather	43	Other business activities
20	Paper and publishing products	44	Public administration, defence
21	Coke, petroleum products	45	Education
22	Other chemical products	46	Health, social work
23	Other nonmetallic mineral products	47	Recreational, cultural and sporting
24	Metals	48	Other services
<hr/>			
No	Activity (a)	No	Activity (a) – contd.
1	Olive	19	Other manufacturing
2	Growing of cereals and other crops n.e.c.	20	Electricity, gas and water supply

No	Activity (a)	No	Activity (a) – contd.
3	Farming animals	21	Construction
4	Forestry	22	Maintenance and repair of motor vehicles
5	Mining and quarrying	23	Repair of personal and household goods
6	Processing of olive oil	24	Retail sale
7	Processing of other vegetable oil and fats	25	Wholesale
8	Processing of basic foods	26	Accommodation and Restauration
9	Processing of dairy products	27	Transport, storage
10	Processing of grain mills and starches	28	National post activities
11	Processing of other food	29	Remaining communication
12	Manufacture of textile	30	Financial services
13	Manufacture of wearing apparels	31	Other rental of buildings
14	Manufacture of paper and publishing articles	32	Other real estate and business activities
15	Manufacture of chemical products	33	Other business activities
16	Manufacture of nonmetallic mineral products	34	Education
17	Manufacture of metals	35	Health and social work
18	Manufacture of machinery equipment	36	Other services

No	Factors (f)	No	Factors (f) – contd.
1	Low-skilled (LS), male, unqualified (UQ), employed in primary sectors	23	HS, male, WQ, employed in tertiary sectors
2	LS, male, UQ, employed in secondary sectors	24	HS, male, HQ, employed in primary sectors
3	LS, male, UQ, employed in construction	25	HS, male, HQ, employed in secondary sectors
4	LS, male, UQ, employed in tertiary sectors	26	HS, male, HQ, employed in construction
5	LS, male, weakly qualified (WQ), employed in primary sectors	27	HS, male, HQ, employed in tertiary sectors
6	LS, male, WQ, employed in secondary sectors	28	HS, female, employed in primary sectors
7	LS, male, WQ, employed in construction	29	HS, female, employed in secondary sectors
8	LS, male, WQ, employed in tertiary sectors	30	HS, female, employed in tertiary sectors
9	LS, male, highly qualified (HQ), employed in primary sectors	31	Foreign workers in the domestic market
10	LS, male, HQ, employed in secondary sectors	32	Capital
11	LS, male, HQ, employed in construction	33	Land
12	LS, male, HQ, employed in tertiary sectors		
13	LS, female, employed in primary sectors	No	Domestic institutions
14	LS, female, employed in secondary sectors	1	Government
15	LS, female, employed in tertiary sectors	2	Enterprise
16	High-skilled (HS), male, UQ, employed in primary sectors	3	Kapital account

No	Factors (f)	No	Factors (f) – contd.
17	HS, male, UQ, employed in secondary sectors	4	Stock change
18	HS, male, UQ, employed in construction		
19	HS, male, UQ, employed in tertiary sectors		
20	HS, male, WQ, employed in primary sectors	1	Israel
21	HS, male, WQ, employed in secondary sectors	2	Rest of the world
22	HS, male, WQ, employed in construction		
No	Households (h)		
1	Households in quintile 1 with mostly low skilled members working only for local employers		
2	Households in quintile 1 with mostly low skilled members with at least one working in Israel		
3	Households in quintile 1 with mostly high skilled members working only for local employers		
4	Households in quintile 1 with mostly high skilled members with at least one working in Israel		
5	Households in quintile 2 with mostly low skilled members working only for local employers		
6	Households in quintile 2 with mostly low skilled members with at least one working in Israel		
7	Households in quintile 2 with mostly high skilled members working only for local employers		
8	Households in quintile 2 with mostly high skilled members with at least one working in Israel		
9	Households in quintile 3 with mostly low skilled members working only for local employers		
10	Households in quintile 3 with mostly low skilled members with at least one working in Israel		
11	Households in quintile 3 with mostly high skilled members working only for local employers		
12	Households in quintile 3 with mostly high skilled members with at least one working in Israel		
13	Households in quintile 4 with mostly low skilled members working only for local employers		
14	Households in quintile 4 with mostly low skilled members with at least one working in Israel		
15	Households in quintile 4 with mostly high skilled members working only for local employers		
16	Households in quintile 4 with mostly high skilled members with at least one working in Israel		
17	Households in quintile 5 with mostly low skilled members working only for local employers		
18	Households in quintile 5 with mostly low skilled members with at least one working in Israel		
19	Households in quintile 5 with mostly high skilled members working only for local employers		
20	households in quintile 5 with mostly high skilled members with at least one working in Israel		



No	Taxes (g)
1	Production tax
2	Factor income tax
3	Direct tax
4	Excise tax
5	Value Added Tax
6	Tariff on imports from Israel
7	Tariff on imports from the rest of the world
8	Factor tax use on Low-skilled male unqualified employed in primary sectors
9	Factor tax use on Low-skilled male unqualified employed in secondary sectors
10	Factor tax use on Low-skilled male unqualified employed in construction sectors
11	Factor tax use on Low-skilled male unqualified employed in tertiary sectors
12	Factor tax use on Low-skilled male weakly qualified employed in primary sectors
13	Factor tax use on Low-skilled male weakly qualified employed in secondary sectors
14	Factor tax use on Low-skilled male weakly qualified employed in construction sectors
15	Factor tax use on Low-skilled male weakly qualified employed in tertiary sectors
16	Factor tax use on Low-skilled male highly qualified employed in primary sectors
17	Factor tax use on Low-skilled male highly qualified employed in secondary sectors
18	Factor tax use on Low-skilled male highly qualified employed in construction sectors
19	Factor tax use on Low-skilled male highly qualified employed in tertiary sectors
20	Factor tax use on Low-skilled female employed in primary sectors
21	Factor tax use on Low-skilled female employed in secondary sectors
22	Factor tax use on Low-skilled female employed in tertiary sectors
23	Factor tax use on High-skilled male unqualified employed in primary sectors
24	Factor tax use on High-skilled male unqualified employed in secondary sectors
25	Factor tax use on High-skilled male unqualified employed in construction sectors
26	Factor tax use on High-skilled male unqualified employed in tertiary sectors
27	Factor tax use on High-skilled male weakly qualified employed in primary sectors
28	Factor tax use on High-skilled male weakly qualified employed in secondary sectors
29	Factor tax use on High-skilled male weakly qualified employed in construction sectors
30	Factor tax use on High-skilled male weakly qualified employed in tertiary sectors
31	Factor tax use on High-skilled male highly qualified employed in primary sectors
32	Factor tax use on High-skilled male highly qualified employed in secondary sectors
33	Factor tax use on High-skilled male highly qualified employed in construction sectors
34	Factor tax use on High-skilled male highly qualified employed in tertiary sectors
35	Factor tax use on High-skilled female employed in secondary sectors
36	Factor tax use on High-skilled female employed in tertiary sectors

Source: Own compilation

**Annex 5.** Shares of commodity groups in total exports and shares of exports in domestic output in the West Bank in 2011

<i>Commodity groups</i>	<i>Shares of exports</i>	<i>Shares of exports in domestic output</i>
<i>Agricultural and food products</i>	21.1%	22.4%
<i>Mining products</i>	0.6%	12.1%
<i>Manufacturing products</i>	62.8%	72.4%
<i>Services</i>	15.4%	3.2%
<i>Total</i>	100%	14.8%

Source: Social accounting matrix used for the study

### Annex 6. Derivation of the Equivalent variation<sup>8</sup>

The Equivalent Variation is defined as the amount of compensation, that must be added (subtracted) to (from) the household's initial income, to leave him as well off as under the combined price and income changes. As such:

$$EV = \mu(p^0; p^1; y^1) - y^0$$

where  $\mu(p^0; p^1; y^1)$  is the indirect compensation function measuring how much money one would need at prices  $p^0$  to be as well off as one would be facing  $p^1$  and having income  $y^1$ .  $y^0$  being the income in the status quo.

For a linear expenditure system, the indirect compensation function is:

$$\mu(p^0; p^1; y^1) = \left[ \frac{(y^1 - \sum_j p_j^1 \gamma_j)}{\prod_i p_i^{\alpha_i}} \right] \prod_i p_i^{0\alpha_i} + \sum_j p_j^0 \gamma_j$$

where  $\prod_i p_i^{\alpha_i}$  is the price index; the marginal budget shares  $\alpha_i$  are such that  $0 < \alpha_i < 1$  and  $\sum_i \alpha_i = 1$ ;  $\sum_j p_j \gamma_j$  is a floor expenditure defined by prices and subsistence requirements and  $\gamma_j$  are subsistence requirements, which are met before the preference structure comes into play.

<sup>8</sup> This annex builds on formulas from Blonigen et al. (1997) (pages 223 – 225).