Economic consequences of intifada

Marco Missaglia and Paul de Boer

June 2004

1. Introduction

The most recent years of the Palestinian history, those of the second *intifada*, have witnessed a dramatic decline in all Palestinian economic and social indicators. Since September 2000, when the violent confrontations started, conditions for a normal life have nearly disappeared and the economic situation has steadily disintegrated.

Using a poverty line of US$ 2.1 per day the World Bank estimated the poverty in Palestine in 1998 at 23.2% of the population, whereas by the end of 2002 the Bank estimated the poverty to have risen to 59 percent. The unemployment rate that amounted to 16.2% in 1998 rose to 37% at the end of 2002. The overall GNI losses have reached US$ 5.2 billion during the first twenty-seven months of *intifada*, which is more than the GNI in 1998 or in 1999 (US$ 5.1 billion).

Two main causes of the Palestinian economic crisis are closure, namely the imposition of restrictions on the movement of goods and people across borders and within Palestine, and the destruction of capital. In September 2000 the Bank estimated the number of Palestinians working in Israel and the settlements at 128,000, while the estimate for end 2002 was about 32,000. The physical damage resulting from the conflict was estimated to be US$ 305 million by the end of 2001 and US$ 930 million by the end of 2002. As a result of damage and of the fall in investment, the real productive capital stock declined by US$ 1.7 billion between 1999 and 2002.

It is clear, in some way even obvious, that an already fragile economy has been hit very hard by the conflict. However, there is no consensus on the extent and the order of magnitude by which the Palestinian economy has suffered during the last years of conflict. Specifically, we will see in the next section that the evaluations coming from the World Bank (World Bank 2003a, 2003b and 2003c) are substantially different from those of the International Monetary Fund (IMF, 2003). Just to anticipate one figure, according to the WB the GNI in 2002 is 25% less than the corresponding figure calculated by the IMF. It goes without saying that such a huge difference is relevant not only to a full understanding of the economic consequences of the conflict, but arguably to the size of the international community intervention as well. This is the reason why in this paper we try to propose our own evaluation of the economic consequences of the conflict, with the help of a computable general equilibrium (CGE) model calibrated on the social accounting matrix (SAM) of 1998, of which we present a part in appendix 1.

The rest of the paper is organized as follows. Section 2 illustrates the different assessments proposed by international agencies. In section 3 we provide a description of the model used for our own evaluation. Section 4 describes what we called the "*intifada* shock", i.e. the set of shocks the Palestinian economy has suffered as a consequence of the violent confrontations started in September 2000. Section 5 illustrates the results and compares them with those obtained by international agencies.

2. Assessments by international agencies

Before comparing the significantly different assessments proposed by the World Bank and the IMF (table 2.8), let us have a look at how these different figures are arrived at.

2.1. Assessment by the World Bank

The estimates of the World Bank are based on "….a quantitative model which describes the economic relations between households, producers, government and the rest of the world through a set of accounting and behavioral equations…." (cf. World Bank, 2003b, footnote 41). The description of this CGE model can be found in Astrup and Dessus (2001, 2002).

The following tables are derived from the "Summary of Macroeconomic Trends and Projections" that has been published in World Bank (2003c) and contains the same data as published in table 7 of World Bank (2003b) but in more detail.

In table 2.1 we calculate from the annual changes provided by World Bank (2003c) the CPI of 2002 based on 1998 = 1 and the compound real growth index of the components of GDP in NIS (1998 prices).

Table 2.1. CPI and compound real growth index of the components of GDP 2002 (NIS, prices 1998)

	1998	1999	2000	2001	2002	CPI 2002 (1998=1)
Exchange rate	3.81				4.74	
CPI, annual change	.056	.055	.027	.021	.057	1.169
Real annual change (NIS, prices 1998)						Compound real growth index 2002 (1998=1)
Private consumption	.090	.075	-.056	-.155	-.148	.731
Public consumption	.070	.203	.310	-.021	-.006	1.534
Total fixed investment	.084	-.083	-.283	-.769	-.440	.085
Exports	.066	.023	-.088	-.134	-.243	.612
Imports	.074	.054	-.162	-.290	-.129	.546

In table 2.2 we give the data on the components of GDP for 1998 in million US$ (World Bank, 2003c) and calculate the 1998 amounts in NIS based on the exchange rate given in table 2.1. We take from the data given in table 2.1 the compound real growth index 2002 (1998 = 1) and the amounts in (real) NIS and in US$ easily follow. The real GDP of 2002 in NIS is derived by taking the sum of the expenditure components and subtracting the imports. The nominal amounts are taken from World Bank (2003c), whereas the price indices easily follow. The price index of private consumption that we derive is, as it should be, equal to the CPI, derived by us in table 2.1.

Table 2.2 Estimate of the real components of GDP (in million US$ or million NIS) and of the price indices

	1998			2002			
	Nominal US$	Nominal NIS	Compound real growth index	Real NIS	Real US$	Nominal US$	Price index (1998=1)
Private consumption	4,014	15,293	.731	11,173	2,357	2,756	1.169
Public consumption	976	3,719	1.534	5,703	1,203	1,757	1.460
Total fixed investment	1,668	6,355	.085	541	114	119	1.044
Exports	624	2,377	.612	1,454	307	345	1.125
Imports	3,052	11,628	.546	6,351	1,340	1,581	1.180
GDP	4,230	16,116		12,519	2,641	3,396	1.286

In table 2.3 we give data taken from World Bank (2003c) and calculate the compound real growth indices per capita for 2002 (1998=1).

Table 2.3 Population and compound real growth index per capita

	1998	1999	2000	2001	2002	
Poulation, mid-year (1,000)	2,731				3,231	
	Real annual change (NIS, prices 1998)					Compound real growth index per capita
GNI per capita	.077	.039	-.075	-.232	-.234	.565
GDP per capita	.039	.031	-.053	-.195	-.225	.609

In table 2.4 we estimate GNI and GDP using the compound real per capita growth index and the data on the population presented in table 2.3. The estimate of real net factor income (NFI) follows from subtracting real GDP from real GNI. The nominal amounts of GNI, GDP and net factor income are taken from World Bank (2003c).

Table 2.4 Estimate of the real components of GNI (in million US$ or million NIS)

	1998			2002		
	Nominal US$	Nominal per capita NIS	Compound real growth index per capita	Real per capita NIS	Real US$	Nominal US$
GNI	5,058	7,056	.565	3,990	2,719	3,768
GDP	4,230	5,901	.609	3,595	2,450	3,396
NFI	828	1,155			269	372

It should be noted that the estimate of GDP reported in table 2.2 (2,641 million US$) is 10.8% higher than the one reported in table 2.4 (2,450 million US$).

2.2. Assessment by the International Monetary Fund

In June 2003, the PCBS published, with the technical assistance of the IMF, a set of annual national accounts statistics for the years 1994 to 2000 (IMF, 2003, p. 22). With the aid of an income-expenditure model the IMF estimated GNI and its components for the years 2001 and 2002. We quote from IMF (2003):

Box 2.5. A simple Income-Expenditure Model to Estimate GDP Developments

The income-expenditure model starts with the identity *GDP equals Exports minus Imports plus Consumption plus Investment*. Information on exports in 2001 can be obtained from the preliminary balance of payments (BOP) prepared by the PCBS and the PMA. For 2002, Israeli BOP figures are available, that identify Israeli imports from the "Palestinian Authority", which is broadly equivalent to WBG excluding East Jerusalem in this context. According to trade statistics from the PCBS, about 90 percent of Palestinian exports go to Israel. Imports and private consumption are both assumed to be a linear function of private disposable income (PDI). PDI is equal to GNI less domestic taxes (available from ministry of finance data) plus transfers from abroad (for which some limited data is available from banks). GNI is equal to GDP plus net factor income from abroad, which is mostly labor income from Israel (estimates based on quarterly labor market survey). Public consumption is derived from the fiscal accounts (which are up to date). Investment is based on partial information on public investment from donors project financing and even more partial information on private investment in construction (based on indicators of cement imports and building permits).

The model provides estimates for GDP and certain components in nominal terms. In order to derive GDP in real terms, each demand component is deflated. The most important component of the deflators is the CPI which is complemented by several other price series, such as oil prices and prices in Israel. Historically, the GDP deflator and the CPI index have in fact been very similar.

In table 2.5 we make use of the fractions of GDP and of the nominal GDP figures reported by IMF (2003, table 2.2) to derive the components for 1998 and 2002.

Table 2.5 GDP and GNI (current prices, million US$) 1998 and 2002

	1998		2002	
	Fraction	Million US$	Fraction	Million US$
Private consumption	.997	4,245	1.247	3,709
Public consumption	.224	954	.343	1,020
Private investment	.264	1,124	.166	494
Public investment	.064	273	.035	104
Change inventories	.023	98	0	0
Exports	.208	886	.139	413
Imports	.780	3,321	.930	2,766
GDP	4,258	4,258	2,974	2,974
Net factor income	.212	903	.145	431
GNI	1.212	5,161	1.145	3,405
Net current transfers	.096	409	.589	1,752
Gross disposable income	1.308	5,569	1.734	5,157

IMF (2003, table 2.1) gives the annual growth of GDP, GNI and CPI. In table 2.6 we use these figures in order to derive the GDP, GNI and, residually, the net factor income (NFI), all in millions US$, prices 1998 (recall from our table 2.5 that in 1998 the GNI was 5,161 and the GDP 4,258 million US$). We present our findings in table 2.6.

Table 2.6 Estimate for 2002 of Real GNI, GDP, NFI (million US$, prices 1998) and CPI (base year 1998)

	1999	2000	2001	2002		Million US$ 2002 (prices 1998)
	Real annual change (US$, prices 1998)				Compound growth index 2002 (1998 = 1)	
Real GNI	.084	-.068	-.162	-.164	.708	3,653
Real GDP	.089	-.054	-.150	-.145	.749	3,188
Real NFI						565
CPI	.055	.028	.012*	.057	1.160	

* The World Bank reports a figure of .021 leading to a CPI of 1.169 in 2002.

IMF (2003, table 2.3) reports that the index of real GDP of 2002 with respect to real GDP 1997 = 100 is equal to .837. Since the index of real GDP in 1998 was equal to 118.8 and the nominal GDP in 1998 4,258, we calculate the real GDP in 2002:

$$\frac{.837 \times 4,258}{1.188} = 3,188$$

which is equal to the real GDP in 2002 reported in our table 2.6, as indeed it should be.

Using the fractions that IMF (2003, table 2.3) reports for 2002, and using the figure of 3,188 million US$, we arrive at table 2.7.

Table 2.7. Estimate of the real components of GDP 2002

	2002	
	Fraction	Million US$* (prices 1998)
Private consumption	1.041	3,956
Public consumption	.274	1,041
Private investment	.144	547
Public investment	.030	114
Change inventories	0	0
Exports	.112	426
Imports	.762	2,986
GDP	.837	3,188

* We balanced the figures to arrive at GDP=3,188

It is puzzling that division of the nominal consumption of 3,709 (cf. our table 2.5) by the real consumption of 3,956 (cf. our table 2.7) does not lead to the CPI of 1.160 (cf. our table 2.6).

2.3. Comparison between the World Bank and the IMF

In table 2.8 we summarize the assessment by the World Bank and the IMF presented in the two previous subsections, as well as their ratio: the assessment of the World Bank as fraction of the one by the IMF.

Table 2.8* Comparison between the assessment by the World Bank and the IMF

	1998 (million US$)			2002 (current prices, million US$)			2002 (prices 1998, million US$)		
	WB	IMF	Ratio	WB	IMF	Ratio	WB	IMF	Ratio
Private consumption	4,014	4,245	.946	2,756	3,709	.743	2,357	3,956	.596
Public consumption	976	954	1.023	1,757	1,020	1.723	1,203	1,041	1.156
Total fixed investment	1,668	1,494	1.116	119	598	.199	114	661	.172
Exports	624	886	.704	345	413	.835	307	426	.721
Imports	3,052	3,321	.919	1,581	2,766	.572	1,340	2,896	.463
GDP	4,230	4,258	.993	3,396	2,974	1.142	2,450	3,188	.769
NFI	828	903	.917	372	431	.863	269	465	.578
GNI	5,058	5,161	.980	3,768	3,405	1.107	2,719	3,653	.744

* The ratio is the figure of the World Bank divided by the one of the IMF.

The reader may easily notice that the differences between the two evaluations (2002, prices 1998) are relevant and worth stressing. In a sense, one should not be too much surprised: the WB predictions are based on a micro-founded, CGE model, whereas the IMF's are based on a macro, income-expenditure model; the WB based its study on a SAM of 1998, whereas the IMF study relies on some more recent data (see Box 2.5). It would not make any sense to assert that one model is better than the other, since they are usually employed for different purposes. What we want to stress here is the fact that the IMF macro figures are based on more recently available data and thus are likely to describe more appropriately the cost of the conflict. Is it possible to get closer to those (IMF) figures using some analytical tool which is closer to the richer, micro-founded kind of model used by the World Bank? This is the question we try to answer in the rest of this paper.

3. Description of the model

3.1. Introduction

In the model we have five economic agents: eight producers, one household, a bank that allocates savings over investments, the Palestinian Authority (PA) and the rest of the world (RoW). In appendix 2 we present the glossary of symbols and in appendix 3 the equations of the model.

3.2. The producers

Intermediate inputs are combined into the intermediates by means of a Leontief technology, whereas capital and labor are combined into value added by means of a CES technology. Both aggregates are, using the Leontief assumption, combined into

the supply of the domestically produced commodity. This commodity is transformed via a CET function into an export commodity and into a domestic commodity supplied to the domestic market. This commodity is combined with imports to produce the composite commodity. To that end we adopt the Armington assumption by using a CES functional form. This commodity is either used in the production process (intermediate demand) or for final purposes: consumption, consumption of the PA and investment.

3.3. The household

The household owns the capital, receives transfers from the PA and from the rest of the world, and it disposes of a time endowment. The household is assumed to maximize its utility in two stages: in the first one it allocates its time endowment over labor supply and leisure. We allow for unemployment so that the labor demand is smaller than the labor supply. We assume that the unemployed do not receive unemployment benefits.

In the model we use the unemployment theory delineated in the migration literature by Harris and Todaro (1970) to describe the wage gap between rural and urban jobs. Compared to the modified version proposed by Ruppert Bulmer (2001), we stay closer to the original Harris-Todaro model. The core of the theory is described by the following arbitrage condition (acting as a wage curve):

$$PL = (\frac{LF}{LF + UNEMP}).b.PLF$$

The wage rate paid by Palestinian firms to Palestinian workers, PL, must be equal, in equilibrium, to the expected wage rate of the Palestinian workers employed in Israel or in the settlements. The latter is equal to the wage rate prevailing in Israel and the settlements, PLF, multiplied by the probability of getting a job in Israel or in the settlements and a factor b. The probability of getting a job in Israel or in the settlements is simply given by the ratio of the Palestinian workers actually employed in Israel or in the settlements (LF) to the workers who look for a job there: those who manage (LF) and those who do not (UNEMP). The factor b is interpreted to be the inverse of the probability of getting a job in Palestine. Then, the arbitrage condition states nothing but the equality between two expected wages:

P (Job in Palestine).PL = P (Job in Israel or in the settlements).PLF

All sources of income (capital, transfers and wages earned in Israel, the settlements and Palestine) together yield the household income.

The household pays income taxes and saves a fixed fraction out of its income after taxes. Subtracting taxes and savings from income yields the budget that it devotes to the purchase of commodities. In the second stage the household maximizes a utility function, with the consumption of these commodities as arguments, subject to its budget constraint. For both stages we use a Linear Expenditure System (LES).

3.4. The Palestinian Authority (PA)

The PA derives its revenues from two sources: taxes (on imports, capital, labor, consumption commodities and on household's income) and foreign aid. These revenues are spent on transfers, savings and on other expenditures. With respect to the latter we assume that the PA maximizes a Cobb-Douglas utility function with its purchases of the

two commodities "Private Services" and "Public Services" as arguments subject to the expenditure constraint.

3.5. The bank

The household savings, the PA savings and the foreign savings are allocated over the investment demand for the commodities. To that end the bank is assumed to maximize a Cobb-Douglas utility function subject to the constraint that savings are equal to total investments.

3.6. The rest of the world

For the Palestinian economy, the RoW basically coincides with Israel and its settlements, at least as far as foreign trade is considered. In 1998, 76 percent of imports and 96 percent of exports came from and were directed toward Israel and its settlements (Astrup and Dessus, 2001). Obviously, the picture is different if one looks at foreign aid disbursements. For instance, out of a total of US$ 1.1 billion by the end of 2002, US$ 840 million came from Arab League countries and US$ 230 million from the EU (World Bank, 2003a).
Palestine earns revenues from the RoW via exports and other sources: foreign aid accruing to the PA, remittances from the workers employed in Israel or in the settlements, foreign transfers directly accruing to the households and foreign savings, i.e. the deficit in the current account balance. These revenues are spent on imports of goods.

Imports and exports are treated in a rather standard way, through, respectively, an Armington-CES and a CET assumption.

4. The 1998 Social Accounting Matrix and the counterfactual SAM

4.1. The 1998 SAM

The CGE model used in this paper is calibrated around the SAM constructed by the World Bank for 1998 (a reduced SAM is reported in Appendix 1). Compared to this original version, we aggregate the several sectors and sub-sectors included in it to eight main sectors: Food, Other Agriculture, Manufacturing, Construction, Transport, Trade, Private Services and Public Services, each of them producing one good. The food sector is an aggregation of the food producing agricultural activities and of those activities that, although belonging to the Manufacturing sector in the SAM, produce food items as well (for instance the "food and beverages" activity).
The data in the SAM is organized in a way that implicitly separates the role of the PA as a consumer from its role as a producer. More precisely, in the SAM the PA does not buy intermediate goods, labor and capital services. It only buys consumption goods. The role of the PA as a producer is captured by the sector "Public Services", which is considered in the SAM as any other producing sector of the economy. In the model, we follow this convention and therefore the reader must be aware that this is not a way of disregarding the overwhelmingly important role of the PA as a producer and, above all, labor demander. If one looks at the "Public Services" column of the SAM, the extremely important role the PA plays as a producer will be immediately apparent.
Our model is a standard one, where each producing sector maximizes its profits under a technological constraint. This assumption might seem inadequate to describe the

behavior of the "Public Services" sector, i.e. of the PA as a producer. Indeed, it is inadequate. One of the key reasons that the Palestinian economy still functions and did not collapse after the tremendous shocks of the last three or four years, lies in the fact that the PA, thanks to donors' budget support, has been regularly paying salaries and providing basic services to the population. It is very difficult to label this behavior as "profit maximization": the PA hired (or did not fire) people in order to provide a sort of social insurance. To overcome this problem - the inadequacy of the profit maximization assumption of the "Public Services" sector - we simply assume that the "PA as a consumer" collects taxes and receives donors' support, and pays labor subsidies to the "PA as a producer", i.e. the "Public Services" sector. This way, we can rationalize the employment level in this sector as being mainly determined by socio-political reasons.

4.2. The counterfactual SAM

We built a "counterfactual" SAM by giving a big "*intifada* shock" to the 1998 benchmark:

1. A reduction in the capital stock

According to World Bank (2003a), physical damages resulting from the conflict (private and public buildings, infrastructure, productive trees and soils, etc.) amounted to 14% of 1998 GNI by the end of August 2002, a huge reduction in the productive capital stock. But what we are mainly interested in is the reduction in capital income rather than in capital stock. In our model the reduction in capital income is determined endogenously, by assuming that it leaves unaffected the factor shares, i.e. by putting it equal to the reduction in GDP prompted by this and the other shocks we are going to illustrate[1]. Accordingly, we may infer that capital income decreased by at least 30% during the last years.

2. A dramatic fall in the level of labor income earned in Israel or in the settlements

According to World Bank (2003a), from September 2000 to the end of 2002, the number of permits was reduced from 128,000 to 32,000. It would make sense to assume a 75% reduction in this source of income, but, taking into consideration the rather large number of Palestinians who manage to cross into Israel or its settlements illegally, we give this variable a 50% shock.

3. An increase in donors' disbursements

According to World Bank staff calculations (2003a), total disbursements increased from around US$ 400 million to around US$ 1.1 billion.

4. A reduction in the household's propensity to save by 50%

5. A reduction in PA saving by 50%

---

[1] The reduction in GDP may be thought of as a function of the different shocks suffered by the economy, including the reduction in the capital stock (and therefore in capital income). Formally: $dy = f (S_1, S_2, ..., dk)$, where each S_i represents a specific shock. Our assumption implies that $dy = dk$ and allows us to solve $dy = f (S_1, S_2, ..., dy)$ for dy ($= dk$).

It must be noted that one of the main reasons of this reduction is the withholding of Israel's transfers to the PA concerning the tax revenue collected by the former on behalf of the latter.

6. An increase in the transfers paid by the PA to the households and in the labor subsidies handed out to the "Public Services" sector

More precisely, we assumed that 90% of the increase in foreign aid was used by the PA to fund social transfers to the households, whereas the remaining percentage was devoted to the payment of labor subsidies. As discussed in section 4.1, these subsidies are a convenient way of modelling the intervention of the PA aimed at absorbing, however partially, the labor market shock suffered by the Palestinian economy.

7. An increase in the labor force

The rise of the population between 1998 and 2002 was almost 15%, but, according to the PCBS data (www.pcbs.org), the labor force growth was around 8%, a fact that witnesses the sharp increase of the dependency ratio.

8. An increase in the parameter b that describes the inverse of the probability of getting a job in Palestine

Its calibrated 1998 value turned out to be 1.178 (equivalent to a probability of getting a job in Palestine of 85%); we multiplied it by 2.5 (equivalent to a 34% probability of getting a job in Palestine).

5. Results and comparison

In the following table we summarize our results and compare them to those of the IMF.

Table 2.9* Comparison between MDB and the IMF

	1998 (million US$)			2002 (prices 1998, million US$)		
	MDB	IMF	Ratio	MDB	IMF	Ratio
Private consumption	3,977	4,245	.937	3,658	3,956	.925
Public consumption	976	954	1.023	1,130	1,041	1.085
Total fixed investment	1,675	1,494	1.121	997	661	1.508
Exports	729	886	.823	467	426	1.096
Imports	3,053	3,321	.919	2,831	2,896	.978
GDP	4,304	4,258	1.011	3,421	3,188	1.073
NFI	779	903	.863	390	465	.839
GNI	5,083	5,161	.985	3,811	3,653	1.043

* The ratio is the figure of MDB divided by the one of the IMF.

As the reader may easily see from the column "2002….", the main difference between our (MDB) results and the IMF results concerns total fixed investment, which is larger in MDB, and, symmetrically, private consumption, lower in MDB. One reasonable explanation for this difference can be found in the role played in our model by the "Construction" sector. Indeed, "in the Palestinian economy more than half of total investment is concentrated into unproductive investment, such as residential building…"

(Astrup and Dessus, 2002, p.18). This kind of investment (or at least a part of it: its annual equivalent) should be assimilated, from the point of view of its economic impact, to consumption, something that does not add anything to the productive capacity of the economy. However, in the SAM we used to calibrate the model almost the whole output of the "Construction" sector is classified as "investment". This may explain the origin of the observed difference. The other items of MDB and IMF are extremely close to each other, which means that the "*intifada* shock" we imposed on the model is reasonable and, arguably, the modelling itself makes sense.

Consequently, it turns out that it is possible to get closer to the IMF figures using our model which is closer to the richer, micro-founded model used by the World Bank.

The conviction that our model can be profitably used to simulate, for instance, the impact of different foreign assistance policies and eventually other policy shocks (see Missaglia and de Boer, 2004) has been reinforced by the outcomes of this study.

References:

Astrup, C. and S. Dessus (2001), Trade options for the Palestinian economy: some orders of magnitude, MENA Working Papers Series # 21, The World Bank.

Astrup, C. and S. Dessus (2002), Exporting labor or goods: long term implications for the Palestinian economy, MENA Working Papers Series # 29, The World Bank.

Harris, J. and M. Todaro, (1970) Migration, unemployment and development: a two-sector analysis, *The American Economic Review*, 60**,** pp.126-142.

IMF (2003), West Bank and Gaza: economic performance and reform under conflict conditions, September 2003.

Missaglia, M. and P.M.C. de Boer (2004), Food-for-work versus cash-for-work: emergency assistance in Palestine, to appear in: *Economic Systems Research*, 16, issue 4 (December 2004).

Ruppert Bulmer, E. (2001), The impact of future labor policy options on the Palestinian labor Market, MENA Working Paper Series # 24, The World Bank.

World Bank (2003a), Two years of intifada, closure and Palestinian economic crisis: an Assessment, March 2003.

World Bank (2003b), Twenty-seven months-intifada, closure and Palestinian economic crisis: an Assessment, May 2003.

World Bank (2003c), West Bank and Gaza Update, A quarterly Publication of the West Bank and Gaza Office, April- June 2003.

Appendix 1: The Palestinian SAM for 1998

Input-output structure and primary income (US$, million)

	Food	Oth Agr	Manuf	Const	Trade	Transp	Priv Svc	Pub Svc	Total
Food	195	6	23	0	229	0	0	4	457
Oth Agr	46	1	28	0	0	0	0	0	75
Manuf	489	23	445	829	78	73	84	135	2,156
Const	4	0	6	113	7	0	22	36	188
Trade	507	0	512	3	263	9	13	58	1,365
Transp	21	4	25	4	45	7	14	40	160
Priv Svc	61	8	39	20	119	19	225	67	558
Pub Svc	0	0	0	0	0	0	15	0	15
Labor	89	38	205	179	473	103	426	349	1,862
Capital	177	4	321	245	214	80	546	18	1,605
Total	1,589	84	1,604	1,393	1,428	291	1,345	707	8,441

Final demand and imports (US$, million)

	Private Cons	PA Cons	Invest-ment	Exports	Total final demand	Imports
Food	1,736	0	117	219	2,072	733
Other Agr	40	0	0	8	48	34
Manuf	821	0	382	450	1,653	1,793
Const	61	0	1,108	38	1,207	1
Trade	126	0	1	10	137	64
Transp	249	0	33	1	283	135
Private Svc	84	215	33	2	334	264
Public Svc	7	761	1	1	770	29
Total	3,124	976	1,675	729	6,504	3,053

Other data (US$, million):

Foreign aid	390
Factor payments from abroad	779
Transfers from abroad	140
Foreign saving	1,015

Appendix 2 The glossary of symbols

Variables:

C_i	: demand for commodity i by the household
C_{n+1}	: demand for leisure
CZ_i	: demand for commodity i in the benchmark
CBUD	: consumption budget of the household
CEBUD	: extended budget of the household
CG_i	: demand for commodity i by the Palestinian Authority
E_i	: export of the domestically produced commodity i
ER	: exchange rate
FAID	: foreign aid
FTRF	: transfers to household from abroad
GOVR	: PA revenues
I_i	: demand for commodity i for investment
K_i	: capital demand by firms
KS	: capital endowment
L_i	: labor demand by firms
LF	: labor demand by Israel
LS	: labor endowment
M_i	: imports of commodity i
P_i	: price of composite commodity i
PZ_i	: price of composite commodity i in the benchmark
PCINDEX	: Laspeyres consumer price index
PD_i	: price of domestically produced commodity i
PDD_i	: price of the domestically produced commodity i supplied to the domestic market
PE_i	: export price (in local currency)
PK	: return to capital
PL	: domestic wage rate
PLF	: wage rate in Israel
PM_i	: import price (in local currency)
$PWEZ_i$	: world price of exports
$PWMZ_i$	: world price of imports

RE   : remittances

S   : total savings
SF   : foreign savings
SG   : PA savings
SH   : household savings

TAXR   : total tax revenues
TRO   : real other transfers to the household
TS   : time endowment

UNEMP   : unemployment

X_i : supply of composite commodity i
XD_i : supply of domestically produced commodity i
XDD_i : domestic commodity i supplied to the domestic market

Y   : household's total income

Parameters:

aA_i : efficiency parameter of the Armington function
aF_i : efficiency parameter of firm's i CES production function
aT_i : efficiency parameter of the CET function

αCG_i : Cobb-Douglas power of the demand of commodity i by
                           government
$\alpha HLES_i$: marginal budget shares of commodity i in the household's LES
                           utility function
$\alpha HLES_{n+1}$: marginal budget share of leisure in the household's LES utility
                           function
αI_i : Cobb-Douglas power of the bank's utility function

b   : shift parameter of the arbitrage condition

γA_i : share parameter of the imports in the Armington function
γF_i : share parameter of capital of firm's i CES production function
γT_i : share parameter of exports of the CET function

$io_{i,j}$: technical coefficients of the inter-industry flows

mps   : marginal propensity to save

μH_i	: subsistence level of commodity i in the household's LES utility function
μH_{n+1}	: subsistence level of leisure in the household's LES utility function
σA_i	: elasticity of substitution of the Armington function
σF_i	: elasticity of substitution of firm's i CES production function
σT_i	: elasticity of transformation of the CET function
tc_i	: tax rate on consumer commodities
tcz_i	: tax rate on consumer commodities in the benchmark
tk_i	: tax rate on capital use
tl_i	: tax rate on labor use
tm_i	: tariff rate
ty	: tax rate on income

Appendix 3. The model

Note: the index i = 1, 2,…,n refers to commodities, while the index n+1 refers to leisure.

Variables:

$C_i, CZ_i, CBUD, CG_i, E_i, ER, FAID, FTRF, GOVR, I_i, K_i, KS, L_i, LF, LS, M_i, P_i, PZ_i,$
$PCINDEX, PD_i, PDD_i, PE_i, PK, PL, PLF, PM_i, PWEZ_i, PWMZ_i, RE, S, SF, SG, SH,$
$TAXR, TRF, TRO, TS, UNEMP, X_i, XD_i, XDD_i, Y$

Parameters:

$aA_i, aF_i, aT_i, \alpha CG_i, \alpha HLES_i, \alpha HLES_{n+1}, \alpha I_i, b, \gamma A_i, \gamma F_i, \gamma T_i, io_{i,j}, mps, \mu H_i, \mu H_{n+1},$
$\sigma A_i, \sigma F_i, \sigma T_i, tc_{i,}, tcz_i, tk_i, tl_i, tm_i, ty$

Household:

$$C_i = \mu H_i + \alpha HLES_i . [(1 + tc_i).P_i]^{-1} . (CBUD - \sum_{j=1}^{n} (1 + tc_j).P_j.\mu H_j)$$

$$SH = mps.(1 - ty).Y$$

$$LS = (TS - \mu H_{n+1}) - \frac{\alpha HLES_{n+1}}{(1 - \alpha HLES_{n+1})} . [(1 - ty).PL]^{-1} \left(CBUD - \sum_{j=1}^{n} (1 + tc_j).P_j.\mu H_j \right)$$

$$PL = (\frac{LF}{UNEMP + LF}).b.PLF$$

$$PCINDEX = \frac{\sum_{i=1}^{n}(1 + tc_i).P_i.CZ_i}{\sum_{i=1}^{n}(1 + tcz_i).PZ_i.CZ_i}$$

Investment demand:

$$S = SH + PCINDEX.SG + ER.SF$$

$$P_i.I_i = \alpha I_i.S$$

Firms:

$$K_i = \gamma F_i^{\sigma F_i}.[(1 + tk_i).PK]^{-\sigma F_i}.\left(\gamma F_i^{\sigma F_i}.[(1 + tk_i).PK]^{1-\sigma F_i} + (1 - \gamma F_i)^{\sigma F_i}.[(1 + tl_i - sf_i).PL]^{1-\sigma F_i}\right)^{\sigma F_i/(1-\sigma F_i)}.$$

$$.(XD_i / aF_i)$$

$$L_i = (1 - \gamma F_i)^{\sigma F_i}.[(1 + tl_i - sf_i).PL]^{-\sigma F_i}.\left(\gamma F_i^{\sigma F_i}.[(1 + tk_i).PK]^{1-\sigma F_i} + (1 - \gamma F_i)^{\sigma F_i}.[(1 + tl_i - sf_i).PL]^{1-\sigma F_i}\right)^{\sigma F_i/(1-\sigma F_i)}.$$
$$.(XD_i / aF_i)$$

Foreign sector:

$$XDD_i = (1 - \gamma A_i)^{\sigma A_i}.PDD_i^{-\sigma A_i}.\left[\gamma A_i^{\sigma A_i}.PM_i^{1-\sigma A_i} + (1 - \gamma A_i)^{\sigma A_i}.PDD_i^{1-\sigma A_i}\right]^{\sigma A_i/(1-\sigma A_i)}.(X_i / aA_i)$$

$$M_i = \gamma A_i^{\sigma A_i}.PM_i^{-\sigma A_i}.\left[\gamma A_i^{\sigma A_i}.PM_i^{1-\sigma A_i} + (1 - \gamma A_i)^{\sigma A_i}.PDD_i^{1-\sigma A_i}\right]^{\sigma A_i/(1-\sigma A_i)}.(X_i / aA_i)$$

$$XDD_i = (1 - \gamma T_i)^{\sigma T_i}.PDD_i^{-\sigma T_i}.\left[\gamma T_i^{\sigma T_i}.PE_i^{1-\sigma T_i} + (1 - \gamma T_i)^{\sigma T_i}.PDD_i^{1-\sigma T_i}\right]^{\sigma T_i/(1-\sigma T_i)}.(XD_i / aT_i)$$

$$E_i = \gamma T_i^{\sigma T_i}.PE_i^{-\sigma T_i}.\left[\gamma T_i^{\sigma T_i}.PE_i^{1-\sigma T_i} + (1 - \gamma T_i)^{\sigma T_i}.PDD_i^{1-\sigma T_i}\right]^{\sigma T_i/(1-\sigma T_i)}.(XD_i / aT_i)$$

$$PM_i = (1 + tm_i).ER.PWMZ_i$$

$$PE_i = ER.PWEZ_i$$

$$\sum_{i=1}^{n}PWMZ_i.M_i = \sum_{i=1}^{n}PWEZ_i.E_i + SF + FAID + RE + FTRF$$

$$RE = PLF.LF$$

Palestinian authority:

$$CG_i = \alpha CG_i.P_i^{-1}.(GOVR - TRF - PCINDEX.SG)$$

$$TAXR = \sum_{i=1}^{n} \left(tc_i.P_i.C_i + tk_i.PK.K_i + tl_i.PL.L_i + tm_i.ER.PWMZ_i.M_i \right) + ty.Y$$

$$GOVR = TAXR + ER.FAID$$

$$TRF = PCINDEX.TRO$$

Market clearing:

$$\sum_{i=1}^{n} K_i = KS$$

$$* \sum_{i=1}^{n} L_i + LF = LS - UNEMP$$

$$X_i = \sum_{j=1}^{n} io_{i,j}.XD_j + CG_i + C_i + I_i$$

Income equations:

$$Y = PK.KS + PL.(LS - UNEMP - LF) + TRF + ER.(FTRF + RE)$$

$$CBUD = (1 - ty).Y - SH$$

$$PD_i.XD_i = (1 + tk_i).PK.K_i + (1 + tl_i).PL.L_i + XD_i.\left(\sum_{j=1}^{n} P_j.io_{j,i} \right)$$

$$P_i.X_i = PM_i.M_i + PDD_i.XDD_i$$

$$PD_i.XD_i = PE_i.E_i + PDD_i.XDD_i$$

*Commented out (Law of Walras): market clearing of labor market

Closure: $CZ_i, FAID, FTRF, KS, LF, PLF, PZ_i, PWEZ_i, PWMZ_i, SF, SG, TRO, TS$

Numeraire: ER