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Full Length Research Paper

Agriculture and economic growth in Palestine: Growth multipliers from a four-sector simulation model

Abbas Tirawi, Tir Ghazil and Qadura Ziad

Agricultural Economics, Faculty of Agriculture, Al-Quds Open University, Palestine.

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This paper develops a four-sector numerical simulation model of economic growth in Palestine which permits the calculation of macroeconomic growth multipliers resulting from income shock to agriculture, services, manufacture and non-manufacture. The resulting multipliers are 1.53 for agriculture, 1.63 for services, 1.52 for manufacture and 1.30 for non-manufacture. An income shock to agriculture is clearly the most progressive choice, indicating the need to highlight agricultural development in growth strategy for Palestine. Yet the simulation results further indicate that going imposes relatively little trade off against total benefit. While a $1 Service sector income shock generates $0.63 in indirect benefit, a $1 agricultural income shock still generates $0.53 in indirect gains-a somewhat smaller benefit, but one likely to make the greatest possible impact on poverty reduction.

Key words: Agriculture, economic growth, growth multiplier, Palestine.

INTRODUCTION

The agriculture sector plays a major role in the Palestinian economy, where agriculture sector provides a lot of raw and primary materials to the various other economic sectors. The gross domestic product (GDP) for the Palestinian agriculture sector has continued to fall in the following years, falling from 10% in 1999 to 3.6% in 2009 (PARC, 2009). As of 2011, however, the Palestinian agricultural sector contributes to 8.1% of the GDP and 15.2% of total exports (MOA, 2011).

The Palestinian agricultural sector contributes 11-20% of the Palestinian GDP and provides 25% of total exports. The majority of Palestinian production is for household consumption. Only 20% is produced for direct retail (ARIJ, 2007). Israel is the main importer of Palestinian produce and controls access to the external market (ARIJ, 2007). The agricultural sector is the third largest employer in Palestine comprising 15.2% of the formal workforce and 39% of the informal workforce. According to UNSCO (2005), the agriculture sector is the main employer in the majority of the rural areas within Palestine.

One approach to quantifying these indirect contributions to growth is to calculate macroeconomic growth multipliers for agriculture and other sectors. The literature in growth linkages has focused almost exclusively on regional-level linkages, using household-level data to measure the forward and backward resource flows arising from both production and consumption in agriculture sector (Hazell and Roell (1983); Haggblade (1989); Haggblade et al. (1989); Lewis and Thorbecke (1992); and Delgado (1994)).

A final set of linkages makes growth originating in the agricultural sector tend to be more “pro-poor” than it would be if the source of growth came from the industrial or service sectors (Mellor, 1976; Ravallion and Datt, 1996; Ravallion and Chen, 2004; Timmer, 1997, 2002).

*Corresponding author. E-mail: Tirawi_abbas@yahoomail.com.

New agricultural technologies that improve farm productivity strengthen this connection. Separate reviews by Thirtle et al. (2004) and by Majid (2004) confirm the strong empirical link between higher agricultural productivity and poverty reduction

This paper describes the application of a four-sector numerical simulation model of economic growth in Palestine, yielding macroeconomic growth multipliers which complement the regional growth linkage literature. The model distinguishes among four sectoral sources of GDP in Palestinian Economy (Agriculture, Manufacture, Non-Manufacture and Services).

In order to calculate the macroeconomic growth multipliers resulting from exogenous shocks in each of the four sectors, the model specifies a set of intersectoral linkages through which the output of one sector can contribute direct forward and backward linkages or indirectly to output in other sectors linkages operate robustly between agriculture and service sectors. This conclusion is reflected in the sectoral growth multipliers which result from the simulated income shocks in four sectors, which are 1.53,1.63,1.52 and 1.30 for agriculture, services, manufacture and non-manufacutre, respectively.

This result provides one step towards developing a growth strategy of the Palestinian economy.

The outline of the study is as follows: section 2 describes the specification of simulation model, the nature of intersectoral linkages it seeks to measure, and the model base run, section 3 presents the main results of the simulation experiments and section 4 briefly summarize the results and some of their implications for an economic growth strategy for Palestine

THEORY AND METHODOLOGY

Model specification

The model is designed to simulate Palestinian economic growth based on Steven (1999). From 1994-2011 as a function of growth in four sectors (Agriculture, Services, Manufacture and Non-manufacture) and their interaction with one another.

Total GDP is the sum of value added in each of these four sectors. Increments to income in any sector add directly to GDP.

In addition, the model allows for income growth in one sector to contribute both directly and indirectly to income growth in the other sectors: *A* is contribution to increased output in sector *B* constitute sector *A* is *indirect* contribution to GDP. It is this indirect contribution that raises a sectoral growth multiplier.

In keeping with both a goal of simplicity and constraints imposed by the data, the model is specified at a level of aggregation which can barely begin to capture the full complexity and richness of underlying processes. The model is thus, presented primarily as a tool for measuring aggregate sectoral growth multipliers rather than as a tool for detailed policy analysis.

The model consists of fourteen endogenous variables and hence fourteen equations six identities and eight stochastic equations. Table 1 summarizes the models structural equations there are two aspects of these equations to be described the specification and estimation of the individual equations, and the manner in which those individual equations interact with one another in creating the simulations.

Identities equations

Equation (1) defines the supply (income) side of the economy, stipulating that GDP at constant price must always be the sum of agricultural GDP (Agriculture sector) and Non-agricultural GDP (Services, Manufacture and non-manufacture sectors).

Equation (2) simply ensures that this relationship is always true in the model .the distinction is necessary because in the national accounts, the expenditure side of the economy is equated with GDP at market price to be internally consistent, the model must ensure that national income equal national expenditure.

Thus Equation (2) connects the income side of the economy with the expenditure side which is expresses in Equation (3).

Equation (3) is the familiar macroeconomic equation stating that national income equals the sum of private consumption, gross investment, government consumption and the trade balance (e.g. Y=C+I+G+X-M). In order to ensure that the system balance (that income equals expenditure), private consumption is calculated as a residual in Equation (3).

Equation (4) defines non-agricultural output (YN) as the sum of output in services, manufacture and non-manufacture sectors).An equation (5) defines gross domestic investment as the sum of investment in non-agriculture and investment in agriculture. Equation (6) defines the trade balance as the difference between exports and exports.

Stochastic equations

Specifications for the remaining eight endogenous variables are estimated econometrically and presented in Table 2. The intersectoral linkages which drive the growth multipliers result primarily from the specification of the output equations.

Specification of direct linkages across sect oral outputs followed from both the characteristics of production and consumption of Palestine and the statistical credibility of the individual output equations presented in Table 3. Equation (7) through (10) describes output in the four

Table 1. Palestinian simulation model.

Equation Number	Identities	Variable list
(1)	YFACP = YA + YN	YFACP: Gross Domestic Product (GDP) at constant prices.
(2)	YMKTP = YFACP + $\overline{\text{INDTXSUB}}$	YA: Agriculture GDP YN: Non-Agriculture GDP
(3)	CONP = YMKTP - GI - TDBAL- $\overline{\text{GOV}}$	YMKTP : GDP at market prices INDTXSUB: indirect taxes and subsidies
(4)	YN =YS +YMAN + YNMAN	CONP: Private Consumption GI: Gross capital formation
(5)	GI = GIN+ $\overline{\text{GIA}}$	TDBAL : Export – Import GOV : Governmental consumption
(6)	TDBAL =EXPORT - IMPORT	YS :Service sector GDP YMAN : Mining and Manufacturing sector GDP
	Stochastic equations	YNMAN : Non-manufacture sector GDP GIN: Gross Capital Formation in Non-Agriculture products.
(7)	YA = ƒ (YSt-1,$\overline{\text{DROUGHT}}$, $\overline{\text{RAIN}}$)****	GIA: Gross Capital Formation in Agriculture products
(8)	YMAN= ƒ (YS, CONP, GOV)**	EXPORT : value of Export IMPORT : value of Import
(9)	YNMAN =ƒ (YS, YMAN, YAt-1, IMPORT)***	CONP : Private consumption
(10)	YS= ƒ (YA, GOV, RUTT)**	RUTT : Rural Urban Term of Trade GIN: Gross Capital Formation in Non-Agriculture
(11)	GIN= ƒ (YNt-1,YAt-1,IMPORTt-1, RUTT,$\overline{\text{INSTAB}}$)**	INSTAB: A proxy of macroeconomic instability. RER: Real Exchange Rate
(12)	RUTT = ƒ (YAt-1, YSt-1, $\overline{\text{RER}}$)*	EXIM: ratio of export and import OLIVE OIL: Olive Oil production (tons).
(13)	EXPORT = ƒ (YN, EXIM, $\overline{\text{OLIVE OIL}}$)*	
(14)	IMPORT = ƒ (YA, YS, $\overline{\text{RER}}$)***	

*Estimated with Least Square;**both LS and AR (1);***Two-stage Least Square;****both TSLS and AR (1).

productive sectors.

In terms of specification of Equation (7) one prior expectation might be that output in non-agricultural sectors would contribute to agricultural output. This type of equation could capture (without distinguishing between) both forward and backward linkages with agriculture. Forward linkages from agriculture would include purchases of non-agricultural goods and services by the agricultural sector, and agricultural product sales to non-agriculture. Backward linkages from agriculture include purchases of manufactured inputs by the agricultural sector.

Alternative specification of the agricultural output equation also considered the effects of drought and rainfall. A general dummy variable for drought years is never significant. A similar explanation may apply to the lack of significantly to the rainfall data in explaining aggregate agricultural output. Accessible time series data for annual average rainfall for any of these three regions: Gaza, Hebron and Nabulus .Neither the average annual rainfall for neither any of these three regions nor the average of all three regions was significantly related to aggregate agricultural output.

It is also notable that neither agricultural investment nor the urban-rural term of trade enters into equation (7).The highly labor-intensive(and relatively unchanged)production techniques practiced by the large majority of Palestinian peasant farmers may also explain the lack of explanatory power of gross investment in agriculture in predicting agricultural output. Virtually all documented investment in agriculture during the period of estimation was public investment.

Equation (8) determines manufacture output as a function of output in services, Private consumption and Government consumption in non-agriculture. For essentially the same reasons mentioned above. Agricultural output does not play any notable role in driving output in Palestinian enclave Manufacture sector. The linkages from services to Manufacture are more direct .For instance; an increase in output in the service sector would lead to an increase in factor demand by the service sector for certain mining and manufacturing

Table 2. Econometric estimates of stochastic equations.

	R^2	D.W.
$YA = -3.13_{-0.01} + 0.10_{2.40}*YS_{t-1} - 23.00_{-1.84}*DROUGHT - 0.30_{-3.57}*RAIN + 0.89_{11.74}*AR(1)$	0.87	2.22
Instruments: $YA_{t-1}, YS_{t-2}, YMAN_{t-1}, RAIN_{GAZA}, RAIN_{HEBRON}, RAIN_{NABULUS}, RUTT_{t-1}$		
$YMAN = -1330.85_{-0.29} - 0.023_{-0.48}*YS + 0.20_{4.29}*CONP - 0.15_{-2.27}*GOV + 0.97_{12.96}*AR(1)$	0.62	1.85
$YNMAN = -840.36_{-2.70} - 0.044_{-0.60}*YS + 1.34_{2.26}*YMAN - 0.331_{-1.08}*YA_{t-1} + 0.27_{2.43}*IMPORT$	0.81	1.99
Instruments: $YNMAN_{t-1}, DROUGHT, YS_{t-1}, RAIN_{avg.\ of\ Hebron,\ Gaza,\ Nabulus}, GIN_{t-1}, YMAN_{t-1}, YA_{t-2}$		
$YS = 918.96_{1.91} - 2.95_{-2.46}*YA + 0.422_{2.47}*RUTT + 2.25_{6.52}*GOV - 0.054_{-0.165}*AR(1)$	0.86	1.85
$GIN = -541.16_{-1.38} + 1.17_{3.71}*YA_{t-1} + 0.569_{3.83} - 29.24_{-1.78}*INSTABILITY + 0.222_{3.20}*RUTT - 0.364_{-1.04}*AR(1)$	0.91	1.85
$RUTT = -1303.07_{-1.079} + 2.65_{1.12}*YA_{t-1} + 629.77_{2.45}*RER + 0.484_{2.16}*YS_{t-1}$	0.46	2.20
$EXPORT = -462.11_{-7.87} + 0.146_{9.74}*YN + 0.0007_{0.65}*OLIVE + 2338.53_{7.21}*EXIM$	0.96	1.41
$IMPORT = 890.49_{2.35} + 1.30_{1.42}*YA - 239.64_{-1.74}*RER + 0.667_{7.88}*YS$	0.83	2.25
Instruments: $IMPORT_{t-1}, YA_{t-1}, RER_{t-1}, RER_{t-2}, YS_{t-1}, ER, ER_{t-1}, RUTT$		

Absolute value of *t*-statistics is in subscript.

Table 3. Results of agricultural income shock[a].

Value	Net Impact of $ 1 shock to Agricultural GDP on					
	(a) Agriculture (YA)GDP	(b) Service (YS) GDP	(c) Manufacture (YMAN) GDP	(d) Non-manufacture (YNMAN) GDP	(e) Non-agriculture GDP (b+c+d)	(f) Total GDP (a+e)
	$0.03	$0.01	$0.27	$0.22	$0.50	$0.53
Share of Total Increase	5%	2%	51%	42%	95%	100%
Share of non-agriculture increase		2%	54%	44%	100%	

[a]Undiscounted sums over life of shock .Note these results are net of the initial $ 1 increment to agricultural GDP.

outputs such as chemical industries and constructions. This type of backward linkage from services to industry likely explains most of the positive association found in equation (8). It seems less likely to be explained byindustrial demand for service sector outputs. This perspective is in keeping with the characterized of Palestinian industry operates largely as an enclave, with its inputs consisting primarily of intermediate goods.

This is, however, is a positive association between private consumption in non-agriculture and manufacture output, which is captured in Equation (8), under the reports from the Palestinian Authority, much of this investment originated from the public sector. It is thus, reasonable to expect a positive correlation between such investment and output in what were largely state-owned industrial enterprises. Given the command nature of many industrial activities during the period of estimation, it is also not surprising that prices (represented by the rural-urban terms of trade) also fail to explain any significant share of the variation in mining and industrial sector output.

Equation (9) determined the Output of Non-Manufacture sector by the output in each of the other sectors.

Increased output in services largely reflects a consumption linkage, through which service sector workers increase their consumption of the output of Non-Manufacture sector. The connection between

Manufacture and Non-Manufacture lies more in the backward linkage of increased demand for modern inputs by producers in mining and manufacturing when their output grows. Similarly, agricultural output provides essential inputs to many industries, most particularly food processing establishments and tanneries.

Equation (10) describes output in the services sector (including agricultural marketing activities).this equation complements the agricultural output Equation (7) in specifying a reciprocal relationship between agriculture and services. Output in either one positively affects output in the other.

There is a strong forward linkage between agriculture output and the agricultural marketing services subsectors, which depend entirely on domestic agriculture for their inputs. There is also a strong forward linkage on the consumption level, as food in the primary wage good for service sector employees. As Lewis (1954) first observed, good agricultural performance helps to maintain real wages in the service sector, facilitating investment in non-agriculture. (While this may be true of industry, as well, the wage bill as a share of total costs is likely to be substantially greater in services than in manufacture owing to the relative capital intensity of the latter, thus making the real income effect more evident in the service sector).

Service sector output is also specified in above equation as a positive function of (lagged) Government Consumption and a negative function of the rural urban term of trade. Investment in this context could take the form of machinery used in providing services (transportation equipment, or small-scale rice milling machines). The rural-urban term of trade broadly measure the incentives shaping trade between the services and agricultural sectors. As expected, an increase in the ratio of agricultural to non-agricultural prices leads to reduced output in the service sector. Notably, industrial output does not play a role in determining service sector output in this model.

The models remaining equations determine prices, non-agricultural investment and the trade balance. Gross investment in non-agriculture is described in Equation (11) as a function of lagged output in agriculture and non-agriculture, as well as macroeconomic instability. That increased non-agricultural income would lead to increase investment in non-agriculture is straightforward yet Equation (11) also incorporates a cross-sectoral investment linkage through which increased agricultural income can be invested in non- agriculture.

In both cases these relationships are specified with a one-period lag. This structure takes account of the time necessary for financial intermediation to translate increased output into investment.

This is particularly necessary in the case of cross-sectoral investment of agricultural income into non-agricultural investment. This lag also serves a more practical purpose in the context of the model, since it contributes to the dynamic properties through which a simulated shock to sectoral in come dies out gradually over time.

Equation (12) predicts the Rural-urban terms of trade as a function of output in the agriculture and service sectors and the real exchange rate. The signs of agricultural and service output are as expected. Increased agricultural output would tend to drive down agricultural prices, thus lowering the rural-urban term of trade. Conversely, increased non-agricultural output would tend to drive down non-agricultural prices, thus increasing the rural-urban term of trade.

The real exchange rate logically should play a role in shaping the rural-urban terms of trade; however the direction of its effect depends on whether the share of tradable in agriculture is greater or less than the share of tradable in non-agriculture. Appendix demonstrates, with qualifications, that a real depreciation increases the rural-urban terms of trade only if the share of tradable in agriculture exceeds the share of tradable in non-agriculture. While agriculture in many countries is typically thought to be more tradable than non-agriculture.

Equations (13) and (14) define exports and imports, respectively, the difference being the trade balance (equation (6)).Exports in equation (13) are a positive function of output in non-agriculture and olive. Olive Oil in Palestine‟s enjoys high export potential.

Base run of the model

The equation by equation relationships described in previous section are estimated in levels, each of the models stochastic equations described and estimated individually by AR (1) correction for serial correlation, least squares and two-stage least square, and both two-stage least square and AR (1), using data from 1994-2011.the relations are specified and estimated in levels, producing a set of coefficient which then provides the basis for simulating the endogenous series in levels. The models performance in simulating true historical time paths for the endogenous variables depends on how well the individual equations work together as a system. The system is dynamic in that the values predicted for the endogenous variables in a given year depend on previous predictions for all endogenous variables.

Prior to using the model to measure counterfactual simulation, it is essential to determine the accuracy with which the model recreates the actual historical time paths of the endogenous variables. In general the model does an excellent job of creating Palestinian economic. The root mean squared percentage errors in the prediction of that series is less than 5%. The model also does an excellent job of predicting output in the specific productive sectors: the root mean square percentage errors in the base run for agriculture, Services, Manufacture and Non-Manufacture are 7.8, 7.6, 4.6 and 12.3%. The model has greater difficulty, however, in predicting gross investment in non-agriculture, which has an RMSPE of 7.6%.

RESULTS AND ANALYSIS

This section describes the results of hypothetical shocks to income in Palestinians agricultural, manufacture, non-manufacture and service sectors. Through which one can derive the macroeconomic growth multipliers associated with each sector.

Experiment 1: Agricultural income shock

The agriculture income growth multiplier, as noted above, is 1.53. This result implies that an incremental $1 of income in the agricultural sector generates and additional $0.53 of income in other sectors. The $1 represents agricultures direct contribution to GDP .the $0.53 represents agricultures indirect contribution.

More generally, this study has argued that Palestinians Manufacture sector is essentially and economic enclave with minimal linkage to the non-manufacture. Decomposition of the agricultural growth multiplier supports this view table below summarizes the results of Experiment 1, distinguishing between the effects of the initial shock to agricultural income on services, manufacture and non-manufacture sectors and feedbacks to agriculture itself.

A $1 shock to agricultural income initiate a chain of events through which the initial shock flows through the intersectoral linkages specified in the model. Resulting in increments to income in each sector. Specifically, a $1 shock to agricultural generates $0.27 income in the manufacture sector as compared with only $0.01 in the service sector and $0.22 income in the non-manufacture sector. In addition, the initial shock to agriculture feeds back into the agricultural sector (via the positive effect of increments to the manufacture and non-manufacture sectors income on agriculture) to create an additional $0.03 income in agriculture.

Thus, 93% of agriculture‟s indirect contribution to total GDP comes through its effect on income in the Manufacture and non-manufacture sectors, while only 2% of agriculture‟s indirect contribution comes through its impact on service sector.

It is important to note that agricultures indirect contribution to Manufacture and Non-manufacture output is Highly Percentage of indirect: agricultural income affects service income as a secondary consequence of agriculture‟s impact on the manufacture and non-manufacture sectors. Feedbacks to agriculture itself account for the remaining only 5% of the net impact of an agricultural income shock on total GDP. Of the total increment to non-agricultural GDP (Manufacture, non-manufacture and service).

Of the total increment to non-agricultural GDP (service, manufacture and non-manufacture), 54% of agriculture‟s impact is directly on manufacture sector, while the secondary effect of agriculture on non-manufacture accounted 44% (via agricultures effect on service and services effect on manufacture and manufacture effect on non-manufacture)and the third effect of agriculture on services only accounted 2%.

Experiment 2: Service sector income shock

Performing a similar experiment by shocking income in the service sector yields a growth multiplier of 1.63. This figure implies that a $1 shock to service sector income generates an additional $0.63 of GDP. Decomposing services indirect contribution to GDP sheds further light on the nature of intersectoral linkages in Palestinian economy‟s suggested above, the linkages between the service and manufacture and non-manufacture sectors are more robust than the operative linkages between manufacture and non-manufacture with agriculture. In contrast, experiment 2 is consistent with Experiment 2 in demonstrating the relatively strong linkages between the service and agricultural sectors. Table 4 summarizes the decomposition of effects from a shock to service sector income.

Table 4 suggests that the effect on agriculture of shock services is symmetric to the effect on services of a shock to agriculture. A $1 shock to service sector income leads to $0.29 increment to agricultural income. This shock also leads to a $0.16 increment to manufacture sector and leads a $0.11 increment to non-manufacture sector. In addition, this experiment demonstrates that there is a feedback effect on service sector income net of the initial shock. The shock of service income increases agricultural income, which (as demonstrated in Experiment 1) creates a secondary increase in service sector income. This latter effect amounts to $0.07 per $1 shock to service income.

Table 4 further illustrates that of the total indirect contribution of service sector income to GDP, 47% come from its impact on agricultural income, while 25% comes from its impact on manufacture income also 17% comes from its impact on non-manufacture sector income. The remaining 11% of the service sectors indirect contribution to GDP derives from second-round feedback onto the service sector itself. As a share of the increment to non-agricultural income resulting from the shock 47% comes from the manufacture sector and 33% comes from the non-manufacture sector.

Experiment 3: Manufacture sector income shock.

The lack of interectoral linkages between Manufacture

Table 4. Results of service income shock[a].

	Net Impact of $ 1 shock to service GDP on					
	(a) Agriculture (YA)GDP	(b) Service (YS) GDP	(c) Manufacture (YMAN) GDP	(d) Non-manufacture (YNMAN) GDP	(e) Non-agriculture GDP (b+c+d)	(f) Total GDP (a+e)
Value	$0.29	$0.07	$0.16	$0.11	$0.34	$0.63
Share of Total Increase	47%	11%	25%	17%	53%	100%
Share of Non-Agriculture Increase		20%	47%	33%	100%	

[a]Undiscounted sums over life of shock .Note these results are net of the initial $ 1 increment to Service GDP.

Table 5. Results of manufacture income shock[a]

	Net Impact of $ 1 shock to manufacture GDP on					
Value	(a) Agriculture (YA)GDP	(b) Service (YS) GDP	(c) Manufacture (YMAN) GDP	(d) Non-manufacture (YNMAN) GDP	(e) Non-agriculture GDP (b+c+d)	(f) Total GDP (a+e)
	$0.08	$0.02	$0.27	$0.15	$0.44	$0.52
Share of Total Increase	16%	4%	51%	29%	84%	100%
Share of Non-Agriculture Increase		5%	61%	34%	100%	

[a]Undiscounted sums over life of shock. Note these results are net of the initial $ 1 increment to manufacture GDP.

and agriculture, and limited (one-way) linkages from service and non-manufacture to manufacture result of growth multiplier for manufacture. Experiment 3 simulates a shock to manufacture income resulting in a growth multiplier of only 1.52. Indeed from figure aforementioned, it is not obvious why manufacture should have any growth linkage. The answer is hidden by the simplification necessary in that figure. Yet, the full equation structure of the model in such that a shock to manufacture income contributes to increase investment in non-agriculture, which in turn contributes to increased manufacture and non-manufacture income in that first year after the shock and increased income in the manufacture and service sectors in the next year after shock. The subsequent increase in manufacture income (through the investment feedback) sets off a smaller round of similar effect. In addition, the increased in service and manufacture sectors income (which results from the investment linkage) extend the positive effects to the agricultural sector through the mechanisms discussed.

An exogenous $1 shock to income in the manufacture sector leads to total increase $0.52 in the income of the other three sectors resulting in a macroeconomic growth multiplier of 1.52 of this net increase. Table 5 shows the results of manufacture sector income shock.

Of the net increment to GDP of $0.52 which results from a $1 shock to manufacture income, only 4% ($.0.02) is concentrated in the service sector. This results of enhanced investment in non-agriculture; in addition this increase in service sector income itself stimulates an increase in agricultural income. The response to a $1 shock to manufacture income. Agricultural income increases by $0.08 which represents 16% of the net impact of the shock to manufacture. Also the non-manufacture income increased by $0.15 represents only 29% of the net impact of the shock to manufacture sector. Which subsequently increases by $0.27 in addition to the initial shock? This also reflects a feedback to manufacture from the increased service and non-manufacture sectors (which was stimulated through investment in non-agriculture).

As a share of the increment to non-agricultural income resulting from the shock 34% comes from the service sector and 5% comes from the non-manufacture sector.

Experiment 4: Non-manufacture income shock

The growth multiplier for non-manufacture is 1.30, the smallest of the four sectors. This result, in part, from the big linkages through which the output of non-manufacture

Table 6. Results of non-manufacture income shock[a]

	Net Impact of $ 1 shock to non- manufacture GDP on					
	(a) Agriculture (YA)GDP	(b) Service (YS) GDP	(c) Manufacture (YMAN) GDP	(d) Non-manufacture (YNMAN) GDP	(e) Non-agriculture GDP (b+c+d)	(f) Total GDP (a+e)
Value	$0.08	$0.03	$0.08	$0.11	$0.22	$0.30
Share of Total Increase	26%	9%	27%	38%	74%	100%
Share of Non-Agriculture Increase		13%	36%	51%	100%	

[a]Undiscounted sums over life of shock .Note these results are net of the initial $ 1 increment to Non-Manufacture GDP.

sectors becomes input in another sectors. The macroeconomic impact of non-manufacture is largely to consumption effects of laborers in this sector as well as to increased factor demand for certain non-manufactures output (Table 6).

A $1 shock to non-manufacture income initiates a chain of events through which the initial flows through the intersectoral linkages specified in the model, resulting in increments to income in each sector. Specifically, a $1 shock to non-manufacture sector generates $0.08 income in the agriculture sector, as compared with only $0.03 in the service sector and $.08 income in the manufacture sector. In addition, the initial shock to non-manufacture feeds back to non-manufacture sector (via the positive effect of increments to another sectors income on non-manufacture) to create an additional $0.11 income in non-manufacture sector. Thus, 27% of non-manufactures indirect contribution to total GDP comes through its effect on income of the manufacture sector, while only 9% of non-manufactures indirect contribution comes through its impact on service sector also 26% of non-manufactures indirect contribution comes through its impact on agriculture sector.

It is important to note that the indirect contribution to service and manufacture and agriculture sectors output have impact on the non-manufacture sector. It is this increment to service, manufacture and agriculture sectors feedbacks to non-manufacture itself account for the remaining 38% of the net impact of an non-manufacture income shock on total GDP.

As a share of the increment to non-agricultural income resulting from the shock 13% comes from the service sector and 36% comes from the manufacture sector.

Conclusions

This study describes the construction and application of simple numerical simulation model of Palestinian economy. The main goal of this study is to measure the linkages between the economies major productive sectors as reflected in macroeconomic growth multipliers. A hypothetical $1.00 increase in agricultural income ultimately adds $1.53 to GDP. Similar shocks to income in the manufacture, non-manufacture and service sectors increase total GDP by $1.52, $1.30 and $1.63, respectively. These results paint a picture of an economy in which intersectoral linkages operate on a highly uneven basis. These limits reflected in the wide disparity between sectoral growth multipliers, and by substantial differences in the pattern of their decomposition. The most robust linkages to emerge from the simulation experiments described before in chapter analysis are between agriculture and service sectors: these two sectors have the two largest multipliers in absolute term, and of the net impacts of income shocks, agriculture and service share the largest portions with each other. In contrast, the two manufacture and non-manufacture sectors have the two smallest multipliers in absolute terms, and manufacture sector retains within itself a much larger share of the net impact of an own-sector income than do any of the other sectors.

The policy relevance of these findings relates, in part, to the distributional implications of growth in particular sectors. Palestinian Center Bureau of Statistics (PCBS) (2011) estimates that agriculture, fishing and forestry accounts for 12% of Palestinian labor force, also Manufacture account 12% of labor force, compared with non-manufacture (commerce, restaurant and hotels and construction) 34% and the services 42%. It is necessary to consider the distribution of both direct and indirect benefits generated by sectoral income shocks in this context. For example a $1 increase in manufacture income generates an additional $0.27 of income (52% of the indirect impact) for its own workforce, which comprises well under 12% of total labour force. Including the initial shock, $1.27(83% of the total benefit) of the $1.52 addition to GDP generated by a shock to manufacture sector income would be concentrated on 12% of labor force. That same shock generates only $0.08 income to be shared the 12% of labor force employed in agriculture. Also same shock generate only$0.02 income to be shared the 42% of labor force employed in services. Similarly, a $1 shock to non-manufacture generates only $0.03 income (9% of the total benefit) for the 42%.

In terms of the "sharing" factor a shock to service sector income in the most regressive. In that case $1.00 shock ultimately increase non-agricultural Income by $1.34 and increases agricultural income by $0.29.thus fully 53% of total income increase is shared by 80% of the labor force while the 20% of labor force employed in agriculture shares 47% of the increase.

In case of manufacture income shock in the most regressive. A $1.00 shocked ultimately increase non-agricultural Income by $1.44 and increases agricultural income by $0.08. Thus, fully 84% of total income increase is shared by 80% of the labor force while the 20 % of labor force employed in agriculture share 16% of the increase.

In case of non-manufacture income shock in the most regressive. A$1.00 shocked ultimately increase non-agricultural income by $1.22 and increases agricultural income by $0.08. Thus, fully 74% of total income increase is shared by 80% of the labor force while the 20% of the labor force employed in agriculture share 26% of the increase.

It is also important to recognize that the results derived from this analysis are conditioned by the constraints currently facing the Palestinian economy. They take no account of the possibility that different initial conditions might dramatically increase the agriculture multiplier.

A concern for poverty alleviation thus points clearly to agriculture as the most efficient sectoral vehicle. In addition, the growth multiplier results presented before indicate that a concentration on agriculture would also make the maximum contribution to Palestinian economic growth.

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