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A STRUCTURAL MODEL FOR PALESTINIAN TERRITORY

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ABBREVIATIONS

PMA	Palestine Monetary Authority
PT	Palestinian Territory
PA	Palestinian Authority
FP	Financial Programming
EM	Econometric Model
DSGE	Dynamic Stochastic General Equilibrium
DPRE	Private Sector Employment
RVAPR	Real Private Sector Value Added
T	Trends
PVAPR	Price Deflator of Private Sector Value Added
DDAWPR$	Daily Average Wage in the Private Sector
PCPIP$	Consumer Price Index
KPR	Private Sector Real Capital Stock
RVAPU	Real Value Added in the Public Sector
DGE	Government Employment
DDAWPU$	Daily Average Wage in the Public Sector
RGFC	Real Government Final Consumption
DGE	Government Employment
FTAID	Total Aid Received
RTEX	Real Total Exports
PTEX	Price Deflator of Total Exports
RTIM	Real Total Imports
RA	Real domestic absorption
PTIM	Price Deflator of Total Imports
RPI	Real Private Investment
DWBPR$	Wage Bill in the Private Sector
DAMWD	Average Monthly Working Days in PT
DWBPU$	Wage Bill in the Public Sector
DWBIS$	Wage Bill in Israel and Settlements
DDAWIS$	Daily Average Wage in Israel and Settlements
DAMWDIS	Average Monthly Working Days in Israel and Settlements
DWBTOTIS$	Total Wage Bill (Private and Public Sector and Israel and Settlements)
GREMIT	Gross Remittances Received from Abroad

RGDP	Real Gross Domestic Product
RGI	Real Government Investment
RGDPFCR	RGDP at factor cost
RNT	Real Tax Net of Subsidies
CGFC	Current Government Final Consumption
FNWE	Government Non-Wage Expenses
FNTR	Government Non-Tax Revenues
FNO	Net Other Government Consumption
DUM00	Equals 1 in 2000 and zero otherwise
DUM01	Equals 1 in 2001 and zero otherwise
DUM02	Equals 1 in 2002 and zero otherwise
DUM03	Equals 1 in 2003 and zero otherwise
DUM05	Equals 1 in 2005 and zero otherwise
D DUM07	Equals 1 in 2007 and zero otherwise
DUMSHIFT	Equals 1 from 2005 to 2011 and zero otherwise

A STRUCTURAL MODEL FOR PALESTINIAN TERRITORY

1. INTRODUCTION: MODELLING IN A CENTRAL BANK

Central banks use different modelling techniques and have different purposes for modelling.

Modelling purposes

Models are used for:

- Forecasting;
- Policy analysis and more specifically monetary policy issues;
- Policy advice to the Government and other institutions;
- Build up research capacity, reputation and credibility.
- Discussing forecasts and policy issues with international organizations, such as the IMF.

Modelling techniques

To serve these ends, several types of modelling tools are used in central banks (we exclude here specific types such as modelling the yield curve,):

- Financial Programming (FP): is mainly used to obtain a coherent picture of the state of the economy and consistency of economic objectives. Sometimes it is also used for forecasting. It is especially popular in countries where the statistical apparatus is still under development.
- Econometric models (EM): are very popular in many central banks. They are used for forecasting (along with judgemental methods), policy analysis and research.
- Combinations of FP and EM: stochastic equations are introduced into the FP model to make its parameters more efficient and to increase its capabilities for forecasting purposes.
- Dynamic Stochastic General Equilibrium Models (DSGE): are more and more in use in central banks with well-developed markets. These models derive important parameters from theory and less from econometric estimations. This new brand of models however is still mostly suited for discussing optimal paths and rules of monetary policy and are less suited for forecasting and simulation analysis.

In the PMA FP and EM are being used and the intention is to introduce EM elements in the FP. The use of EM techniques requires a number of basic elements.

Basic properties of EM

Econometric modelling nowadays is substantially different in several respects from the typical past reference model such as the well-known Klein-model.

First, EM used in central banks and other institutions are now required to contain a well-defined steady state. The steady state is the real anchor point or path of the real side of the economy. In fact, this requirement was related to the growing attention in modelling given to the importance of market agents' expectations. For example, investors will base their investment decisions on the future expected profitability of their investment projects. Consumers base current consumption/ saving decisions on their expectations of future incomes. Incorporating expectations into EM requires an assumption as to the basis market agents base their expectations on. As the Dornbush overshooting model has shown, models and indeed the economy will only display stability if market expectations are formed rationally. Rational expectations require that agents know the long run steady state path of the economy, which therefore should also be included into the EM.

Second, along with the first requirement, the model should not only describe the demand side (as in demand driven models) but should also contain a very explicit description of the supply side. This is because the long run steady state growth path of the economy is mainly supply driven.

Third, the long run steady state and therefore the long run equilibrium conditions in the model should be derived from sound economic theory. Given the importance attached to the role of expectations, behaviour of economic agents is derived and modelled based on intertemporal optimization assumptions (using intertemporal objective functions and intertemporal budget constraints).

Fourth, the econometric estimation strategy is focused on finding the parameters in the long run equilibrium relations. To that end, it uses co-integration tests. Furthermore, shocks make the economy deviate temporarily from its long run steady state growth path. The EM therefore also has to model these short run dynamics describing the inherent market forces that continuously attempt to drive back the economy to its long run path. Also under certain assumptions, these dynamics capture the influence of markets' expectations. To this end, error correction or vector error correction methods are used (describing the correction of

'errors' in the economy, that is the deviations from long run equilibrium). In order to use these techniques, all data have to be checked beforehand on their order of integration.

2. BASIC CHARACTERISTICS OF THE MODEL

The basic characteristics of the model developed in the PMA for the PT economy are the following:

- The ultimate drivers of growth in real output, real income and real expenditures are in the supply side of the economy. More specifically, the growth of labor productivity is the main source of income, demand and welfare creation.
- The estimated behavioral equations are based on accepted theories.
- The focus lies on the estimation and testing of long run equilibrium relationships. The estimated dynamics are modest (only capital accumulation and private investment expenditures contain explicit dynamics). In fact, dynamics originate in large part from the role of expectations on behalf of economic agents. For example, according to mainstream consumer theory, current consumption decisions depend on the expected future path of income growth. But as is well known, when consumers are liquidity constrained, their current consumption decisions mainly depend on current income conditions.
- The focus on the long run relationships also implies that the short run movements of the PT economy are mainly explained by short run shocks to the economy, i.e. short run deviations from long run equilibrium. Most of these shocks are of course unpredictable. But some of the most important ones will be identified and alternative future scenarios will be explored.
- The development of the model is constrained by the availability and quality of official data. Along the way these shortcomings and required improvements in the data will be mentioned.
- This first version of the model only describes some of the basic supply, demand, government and international trade relations. It needs to be developed further to include more interdependencies, especially in the central government accounts and balance of payments. These further developments will show additional gaps in the official statistics which will need to be addressed.

3. MODEL SPECIFICATION

3.1 The supply side[2]

The supply side analysis is based on the following main characteristics:

- Production technology is Cobb-Douglas with labor saving technological progress;
- Firms minimize production costs, given the expected demand for their products and the prices of the production factors: labor and capital. In this way, firms determine their optimal demands for labor and capital.
- Given the optimal cost minimizing production technology, firms set their prices so as to maximize profits, taking into account the price elasticity for the demand for their products.
- Real wage growth is constrained by the growth of labor productivity.
- The consumer price index is a weighted average of the prices of consumer goods and services that are produced domestically and of those that are imported.
- A real private sector capital stock has been constructed according to the permanent inventory model. The capital – output ratio was found to be trend stationary.
- Along the long run steady state, real per capita private sector value added, real private sector wages and all expenditures at constant prices grow at the rate of labor saving technological progress.
- Along the steady state in a fixed exchange rate regime all prices are eventually determined by the cost of imports.

In such a world, the role of policy makers is confined to:

- When shocks occur that make the economy deviate from its steady state, to enhance convergence to the steady sate growth path by taking measures that ensure markets are sufficiently flexible and that promote market competition. Also temporary demand oriented fiscal and monetary policy measures can be appropriate.
- To enhance the technological growth rate of labour productivity by a set of institutional measures, such as investments in education, infrastructure, R&D, well functioning state institutions, credibility of monetary policy insured by an

[2] For a more detailed description, see Michel Dombrecht, et al, "Analysis of the Supply Side of the PT Economy", PMA, January 2012.

independent central bank with full monetary policy functionality, sound fiscal policies, promoting confidence of investors and consumers, attracting foreign direct investments, openness to trade, a performing financial sector, enhancement of the competitiveness of domestic firms on the international and domestic markets, etc. And additionally in the specific case of PT: an expansion of the domestic and international competences of the PA.

Stationarity test revealed that all variables are integrated of order one (at the 5 or 10% level), except for the private sector capital/output ratio which was found to be trend stationary (at the 10% level).

The long run equilibrium relations suggested by theory were estimated over the sample period 1994 – 2010 (using annual data) in reduced form format and were all tested for co-integration. All within and cross equation coefficient restrictions as suggested by the underlying theory were imposed during the estimation.

Also account was taken of the specific shocks that hit the PT economy in the past:

- The second intifada (conflict between Palestinians and Israel) which started September 2000 and strengthened during 2002 and 2003. Its effects were negative for the overall PT economy, but these negative effects differed from year to year and from indicator to indicator.
- During a number of days, trade and labour mobility were prevented or limited by Israeli policy and by the building of the isolation wall. The number of closure days impacted negatively on trade, total output, employment, wages, productivity, etc.;
- The separation between West Bank and Gaza after Hamas controlled the Gaza strip in 2006.
- In 2007 Israel considered the Gaza strip as an enemy entity, which prevented transactions with Gaza in all aspects (trade, labour, banking …) and strengthened closures.
- At the end of 2008 Israel started war on the Gaza strip and this destroyed substantially infrastructures of the economy in the Gaza strip.

The estimation results are presented in **table 1.**

Table 1: The estimation results of the supply system

Variables	Private sector employment	Value added in private sector	Daily average wage in private sector	Consumer price index in Palestine in US$	Private sector real capital stock
CONSTANT	-2.546 [0.061]	-0.146 [0.060]	2.782 [0.02	-1.051 [0.207]	1.938 [0.068]
Real private sector value added	1				
Number of closure days for trade	0.083 [0.014]	0.034 [0.013]			0.106 [0.015]
Cost of imports		1[3]	1		
World food price index				0.225 [0.044]	
Real user cost of capital					-0.098 [0.095]
Trend1	-0.004 [0.002]		-0.004 [0.002		
Trend2					-0.027 [0.002]
DUM00+DUM01 +DUM02		0.091 [0.023]	0.096 [0.025]		
DUM01				0.067 [0.039]	
DUM02+DUM03					0.172 [0.028]
DUM03	0.184 [0.037]				
DUM06					0.091 [0.037]
DUM06+DUM07	0.098 [0.028]				
No. Observations	17	14	12	14	16
Adjusted R^2	96.3	88.4	95.8	97.3	36.5

- [standard error]
- All nominal variables are expressed in USD.

Multiple unit root tests on the complete system indicated that all residuals are stationary, thereby confirming that the estimated equations represent long run equilibrium relationships. Furthermore, system residual portmanteau tests indicate absence of autocorrelation and therefore these equations can be considered to represent an acceptable description of the supply side in the PT economy.

[3] Theortical, an increase of cost of imports or prices by 10%, icreaseses the value added by the same amount, in small open economy.

3.2 The Government sector[4]

The analysis of the government sector in PT is hampered very much by the absence in the official statistics published by the PCBS of a general government account. Also in the national accounts, the government sector is not identified as such in a coherent way.

The representation of the government sector in the model is based on the following characteristics:

- Labour productivity in the government sector seems to be on a declining trend;
- Public value added is driven by real value added (government employment) and the nominal wage rate per government employee;
- The wage rate in the public sector seems to be rising somewhat faster than in the private sector;
- Real public value added (produced by government employment) is by far the largest part of real public consumption of goods and services.

All variables were found to be stationary at the 5 or 10% level. The estimation results are shown in **table 2**.

[4] For a more detailed description, see Michel Dombrecht, et al, The Government Sector in PT, PMA, March 2012.

Table 2: The estimation results of the government sector

Variables	Real Value added in Public sector	Nominal value added in Public sector	Daily average wages in Public sector	Real Government Final consumption	Government Employment
CONSTANT	1.699 [0.019]	0.490 [0.461]	-0.245 [0.524]	0.967 [0.460]	-5.920 [2.357]
Government employment	1[5]				
Real value added in the public sector		0.844 [0.104]		0.989 [0.075]	
Daily average wage in the public sector		0.182 [0.111]			
Daily average wage in the private sector			1.043 [0.214]		
Number of closure days for trade				-0.065 [0.022]	
Total aid received / Consumer price index					0.367 [0.086]
Real Gross Domestic product					0.996 [0.326]
DUM95	0.575 [0.042]				
DUM00-DUM01	-0.132 [0.027]			0.123 [0.042]	
DUM03	0.139 [0.039]			-0.246 [0.063]	
DUM00+DUM01 +DUM02			-0.117 [0.049]		
Trend1	-0.016 [0.002]				
Trend2			0.015 [0.009]		
DUMSHIFT				-0.249 [0.043]	
No. Observation	17	16	12	17	17
Adjusted R^2	98.1	94.8	95	94.5	86.4

[standard error]

Stationarity tests on the residuals of these equations revealed stationarity in levels at the 5 or 10% level and therefore these equations are considered to represent long run equilibrium relationships.

[5] Theoretically, if employment increases by 1% the real value added will increase by 1%, this mean the value of coefficient will equal 1

3.3 International trade[6]

PT international trade is modeled according to the following assumptions:

- Export and imports and their prices are derived from supply and demand relationships, according to an extended version of the well-known Bickerdike-Robinson-Metzler model (the so-called elasticity model);
- Export supply depends on the expected profitability of this kind of production;
- Demand from the rest of the world for domestic products depends on the price competitiveness of domestic products on the world markets and on real income developments in the rest of the world;
- Domestic demand for imports in proportion of total domestic absorption depends on the relative price of foreign suppliers compared to the price of domestic alternatives;
- Prices of domestic suppliers depend on production costs (labor costs) and cost of imports;
- Supply of foreign producers on the domestic market depends on the expected profitability.

All variables were found be integrated of order 1, at the 5 or 10% level. The estimation results are presented in **table 3**

Table 3: The estimation results of the international trade sector

variables	Real total export	Nominal total export	Cost of import	Real total import	Nominal total import	Price deflator of total imports
CONSTANT	7.236 [0.199]	7.084 [0.219]	0.016 [0.016]	-0.723 [0.882]	-0.939 [0.775]	-0.008 [0.012]
Real world GDP calculated by taking an average of import and export weights	0.439 [0.252]	0.484 [0.288]	0.134 [0.099]			
World prices calculated using export weights	1.060 [0.343]	1.454 [0.384]				
Number of closure days for trade	-0.176 [0.040]	-0.144 [0.044]				
Cost of import			0.347 [0.123]	-0.304 [0.094]	0.660 [0.084]	0.961 [0.090]
Real domestic absorption				0.995 [0.100]	1.019 [0.088]	
DUM02+DUM03	-0.181 [0.084]	-0256 [0.094]	-0.064 [0.033]			
DUM05				-0.117 [0.040]	-0.087 [0.035]	
DUM07		0.264 [0.118]	0.193 [0.043]		0.148 [0.035]	0.188 [0.047]
No. Observation	15	15	15	15	15	15
Adjusted R^2	83.4	87.6	85.7	88.7	97.3	91.1

[standard error]

[6]For a more detailed description, see Michel Dombrecht & Shaker Sarsour, "International Trade in the Palestinian Territory", PMA, July 2011.

Stationarity tests applied to the residuals of these equations confirm that these equations can be considered to be long run equilibrium relationships.

3.4 The demand side[7]

This part of the model focuses on private consumption and private investment expenditures. It is based on the following characteristics:

- The PCBS does not publish the income and capital account of the household sector. Therefore the modeling of household expenditures (mainly consumption and housing investment) are extremely difficult to estimate. In fact PCBS does not publish data on households' housing investment expenditures. Therefore the model misses one of the main driving forcers of the business cycle. Also household disposable income is not published so that the modeling of household consumption, had to rely on own estimated components of household income. Also the other explanatory variables suggested by standard consumption theories are not available;
- Given these data constraints, household real consumption depends on real labor income, transfers received from abroad, a wealth effect generated by exchange rate movements and an interest rate effect;
- The deviations of the consumer price deflator and the consumer price index are mainly caused by shocks in the world food prices and other import costs;
- Also the investment expenditures of the corporate sector are unavailable as are the corporate income and capital accounts. Again this means that the most important components of the demand cycle are unavailable. For the modeling purposes, an estimate of the private sector investments was used, which was modeled by using the private sector capital accumulation assumption used in the aggregate supply side of the model.

All variables were checked for stationarity in their first differences. The estimation results are reported in **table 4.**

[7] For a more detailed description, see Michel Dombrecht, et al, "Analysis of the Demand Side of the PT Economy", PMA, February 2012.

Table 4: The estimation results
of the aggregate demand sector

Variables	Real private consumption	The consumer price deflator
CONSTANT	0.596 [0.024]	-0.809 [0.532]
Total wage bill in the domestic private and public sectors and in Israel and settlements, deflated by CPI	0.966 [0.013]	
Nominal remittances from abroad deflated by the consumer price index	0.034 [0.010]	
Exchange rate index of USD/NIS	-0.507 [0.093]	
The US Federal Funds interest rate	-0.028 [0.004]	
Consumer price index in US$		0.923 [0.199]
World food price index		0.186 [0.116]
Cost of import		-0.625 [0.355]
DUM97-DUM00	0.160 [0.024]	
No. Observation	14	14
Adjusted R^2	95.8	97.5

- [standard error]
- Both these equations passed the co-integration tests.

3.5 Links between demand and supply

On the steady state path of the economy, the aggregate supply side determines the growth of employment as function of output, real wage growth, price setting and capital accumulation. Income generation and prices stemming from the supply side are the basis for real demand growth in terms of consumption, imports and investment. These together with export performance and the government activity determine the growth of private sector value added, which in its turn drives private sector employment. These interdependencies between aggregate demand, supply, government activity and international trade are established in a limited number of identities that have to be added to the model:

RPI = KPR - KPR (-1) + 0.033333 * KPR (-1)

DWBPR$ = DDAWPR$ * DAMWD * 12 * DPRE / 1000

DWBPU$ = DDAWPU$ * DAMWD * 12 * DGE / 1000

DWBIS$ = DDAWIS$ * DAMWDIS * 12 * DISE / 1000

DWBTOTIS$ = DWBPR$ + DWBPU$ + DWBIS$

RDWBTOTIS = DWBTOTIS$ / PCPIP$

RGREMITCPI = GREMIT / PCPIP$

RGDP = RPC + RGFC + RPI + RGI + RTEX - RTIM

RGDPFCR = RGDP - RNT

RVAPR = RGDPFCR - RVAPU

RA = RPC + RGFC + RPI + RGI

CGFC = CVAPU + FNWE - FNTR + FNO

4. MODEL SIMULATION

This first version of the model contains 30 equations among which 16 are behavioral stochastic equations. The complete model has been solved and simulated over the common denominator sample period which covers 2000 – 2010.

Such within-sample simulations allow to obtain an impression of the overall performance of the model and to detect shortcomings and to suggest possible improvements. Since RGDP is calculated as the sum of all real demand components of which most are entirely endogenous in the model, comparing the model simulations of real GDP with the observed GDP series gives a good impression of the model performance.

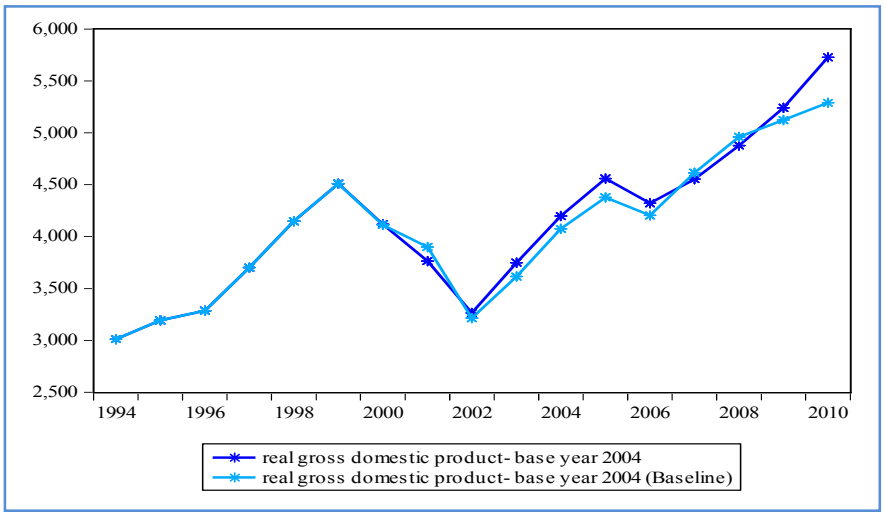
Several simulation methods are possible among which the following are the most important ones:

- In sample static simulation in which the model simulation contains all endogenous interactions, but where previous period errors are corrected. This type of simulation is a relevant criterion to evaluate the in-sample one period ahead forecast capabilities of the model;

- In sample dynamic simulation in which previous period errors are not corrected. This method allows to evaluate the model's performance in more than one period ahead predictions;
- Out of sample forecasts, which allow to evaluate the model's capacity to predict the unknown future, conditional on the assumptions used as to the model's exogenous variables.

By way of example, **figure 1** shows the in-sample static simulation of real GDP over the available sample period in comparison with observed real GDP.

Figure 1: Static in-sample simulation of real GDP



5. FORECAST ANALYSIS

For illustrative as well as for testing purposes the model was used to perform a one year ahead forecast. Such an out-of-sample period forecast requires a correct starting point. This implies that the forecast is based on the observed values of all variables for the periods preceding the forecast horizon. As shown for real GDP in **Figure 1**, this is mostly not the case. Therefore it is necessary to adjust the trajectory of the endogenous variables as explained by the model to track their observed values. This can be done by calculating the add factors for each stochastic equation in each in-sample period.

After introduction of the add factors in the stochastic equations, an out-of-sample forecast needs trajectories for each of the exogenous variables as well as for the future values of the

add factors. In a first step, we adopted a neutral baseline scenario in the sense that the assumed out-of-sample growth rates of each exogenous variable are kept the same as the last year preceding the forecast. Furthermore the last in-sample observed changes in the add factors were extrapolated in the out-of-sample forecast period. Of course this neutral scenario produces a forecast in growth terms which is the same as the previous year. From this neutral approach, the next step is to investigate in which areas the following periods differ from the current ones. This requires adjustments in the paths of the exogenous variables based on the most recent available information. After adjusting the future paths of the exogenous variables according to the available information set, a new baseline forecast can be produced.

In this simple illustrative forecast exercise, we limited ourselves to the first step, i.e. the production of the neutral scenario which will be used as the bench mark for the scenario analysis in the next section.

6. SCENARIO ANALYSIS

Of course, this baseline scenario is conditional on the assumed future values of the exogenous variables. Therefore it is useful to explore alternative scenarios to take into account more pessimistic, or alternatively, more optimistic views about the future. In this sense the central forecast is accompanied with scenario or risk analysis. These alternative scenarios provide also information on the multipliers of the exogenous variables on e.g. real GDP and on all other endogenous variables. They can also be used to design and evaluate policy responses, among which monetary policy actions.

For illustrative purposes we used the model to analyze the effects of two shocks on the PT economy.

The first shock is an increase in the number of closure days for trade. There are several alternative ways to illustrate such a shock. The first one would be a ceteris paribus analysis, introducing a permanent shock over a certain period in the past (in that period the number of closure days would be for example 10% higher in each period compared to the number of closure days that were actually observed over that period). The outcome of that shocked simulation would then be compared with the baseline no-shock scenario. This would allow calculating the cumulated cost in terms of real GDP of the imposition of such trade restrictions. An alternative strategy is to consider the number of closure days as a risk factor in the forecast. The forecast depends on an assumption (for example a neutral assumption) as to the number of closure days in the forecast period. The scenario analysis would then be

focused on the question: what would happen in for example a more pessimistic scenario concerning these trade restrictions. We have chosen the to conduct the latter exercise and to calculate the impact for the 2011 forecast of a 10% higher number of closure days in 2011 as the one assumed in the neutral scenario. The effects on some of the endogenous variables forecasts are illustrated in **table 5**.

Table 5: Effects of A 10% rise in number of closure dates for trade

	2010	2011	Percentage difference
NCDT_0	130.0	120.7	
NCDT_1	130.0	132.8	10.0
RTEX_0	859.1	897.6	
RTEX_1	859.1	882.7	-1.7
RVAPR_0	3935.7	4322.5	
RVAPR_1	3935.7	4274.6	-1.1
DPRE_0	487.0	512.4	
DPRE_1	487.0	510.7	-0.3
KPR_0	27675.8	28022.2	
KPR_1	27675.8	27993.4	-0.1
RPC_0	5966.0	6424.0	
RPC_1	5966.0	6400.0	-0.4
DGE_0	179.0	181.3	
DGE_1	179.0	179.7	-0.9
RDWBTOTIS_0	3050.7	3039.3	
RDWBTOTIS_1	3050.7	3027.6	-0.4
RGDP_0	5728.1	6306.7	
RGDP_1	5728.1	6251.4	-0.9

_0 is the baseline (neutral) value
_1 is the alternative scenario value

As can be seen the 10% higher number of closure days would reduce the real GDP forecast for 2011 by 0.9%. In terms of the steady state properties of the model, this can be explained by the following transmission mechanisms. The most important impact effect of a rise in the number of closure days for trade is a decline in the volume of exports. This reduces the real value added of the private sector, which in its turn puts downward pressure on private sector employment, private capital accumulation, real private sector income and therefore real consumption. The reduced government receipts necessitate the government to limit the expansion of government employment which contributes to the overall deflationary effect of this alternative scenario.

The second shock involves a 10% decline in total grants and donations that flow to the government budget. As can be seen from **table 6** this would reduce real GDP by 0.4%. The shock reduces the public wage bill (part of public wages are no longer paid for). Therefore

also the real total wage bill of the country is reduced, limiting real private consumption. But a large part of the decline in private consumption is accounted by a reduction of imports. Therefore not the real value added of the private sector but rather the decline of public sector value added is responsible for the deflationary effect on real economic growth.

Table 6: effects of A 10% decline

in grants and donations

	2010	2011	Percentage difference
FTAID	1277.0	1163.3	
FTAID_2	1277.0	1047.0	-10.0
DWBPU$_0	1100.7	1174.8	
DWBPU$_2	1100.7	1125.4	-4.2
RDWBTOTIS_0	3050.7	3039.3	
RDWBTOTIS_2	3050.7	3012.3	-0.9
RPC_0	5966.0	6424.0	
RPC_2	5966.0	6368.9	-0.9
RTIM_0	3692.3	4026.9	
RTIM_2	3692.3	4006.8	-0.5
RVAPU_0	798.8	856.4	
RVAPU_2	798.8	820.3	-4.2
RGDP_0	5728.1	6306.7	
RGDP_2	5728.1	6279.5	-0.4

_0 is the baseline (neutral) value
_1 is the alternative scenario value

7. CONCLUSIONS

This paper presents a new structural econometric model for the PT economy. This model was developed in the best recent international central bank practice. This meant that special care has been taken to include a theory and estimation of the steady state of the economy. Also that the estimation of the steady state long run equilibrium relationships is based on best practice, e.g. using co-integration techniques.

This model developed for PT focuses nearly exclusively on the long run equilibrium relations. Short run dynamics are limited to the lags involved in capital accumulation. Given the limited size of the available sample period in the data, it was not possible to estimate simultaneously or separately the short the long term equilibrium and short term dynamics. In fact, given that data used are on an annual basis, a large part of the error correction (correction of deviations from equilibrium) can be assumed to take place within the current year. Furthermore when using the model for testing the effects of shocks to the economy, the main interest lies in

estimating the long run outcomes of such shocks. Also when using the model for forecasting purposes, all deviation from long run equilibrium are taken up by the add-factors which are added to the model equations before starting the forecast.

The model is presented here in a very concise manner. Each of the main sectors included in this model are treated in much more detail in separate papers to which the current paper refers. These separate papers also explain in substantial detail the data restrictions that constrain the application of large elements of mainstream theories to the PT economy. The available macro-economic data for PT are as of yet insufficient to allow analysis according to best international practice. Since such models and analysis in most countries serve as input in monetary policy decisions, the deficiencies in the available macroeconomic data may seriously hamper the PMA when conducting an efficient monetary policy in the future.

Besides presenting the main elements of the model, we also used the model for an out-of-sample forecast exercise as well as for scenario analysis.

The forecast exercise was based on the following steps. First, a neutral baseline scenario was constructed. The neutrality implies that in the forecast period the rates of growth of the exogenous variables and the absolute changes in the add-factors are the same as those observed in the year preceding the forecast. This results of course in a scenario with unchanged (neutral) growth rates of all endogenous variables. The second step consists in updating the current stance of the exogenous variables, as well as including judgment based on all information currently available. This changes the assumed time paths of some or all exogenous variables and if deemed necessary also some of the add-factors. In this way, a new baseline scenario is obtained that can serve as a reference point for alternative scenarios and risk analysis to be the subject of a third step in the overall forecast exercise.

The scenario exercise was limited to the analysis of the two shocks: a 10% increase in the number of closure dates for trade and a 10% decline in total grants and donations flowing to the government budget both in the forecast period for 2011 and as compared to the neutral assumption for the same period. The deflationary effect on real GDP was calculated to be 0.9 and 0.4 % respectively.

Further developments to this first version of the model are necessary. One necessity would be to add more identities such as the budget constraints of all sectors. But unfortunately the national accounts data that are currently available do not allow obtaining a complete and coherent picture of the budgets and their interactions. Furthermore, when longer time series become available, it will be possible to add more dynamics to the model. In general, models require continuous review of their properties and adjustments where necessary.