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# The impact of military expenditure on the Moroccan economy

Jacques Fontanel

In

*Military expenditures and Economic Growth (France, Morocco)*

Report written for United Nations 6, New York, 1982  
Centre d'Etudes de Défense et de Sécurité Internationale, Grenoble

Dans le cadre des études relatives à la proposition de Désarmement pour le Développement organisé par L'ONU, cette étude économétrique et de simulation a pour objectif de mettre en évidence les relations économétriques des grandes variables macroéconomiques d'un pays en voie de développement (Maroc) avec les dépenses militaires globales ou d'investissement. Les résultats ne sont pas toujours solides, même s'ils mettent en évidence le fait que d'autres dépenses publiques seraient plus efficaces pour favoriser la croissance économique des deux pays. L'évolution d'autres variables macroéconomiques, comme l'investissement, l'inflation, les échanges commerciaux, les salaires, l'emploi ou la consommation sont aussi analysées à la suite d'une variation des dépenses militaires.

As part of the studies related to the UN's Disarmament for Development proposal, this econometric and simulation study aims to highlight the econometric relationships of major macroeconomic variables in a developing country (Morocco) with aggregate military spending or investment. The results are not always robust, although they highlight the fact that other public spending would be more effective in promoting economic growth in both countries. The evolution of other macroeconomic variables, such as investment, inflation, trade, wages, employment or consumption are also analysed following a change in military expenditure.

Dépenses militaires, croissance économique, inflation employ, investissement

Military expenditure, economic growth, inflation, employment, investment



We shall present this impact in three strongly interdependent chapters:

- Chapter 1 - Gross results of the regressions
- Chapter 2 - Interpretations of the regressions
- Chapter 3 - The models and their interpretation

#### Chapter 1 - Gross results of the regressions

We shall denote by F, SH, DW, D and SE, respectively, the F test, the homogeneous-sequence test, the Durbin-Watson test, the multiple-determination coefficient, and the residual standard deviation. The figures written under the coefficients calculated by the regressions indicate the results of Student's test. <sup>1/</sup> If we adopt a confidence level of 0.05, it is interesting to note the approximate validity figures for the statistical tests. For the F test, any value above 10 is significant, but we shall consult the table for the validity of the F test for any value below 10. The critical values of Student's test are  $t = 2.13$  (confidence 0.05), and  $t = 1.75$  (confidence 0.1). For DW, the values depend on the number of explanatory variables (k):

For  $k = 1$ , DW inf = 0.95 and DW sup = 1.23;  
For  $k = 2$ , DW inf = 0.83 and DW sup = 1.4;  
For  $k = 3$ , DW inf = 0.71 and DW sup = 1.62;  
For  $k = 4$ , DW inf = 0.59 and DW sup = 1.84.

We shall consult SH and D only in doubtful cases, and SE enables us to choose between two equations which are equally satisfactory at the statistical level.

Nomenclature of the fundamental macroeconomic  
variables of Morocco

GDP	= Gross domestic product in billions of current dirhams (at acquisition values)
CG	= Public consumption in billions of current dirhams
CP	= Private consumption in billions of current dirhams
PIND	= Gross domestic product at acquisition values in billions of constant dirhams (1960)
GFCF	= Gross fixed-capital formation in billions of current dirhams
X	= Exports in billions of current dirhams
M	= Imports in billions of current dirhams
DNR	= Disposable national revenue in billions of current dirhams
IRES	= International reserves in millions of United States dollars at the end of the period
IRESM	= International reserves in billions of current dirhams at the end of the period
IPBC	= Index of economic activity (base 1970)
IPBCP	= Activity index in constant dirhams (base 1970)
W	= Earnings in manufacturing industries (hourly wages) in dirhams
PW	= Wholesale price index (base 1970)
PC	= Consumer price index (base 1970)
CHANGE	= Rate of exchange in United States dollars
TT	= Index of terms of trade
AGRI	= Agricultural activity in billions of current dirhams
IND	= Industrial activity in billions of current dirhams
CONSTR	= Construction activity in billions of current dirhams
COM	= Commercial activity in billions of current dirhams
POP	= Population of Morocco (in millions)
UNEM	= Number of persons declared unemployed
RMME	= Military expenditure in billions of current dirhams (SIPRI Yearbook)
CMME	= Military expenditure in billions of constant (1973) dirhams (SIPRI Yearbook)

CMDME = Military expenditure in billions of constant dollars (prices and rate of exchange in 1973) (SIPRI Yearbook)

IMME = Military expenditure as a percentage of the gross domestic product (SIPRI Yearbook)

MMM = Military imports in billions of current dirhams (USACDA)

MMX = Military exports in billions of current dirhams (USACDA)

RIIMEUS = Total military expenditure in billions of current dirhams (USACDA)

DL = Net balance M - X

DMM = Net balance MMM - MMX

Table 1  
Regressions on the economy of Morocco

(1)	$GDP = 5,69.RMME-1 + 0,26.GDP-1 + 3,5.CG + 1,485$ (1,48) (1,57) (3,3)
(2)	$GDP = 8,89.RMME + 26,59.RMME-1 + Const$ (1,03) (2,79)
(3)	$GDP = 1,46.RMME + 0,715.GDP-1 + 11,31.RMME-1 + Const$ (0,37) (7,2) (2,37)
(4)	$GDP = 5,99.RMME-1 + 4,76.CG + 2,4$ (1,47) (6)
(5)	$GDP = 6,1.CG-1 + 0,24.GDP-1 - 0,35$ (0,95) (0,24)
(6)	$GDP = 1,88.CG-1 + 0,383.GDP-1 + 13,46.RMME-1 + Const$ (0,36) (0,5) (3,14)
(7)	$GDP = 21.RMMEUS + 0,1.GDP-1 + 1$ (1,3) (0,12)
(8)	$GDP = -1,62.GDP-1 + 21,3.RMMEUS + 10,81.CG + 3,79$ (0,53) (1,25) (0,6)
(9)	$GDP = 2,64.CG + 8,15.RMMEUS-1 + 8,42.RMMEUS + 0,36$ (0,46) (0,62) (0,37)
(10)	$GDP = 1,74.CG-1 + 4,59.CG + 1,67$ (1,42) (4,95)
(11)	$GDP = 8,02.CG - 1,12.RMME - 1,17.GFCF + 0,57$ (9,3) (0,5) (4,1)
(12)	$GDP = 4,57.CG + 0,275.GDP-1 + 1,33$ (5,3) (1,57)
(13)	$GDP = 5,9.CG + 2,29$ (33)
(14)	$RMME = 0,526.RMME-1 + 0,019.GDP - 0,062$ (1,35) (1,57)
(15)	$RMME = 0,705.RMME-1 + 0,0163.GDP-1 - 0,069$ (2,55) (1,49)
(16)	$M = 5,53.RMME-1 + 0,935.M-1 - 1,573$ (2,9) (4,24)
(17)	$M = 0,7.M-1 + 4,8.RMME-1 + 0,028.PW-1 - 3,14$ (2,15) (2,3) (0,9)
(18)	$M = 1,17.M-1 + 2,87.RMME-1,42$ (4,7) (1,5)
(19)	$M = 0,935.M-1 + 5,2.RMME-1 - 0,192.CHANGE - 0,5$ (4,1) (1,8) (0,15)
(20)	$M = 1,77.RMME-1 + 0,91.PW - 6,06$ (0,4) (2,6)
(21)	$M = 0,8.M-1 - 1,34.RMME-1 + 0,066.PW - 4,93$ (4,47) (0,47) (2,89)

Table 4

Regressions on the economy of Morocco

(59)	PW	=	85,23.RMME-1	+	0,27.PW-1	-	31,9.CHANGE	-	32,53.RMME	+	213
			(3,4)		(1,91)		(2,96)		(1,66)		
(60)	PW	=	54,62.RMME-1	+	0,289.PW-1	-	27,01.CHANGE	+	Const		
			(3)		(1,92)		(2,42)				
(61)	PW	=	-14,2.CHANGE	+	96,3.RMME-1	+	131				
			(1,1)		(4,15)						
(62)	PW	=	85, RMME-1	+	0,406.PW-1	-	147,22.UNEM-1	+	30,8		
			(4,4)		(2,3)		(0,36)				
(63)	PW	=	- 35,86.RMME	-	39,56.CHANGE-1	+	102,2.RMME-1	+	271,12		
			(1,65)		(3,55)		(3,94)				
(64)	PW	=	49,87.RMME-1	-	17,4.CHANGE	+	0,45.PW-1	+	122,4		
			(2,1)		(1,72)		(2,8)				
(65)	PW	=	0,48.PW-1	-	48,15.CHANGE-1	+	292,62				
			(2,6)		(4,3)						
(67)	PW	=	0,44.PW-1	-	39,44.CHANGE	+	16,93.RMME	+	246,3		
			(2,4)		(2,7)		(0,9)				

Table 5

Supplementary results

(68)	GDP	=	10,3.RMME-1	+	1,68.GFCF-1	+	2,48.CG	+	2,67		
			(2,3)		(1,75)		(1,6)				
(69)	GFCF	=	0,45.GFCF-1	+	5,05.CG	-	0,64.GDP	+	0,09		
			(1,1)		(6,5)		(5,2)				
(69 bis)	CP	=	0,48.CP-1	+	0,12.RMME-1	+	2,27.CG	+	1,21		
			(3,2)		(0,05)		(3,6)				
(69 ter)	X	=	0,81.RMME	+	0,67.PW	-	0,94.CHANGE	+	1,07		
			(0,35)		(4,2)		(0,65)				



Table 6

Statistically satisfactory regressions

Morocco

$$(70) \quad \text{GDP} = 16,79 \cdot \text{RMME-1} + 3,06 \cdot \text{GFCF-1} + 3,02$$

(7,2)                      (6,1)

$$\begin{aligned} \text{DW} &= 2,84 \\ \text{SH} &= 10 \\ \text{D} &= 0,99 \\ \text{F} &= 616 \\ \text{SE} &= 0,626 \end{aligned}$$

$$(71) \quad \text{GDP} = 8,42 \cdot \text{RMME} + 0,822 \cdot \text{GDP-1} - 0,028$$

(2,06)                      (4,48)

$$\begin{aligned} \text{DW} &= 2,69 \\ \text{SH} &= 10 \\ \text{D} &= 0,975 \\ \text{F} &= 246 \\ \text{SE} &= 0,984 \end{aligned}$$

$$(72) \quad \text{GDP} = 13,88 \cdot \text{RMME-1} + 0,66 \cdot \text{GDP-1} + 0,46$$

(3,49)                      (4,19)

$$\begin{aligned} \text{DW} &= 2,41 \\ \text{SH} &= 9 \\ \text{D} &= 0,96 \\ \text{F} &= 368 \\ \text{SE} &= 1,22 \end{aligned}$$

$$(73) \quad \text{GDP} = 7,64 \cdot \text{CG} - 1,077 \cdot \text{GFCF} + 0,73$$

(21)                      (5)

$$\begin{aligned} \text{DW} &= 1,74 \\ \text{SH} &= 8 \\ \text{D} &= 0,996 \\ \text{F} &= 1587 \\ \text{SE} &= 0,39 \end{aligned}$$

$$(74) \quad \text{GDP} = 17,75 \cdot \text{RMME} + 1,235 \cdot \text{GFCF} + 4,85$$

(6,32)                      (3,35)

$$\begin{aligned} \text{DW} &= 1,79 \\ \text{SH} &= 6 \\ \text{D} &= 0,96 \\ \text{F} &= 176 \\ \text{SE} &= 1,16 \end{aligned}$$

$$(75) \quad \text{CP} = 0,84 \cdot \text{CP-1} + 5,93 \cdot \text{RMME-1} + 0,115$$

(5,13)                      (2,24)

$$\begin{aligned} \text{DW} &= 1,73 \\ \text{SH} &= 9 \\ \text{SE} &= 0,54 \\ \text{D} &= 0,98 \\ \text{F} &= 337 \end{aligned}$$

Table 1

Statistically satisfactory regressions

Morocco

(76)	RMME	= 0,76.RMMEUS - 0,072	
			$F = 81,4$ $DW = 1,88$ $SH = 6$ $SE = 0,058$ $D = 0,92$
(77)	M	= 0,935.M-1 + 5,53.RMME-1 - 1,57 (4,24) (2,91)	$F = 124$ $DW = 1,47$ $SH = 5$ $D = 0,945$ $SE = 0,608$
(78)	M	= 0,783.M-1 + 0,0563.PW - 4,48 (4,65) (4,82)	$F = 218$ $DW = 1,33$ $SH = 5$ $D = 0,96$ $SE = 0,46$
(79)	X	= 6,054.RMME-1 - 3,17.CHANGE-1 + 16,76 (3,64) (2,99)	$F = 160$ $DW = 2,785$ $SH = 10$ $D = 0,96$ $SE = 0,44$
(80)	X	= 0,114.PW - 0,036.PW-1 - 4,48 (8,2) (2,1)	$F = 168$ $DW = 1,68$ $SH = 8$ $D = 0,96$ $SE = 0,43$
(81)	CHANGE	= 0,01364.PW + 6,271	$F = 87$ $DW = 1,3$ $SH = 6$ $SE = 0,132$ $D = 0,87$

Table 8

Statistically satisfactory regressions

Morocco

$$(82) \text{ PW} = 82. \text{RMME-1} + 0,42. \text{PW-1} + 26,98$$

(4,9)                      (2,53)

$$\text{DW} = 1,43$$

$$\text{F} = 150$$

$$\text{D} = 0,96$$

$$\text{SE} = 5,08$$

$$\text{SH} = 6$$

$$(83) \text{ PW} = 69,63. \text{RMME-1} - 34,78. \text{CHANGE-1} + 244,5$$

(3,1)                      (3,86)

$$\text{DW} = 1,35$$

$$\text{F} = 173$$

$$\text{D} = 0,96$$

$$\text{SE} = 4,75$$

$$\text{SH} = 6$$

$$(84) \text{ PW} = 35,85. \text{RMME} + 6,09. \text{M} + 61,23$$

(2,14)                      (4,32)

$$\text{DW} = 1,29$$

$$\text{F} = 104$$

$$\text{D} = 0,94$$

$$\text{SE} = 6,05$$

$$(85) \text{ PW} = 70,46. \text{RMME-1} + 3,91. \text{M} + 57,02$$

(3,4)                      (2,58)

$$\text{DW} = 1,14$$

$$\text{F} = 152$$

$$\text{D} = 0,96$$

$$\text{SE} = 5,05$$

$$\text{SH} = 6$$

$$(86) \text{ IND} = 1,665. \text{CMME-1} + 0,147. \text{PIND} + 0,0996$$

(3,41)                      (4,4)

$$\text{DW} = 1,35$$

$$\text{F} = 210$$

$$\text{D} = 0,97$$

$$\text{SE} = 0,102$$

$$\text{SH} = 6$$

$$(87) \text{ IND} = 1,35. \text{CMME} + 0,166. \text{PIND} + 0,0075$$

(2,49)                      (4,36)

$$\text{DW} = 1,49$$

$$\text{F} = 160$$

$$\text{D} = 0,96$$

$$\text{SE} = 0,116$$

$$\text{SH} = 5$$



Table 9

Statistically satisfactory regressions

Morocco

(88)	IND	= 1,37.CMME-1 + 0,943.CMME + 0,105.PIND + 0,225	
		(3,05) (2,15) (2,97)	
			DW = 1,24 D = 0,98 F = 184 SE = 0,09 SH = 5
(89)	TT	= 89,16.CG - 220,3. RMMEUS + 46,72	
		(3,77) (3,3)	
			DW = 1,88 D = 0,76 F = 11 SE = 6,9 SH = 4
(90)	TT	= 32,04.CG - 178,75.DL + 108,04	
		(4,6) (3,3)	
			DW = 2,2 D = 0,72 F = 19,3 SE = 7,38 SH = 9
(91)	DL	= -0,00179.TT + 0,0828.CG + 0,273. RMME + 0,314	
		(2,46) (2,9) (2,43)	
			DW = 1,72 D = 0,97 F = 144 SE = 0,024 SH = 7
(92)	DL	= -0,00255.TT + 0,149.CG + 0,3648	
		(3,3) (14,1)	
			DW = 2,17 D = 0,96 F = 155 SE = 0,028 SH = 9
(93)	GFCF	= 5,187.CG - 0,513.GDF - 2,56.RMME - 0,34	
		(7,7) (4,03) (1,98)	
			DW = 2,04 D = 0,98 F = 180 SE = 0,27 SH = 9
(94)	GFCF	= 5,32.CG - 0,628.GDF - 0,011	
		(5,01) (7,15)	
			DW = 1,69 D = 0,97 F = 215 SE = 0,3

Table 9 bis

Supplementary results for Morocco

(95) $CG = 0,764.CG-1 + 2,137.RMME-1 - 0,18$ (3,76) (2,68)	DW = 1,39 SH = 7 F = 277 SE = 0,156 D = 0,96
(96) $GDP = 8,2.CG - 1,18.GFCF - 2,09.RMME-1 + 0,54$ (8,8) (4,3) (0,65)	
(97) $PW = 0,289.PW-1 - 27,01.CHANGE-1 + 54,62.RMME-1 + 184,5$ (1,92) (2,42) (3)	DW = 1,89 SH = 8 F = 142 SE = 4,3 D = 0,97
(98) $CP = 0,48.CP-1 + 2,29.CG - 1,21$ (3,3) (5)	DW = 1,59 SH = 6 F = 744 SE = 0,364 D = 0,998
(99) $CP = 0,48.CP-1 + 0,12.RMME-1 + 2,27.CG + 1,21$ (3,1) (0,15) (3,6)	

## Chapter 2 - Interpretations

We carried out more than 250 regressions on the Moroccan economy alone. We retained those which we thought most significant at the statistical and theoretical levels. With regard to the information on the Moroccan economy that is provided in annex 4, several variables are not included in the analysis presented in this report, essentially because we have tried to demonstrate the fundamental phenomena of the relation between growth and military expenditure. Thus, disposable national revenue, activity indices, the consumer price index (limited to the city of Casablanca alone), activities in construction or commerce, the population, the number of persons declared unemployed (a variable of very little significance) are not the subject of any particular analysis in this study.

We have dealt in succession with the analysis of the direct impact of military expenditure on:

- Gross domestic product;
- Gross fixed-capital formation;
- Private consumption;
- Public consumption;
- Imports and exports;
- The rate of exchange and the terms of trade;
- The wholesale price index;
- Arms imports and exports, the wage index and the foreign-currency reserve.

We have added a summary investigation of the economic determinants of military expenditure.

### I. Gross domestic product and military expenditure

We shall give priority consideration to the relations between military expenditure and gross domestic product in Morocco. A number of equations were tested, and several of them are statistically significant at a confidence level of 0.05. It should be borne in mind that the phenomenon of multicollinearity plays a very large role in macroeconomic analysis and that consequently it is difficult to demonstrate the explanatory variables that are most significant. Our procedure in terms of "steps" enables us to understand the explanatory contribution of each variable tested, in relation to the other explanatory variables.

We worked with the following explanatory variables: RME, RME-1, GFCF, GFCF-1, GDP-1 and CG.



These six variables are rather closely related to one another, and the statistical tables show the existence of relations between RMTE and RMTE-1, GFCF and GFCF-1, GDP-1 and RMTE, GFCF and CG, etc. Thus, it is necessary to demonstrate the regression or regressions most satisfactory at the statistical level, or more precisely, those which best explain the gross domestic product.

As a first step, it should be noted that CG is always considered a statistically satisfactory explanatory variable, except when the regressions are carried out on nine items of information instead of the 15 generally used. One may legitimately suppose that public consumption has a real share in the explanation of GDP.

Equations 72 and 71 show the important role played by GDP-1 in the explanation of GDP (phenomena of inertia, cumulative effects or habit effects). However, this variable seems less explanatory than CG, a phenomenon clearly shown by equation 12. To be sure, GDP-1 indicates the existing infrastructure of Morocco and the short-term potentialities of economic growth, but external phenomena and the desire of governmental leaders seem to have a more decisive influence. Morocco's gross domestic product is more sensitive to international speculation or to State action than to cumulative phenomena, as is the case in developed countries. This analysis is not surprising in a developing country.

Gross fixed-capital formation constitutes a particularly interesting explanatory variable, which is often statistically significant. Equations 11, 73 and 74 support our proposition. In equation 70 we note a lag of one year between gross fixed-capital formation and its effect on GDP. Equation 73 seems to be statistically most satisfactory (F, D, SE). It appears that investment effort and public expenditure constitute the two fundamental explanatory variables of GDP.

The introduction of military expenditure into this equation is not always significant. We can state, however, that military expenditure for the preceding period has statistical tests which are more correct than military expenditure for the current period (equations 2, 3, 6). Moreover, the notion of military expenditure defined by the United States Department of Defense leads to an aggregate which does not explain very well the growth problems of Morocco (equations 7, 8, 9). In particular, we should note that the introduction of current military expenditure into the equation  $GDP = f(CG, GFCF)$  leads to a very slight contribution of information on GDP and that RMTE has a very low t test. Furthermore, the sign of RMTE becomes negative. In fact, RMTE plays only a weak role in Morocco's economic growth. As an item of public expenditure, it <sup>1/</sup> has a positive role, but this role becomes negative if the other items of public expenditure are included. Thus, it is possible to say that in the absence of any

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<sup>1/</sup> Whenever we use mathematical notation to designate any macroeconomic variable, whether its description in words is singular or plural, we shall use the word "variable" in the singular, with a singular verb. Thus, "RMTE is" means "the variable 'Morocco's military expenditure' is", and "X increases" means "the variable 'exports' increases".

other action, increased military expenditure may lead to a slight increase in gross domestic product, but public action would be better justified, at the strictly economic level, if it were aimed at other items of public expenditure (education, health, etc.). This, in our view, is the most satisfactory explanation of the simultaneous existence of equations 70, 71, 72 and 74 and of equations 11 and 73. In connexion with equation 73, it should be noted that our program indicates t tests of 0.5 and 1.2 respectively for the introduction of RMTE and GFCF-1. On the other hand, for equation 70 the introduction of CG-1 and CG leads to t tests of 0.5 and 1.7 respectively.

To be more precise, let us add that CG and GFCF are closely connected (equations 93 and 94) and that RMTE-1 partially explains the value of CG if we assume that this variable is partly endogenous.

On the other hand, gross domestic product in constant dirhams rejects (equations 22, 23, 24) military expenditure in constant dirhams as an explanatory variable. We can then conclude that military expenditure has no direct impact on growth. However, this does not mean that military expenditure does not affect the country's economic growth; it means merely that this variable cannot be considered a positive or negative factor determining the over-all behaviour of gross domestic product.

To sum up, we may state that Morocco's economic growth:

- Depends fundamentally on public consumption and gross fixed-capital formation;
- Is influenced more or less indirectly by the military expenditure for the preceding period, which, incidentally, plays an appreciable role in the determination of public consumption;
- Is relatively uninfluenced by gross domestic product for the preceding period - thus we observe the interesting fact that the Moroccan economy is not much affected by the cumulative processes characteristic of developed countries but depends on public consumption and gross fixed-capital formation, partly financed by external resources and external centres of decision.

If we introduce the study of the agricultural sector and the industrial sector, we can see that the industrial sector is rather strongly affected by military expenditure, no doubt with a time lag. The situation is not the same for the agricultural sector, which seems to recognize as an explanatory variable only the gross domestic product at purchase prices expressed in constant dirhams (equations 26 and 27).

## II. Military expenditure

Morocco's military expenditure, as defined by SIPRI, is related to military expenditure as defined by USACDA. Although not surprising, this relation should be pointed out, since its quality enables us to extend to RMTEUS the results obtained by using RMTE (equation 76).



The determination of Morocco's military expenditure seems to be subject to constraints which are largely extra-economic. Indeed, equations 14 and 15 demonstrate the low statistical significance of GDP and GDP-1, and while RME-1 seems correct as an explanatory variable in equation 15, it is not correct in equation 14. It appears that Morocco's military expenditure depends on military expenditure for the preceding period (habit effect, development of military products), but other variables not included in our analysis reduce this role somewhat. Thus, it would be desirable to conduct a multidisciplinary study on this subject, but it seems clear that economic phenomena play a very small role in the determination of Morocco's military expenditure.

### III. Gross fixed-capital formation

Equations 93 and 94 designate CG and GDP as explanatory variables of GFCF, the first of these equations also including RME. Equations 37 and 38 also define GFCF-1 as an explanatory variable, which incidentally contradicts equation 34. Lastly, it should be noted that RME is not significant either in equation 36 or in equation 37. As a first step, it seems to us useful to include CG and GDP as fundamental explanatory variables, CG-1 and GDP-1 being rejected in equations 34 and 35.

RME seems to become an explanatory variable as soon as it can assert its specific role as an important item of public expenditure; we can then see that its influence on GFCF becomes negative, a fact which had already been partially taken into account in equations 37 and 36. Equation 93, in our view, should be retained as a part of an analysis aimed at demonstrating the economic ramifications of military expenditure.

Gross fixed-capital formation is:

- A positive function of public expenditure; the first hypothesis concerning GDP is partially confirmed by this equation;
- A negative function of the gross national product; this hypothesis seems paradoxical.

The greater is the gross national product for the current period, the less favourable will be the effect on investments. Theory generally indicates a contrary relation. However, we can find an explanation for this phenomenon in the demonstration of a partially extroverted Moroccan economy. The growth of GDP is often due to an increase in exports, which, incidentally, have a negative effect on GFCF (speculation in raw materials, reduction of investments to bring about shortages that might increase the profits of multinational firms, anomalous effects of the calculation of GDP). It should further be noted that the gross domestic product is also a function of CG, whose role is partially represented in the first term of equation 93. The other components of the national product therefore have a strongly negative effect on gross fixed-capital formation, as if it were possible to make substitutions for the components of GDP;

- A negative function of military expenditure. This kind of expenditure is incurred at the expense of fixed-capital formation.

We have conducted some supplementary studies aimed at demonstrating the role of external factors on investment in the Moroccan economy. We obtained the following results:

$$(M.1) \quad GFCF = 2,1.CG - 0,24.X - 1,69$$

(5,2)      (1,3)

$$(M.2) \quad GFCF = 3,73.CG - 0,27.GDP-1 - 0,4.X - 0,9$$

(1,96)      (4,1)      (2,2)

$$(M.3) \quad GFCF = 1,53.CG - 6,05.RMME-1 + 0,482.M - 0,643$$

(3,3)      (3,4)      (4,3)

$$(M.5) \quad GFCF = 0,7.CG - 0,52.X + 0,3.RMME-1 + 0,75.M - 0,52$$

(2,8)      (6,5)      (0,3)      (11,3)

$$(M.6) \quad GFCF = 0,75.CG - 0,5.X + 0,74.M - 0,53$$

(5,4)      (10)      (14)

The results obtained confirm, on the one hand, our earlier results (positive relation between GFCF and CG, negative relations between GFCF and RMME-1 and between GFCF and GDP-1). On the other hand, they give us two new items of information: gross fixed-capital formation is closely dependent on imports and exports. Equation M.6 (whose other statistical tests are significant at 0.05) <sup>1/</sup> indicates that imports may turn out to be a bottle-neck of appreciable importance for investment in the Moroccan economy and that industries designed for export reduce their productive effort in Morocco considerably, no doubt by holding back the repatriation of capital and limiting fixed assets to the strict minimum. Furthermore, these industries should be relatively non-capitalistic, and they can be developed only by simultaneously reducing the investment potential of other industries which are more strongly capitalistic. Thus, it clearly appears from a reading of these results that there is a rather strong antagonistic relation between activities aimed at the export market and activities aimed at meeting domestic demand. It should be noted that the adjoining of RMME-1 to equation M.6 as an explanatory variable is no longer correct (M.5). However, equation M.3 confirms the direct or indirect influence that military expenditure can have on gross fixed-capital formation.

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<sup>1/</sup> D = 0.996; F = 903; DW = 2.04; SE = 7; SE = 0.12.



#### IV. Private consumption

Equation 39 accepts CP-1 as an explanatory variable but rejects RME. Equation 40 confirms this hypothesis, but it also emphasizes the low statistical significance of RME-1, which, it must be stated, loses some of its significance by reason of the relation connecting it with RME. Equation 75, in our view, should be provisionally retained.

It expresses the fact that Morocco's private consumption depends on:

- Private consumption for the preceding period. This relation was established long ago by Keynesian theory; thus, there is no need to devote much attention to it, even if it is applied to the economy of a developing country;
- Military expenditure for the preceding period. It should be noted that this hypothesis partially verifies the hypothesis we have stated concerning the gross formation of fixed capital. In fact, military expenditure promotes consumption and reduces investment potentialities.

However, equations 98 and 99 partly vitiate this last proposition. Equation 98 shows the close relation between private consumption and governmental expenditure. Equation 99 rejects RME-1 as an explanatory variable of CP. Equation 75 indicates the influence of military expenditure on private consumption in the absence of the variable CG. In fact, RME is bivalent: on the one hand, it expresses an item of governmental expenditure which, like CG, of which it is a part, has an influence on CP; on the other hand, it is seen as a specific phenomenon whose impact on private consumption is negligible. A governmental policy which aims at increasing private consumption should endeavour to increase public expenditure, preferably non-military expenditure.

#### V. Public consumption

Public consumption is often regarded in models as an exogenous variable. However, there are strong chances that this variable will be dependent on the national product, on military expenditure for the preceding period and on military expenditure for the current year. Our equations give an over-all confirmation of this hypothesis.

Public consumption seems to retain two fundamental explanatory variables: public consumption for the preceding period and military expenditure for the preceding period (equations 52 and 53 demonstrate that military expenditure for the current period is not statistically significant). We might have added GDP, but we thought it preferable, for the rest of our analysis, to emphasize these two fundamental explanatory variables (equation 95).

- Public consumption for the preceding period plays a very important role, since its coefficient is 0.764. This relation demonstrates the inertia of public expenditure and the need to develop procedures to be used in considering the case-by-case utility of each item of budgetary expenditure.



The techniques of the zero-base budgeting system could no doubt be put to good use in Morocco. Moreover, certain items of public expenditure commit the State for several periods, and it is normal that there should be a certain continuity in public expenditure.

- Military expenditure for the preceding period leads to an increase in military expenditure for the current period, both because of the choices it implies and because of the development of the role of the State which it promotes during periods of international tension. Military expenditure constitutes an indicator of the influence the State will have on the national economy, at the level of its expenditure and its economic weight.

## VI. Imports - Exports

Equations 77 and 78 indicate that current imports are a function of imports for the preceding period, of military expenditure for the preceding period and of the wholesale price index. Equation 21 indicates that the equation which would explain  $I_t$  on the basis of these three explanatory variables is not satisfactory, since  $RME-1$  is no longer significant; equation 20 confirms this hypothesis; indeed, it appears that  $PG$  is partly determined by  $RME-1$ . Therefore there exists a phenomenon of multicollinearity, which favours  $PG$  at the expense of  $RME-1$  in the explanation of  $I_t$ . We should also note that  $PG-1$ ,  $RME$  and  $CHANGE$  are not significant at all.

It is therefore preferable to retain equation 78, even though the Durbin-Watson test is less satisfactory than the test of equation 77. In fact,  $RME-1$  also has an effect on  $I_t$ , through its action on  $PG$ . Thus, this variable may also be retained as an indirect explanatory variable.

For exports,  $RME-1$ ,  $CHANGE-1$ ,  $PG$  and  $PG-1$  are rejected as explanatory variables. It should be noted that  $PG$  is always rejected, as are  $GDP$ ,  $CHANGE$ ,  $X-1$  and  $RME$ . These rejections are interesting to note:

- The rejection of  $GDP$  shows that Moroccan exports are not linked at all to the country's development; they concern only the extractive industries, whose impact on the Moroccan economy is relatively slight. Thus, exports do not constitute a profound economic phenomenon; they depend on international speculation and on foreign centres of decision.
- The rejection of  $CHANGE$  demonstrates the same reality. The prices of exported products are generally established in dollars, and the income from these activities is not necessarily repatriated. Thus, there is a clear-cut "indifference" between  $CHANGE$  and  $X_t$  in the short term.
- The rejection of  $X-1$  demonstrates the weakness of inertia phenomena on profoundly speculative markets.
- Military expenditure for the current period has little influence on exports, whereas military expenditure for the preceding period may have an effect on this variable.

The rejected variables are more significant at the level of explanation than the accepted explanatory variables, which, except for PG and CHANGE-1, hardly seem to represent important practical and theoretical phenomena. Equation 80 demonstrates the paradoxical role of PG. In the short term, PG has a positive influence on X. The products sold are not very easily replaceable by potential clients, so that an increase in prices in Morocco leads to a maintenance of the quantities sold for export and an increase in export income. At the end of a year, wholesale prices tend to reduce exports, either because customers have looked for replacement products or have decreased their purchases, or because external powers of decision are acting to reduce the phenomenon of imported inflation generated in this way. Equation 79 seems to us less explanatory, but it does indicate that an increase in the rate of exchange leads, in the long term, to a reduction in exports (which is confirmed by economic theory as a whole) and that military expenditure has a positive effect on exports, as if their financing implied an increase in exports, manifested, for example, in larger amounts of phosphates sold. All these phenomena operate simultaneously, but the effects of multicollinearity do not always permit us to define correctly the specific coefficients of the explanatory variables.

A supplementary study led us to the following equation:

$$(11.7) \quad X = -0.058.PG-1 + 0.0945.PG + 0.911.CG - 2.48$$

(3.3)                      (6.2)                      (2.2)

$$F = 149$$

$$DW = 2.06$$

$$SH = 8$$

$$SE = 0.37$$

$$D = 0.97$$

Our analysis in terms of "steps" tells us that the introduction of RME and RME-1 into this equation would not be significant, since the corresponding Student tests would be 0.02 and 0.2 respectively. Another equation test led us to equation 11.8.

$$(11.8) \quad X = -0.04.PG-1 + 0.098.PG + 1.98.RME - 3.65$$

(2.3)                      (5.7)                      (1.5)

It should be noted that the introduction of RME-1 would lead, for this explanatory variable, to a t test of 0.7, which is not significant.

Equation 11.7 confirms our previous hypotheses, but it introduces public expenditure as a fundamental explanatory variable. It appears that the action of the Moroccan State tends to increase the export potentialities of the national economy, an action facilitated by the very small number of exporting industries and firms concerned. Conversely, one may also assume that certain types of public expenditure cannot be tangibly realized except with resources indirectly procured by activities intended for export.



To sum up, we shall say that exports are fundamentally dependent on the price indices for the current period and the preceding period (ambiguity of action depending on term and on time lags) and on public consumption, which represents the action of the State. Military expenditure has only a secondary effect on exports, no doubt limited to the search for the foreign currency needed for the military effort.

The excess of Moroccan imports over exports (DL) includes three supplementary fundamental explanatory variables:

- The terms of trade: the worse they get, the more the excess will tend to increase. This is not paradoxical. Most of the products bought by Morocco are priced in foreign currency; a deterioration of the terms of trade thus leads to an increase in the value of the imports. In order to combat the trade-balance deficit, Morocco must work to prevent the terms of trade from deteriorating; conversely, restoring equilibrium to the trade balance is a prerequisite for an improvement in the terms of trade. This is a vicious circle, which is all the more troublesome because the true centres of decision are frequently prompted to speculate on this deterioration.

- Public consumption increases the trade-balance deficit. The State has a paradoxical role, since it promotes imports, no doubt in its efforts to encourage investment.

- Lastly, military expenditure has a positive influence on this excess of imports over exports, which is not surprising, since Morocco imports its armaments (or at least part of its armaments) and does not export any military matériel.

#### VII. Exchange and the terms of trade

It is extremely difficult to demonstrate the role of the different explanatory variables affecting the rate of exchange, since there has been a change in its international regulation. We have passed from a fixed rate of exchange to a fluctuating rate of exchange; these two systems have explanatory variables which are undoubtedly quite different. Our study is not very significant even if we note the negative influence of PG on the rate of exchange (which confirms the theory) and the over-all negative influence of expenditure for military matériel, most of which comes from abroad.

With regard to terms of trade, it should be noted that, on the basis of the figures published by the United Nations, they are independent of the rate of exchange. Equations 49 and 50 verify this hypothesis. In contrast, public consumption seems to have a constant rather positive influence on the terms of trade, whereas military expenditure as a whole promotes their deterioration (which is not surprising). Lastly, it should be noted that the deficit in the trade balance reduces the value of the terms of trade. It appears, in the light of these results, that a voluntaristic action by the State is likely to work against the deterioration of the terms of trade, that military expenditure has a negative influence on TT and that the same is true of the net trade balance.

### VIII. The wholesale price index

Our regressions make clear the following:

- The globally inflationary role of military expenditure (equations 59, 60, 61, 62, 63, 82, 83, 84, 85), no doubt with a one-year time lag. This demonstration of the negative role military expenditure plays at the level of prices seems to us extremely important.

- The rate of exchange also may constitute an explanatory variable (again with a one-year time lag) (equation 83). If the rate of exchange decreases, wholesale prices also tend to decrease. This relation is confirmed by the demonstration of the effect of imports on price increases (equations 83 and 84). Much of the inflation troubling Morocco today is of external origin, with imported products having a very direct influence on the level of wholesale prices.

On the other hand, unemployment, or even wholesale prices for the preceding period, will not always be very significant as an explanatory variable of PG in spite of equation 82.

### IX. Other variables

In our work for this report, we have prepared many other regressions which are not presented here. However, we should note some supplementary results.

Studies were conducted on the excess of arms imports over arms exports, as defined by USACDA. We found virtually no significant explanatory variables other than CHANGE. No doubt this research should have been continued. Nevertheless, it appears that the rate of exchange constitutes an important factor in the decision to buy or sell (most especially to buy). If the rate of exchange is very high, the excess will decrease, since purchases made abroad will cost less. Morocco's foreign-currency reserves seem to accept only  $\Delta$  as an explanatory variable. It should be noted that  $R_{MEE}$  may also constitute an explanatory variable, directly or indirectly. The result is paradoxical, since an increase in expenditure for military matériel, largely imported, leads to an increase in foreign currency; however, this overlooks the fact that an increase in military expenditure generates an increase in exports to finance it and to make a preventive response to the possible problems suggested by the aggravation of international tension.

Lastly, the wage index seems to be partly a function of military expenditure. Each time military expenditure increases, it generates inflationary tensions which have repercussions on wages. Moreover, the military effort generally leads to a reduction in unemployment, which can have a favourable effect on wages.

### Chapter 3 - The models and their interpretation

We shall take account of the gross domestic product, imports, exports, public consumption, private consumption, gross fixed-capital formation and the wholesale price index.

For GDP, equations 70 and 71 can be rejected, since the DW test is not significant. As our first relation, we shall use equation 72, although its SE value is low. Equation 74 seems more interesting and empirically more exact, but, when we take account of the equation used for expressing gross fixed-capital formation, this equation leads to the construction of a model with simultaneous equations, for which the use of the least-square method is no longer satisfactory. We could, of course, resort to the method of double least squares, but that could mean turning the non-specialist reader's attention to techniques which are relatively complex to explain. Since our model is aimed primarily at demonstrating orders of magnitude, we feel that equation 72 is entirely usable. An analysis less oriented towards military expenditure would, instead, use equation 73, which is statistically more significant. We shall use this for model 2.

For private consumption, we shall use equation 75 for the first model and equation 98 for the second model, in accordance with the criteria defined earlier.

For imports, we shall use equation 77 for the first model, but we believe that equation 78, despite a low DW, is statistically more significant. The low DW value can be explained by the unduly large reduction in the number of explanatory factors, not by the lack of any relation between M on the one hand and M-1 and PG on the other hand.

For exports, equation M.7, which offers the best statistical guarantees from every point of view, will be used for both models.

For gross fixed-capital formation, if preference is to be given to the role of RME, we feel that equation 93 should be used, even though the t value of the coefficient of RME is significant only at 0.06. For model 2, we shall use equation M.6, which undoubtedly offers the best theoretical and practical explanation of gross fixed-capital formation in the Moroccan economy.

For the wholesale price indices, equation 97 will be used in both models.

Lastly, public expenditure may be pictured as a simple exogenous variable or as an endogenous variable (equation 95). We shall use both possibilities, while emphasizing in the first case the inevitable inertia of public expenditure.

#### I. Model 1

This is a recursive model with eight equations and nine unknowns. RME is considered an exogenous variable, although this is only partly true.



- (E.1)  $GDP = 13,88.RMME-1 + 0,66.GDP-1 + 0,46$
- (E.2)  $M = 0,935.M-1 + 5,53.RMME-1 - 1,57$
- (E.3)  $CG = 0,764.CG-1 + 2,14.RMME-1 - 0,18$
- (E.4)  $GFCF = 5,19.CG - 0,51.GDP - 2,6.RMME - 0,34$
- (E.5)  $CP = 0,84.CP-1 + 5,93.RMME-1 + 0,12$
- (E.6)  $PG = 0,29.PG-1 - 27.CHANGE + 54,6RMME-1 + 184,5$
- (E.7)  $X = 0,0945.PG - 0,058.PG-1 + 0,911.CG - 2,48$
- (E.8)  $CHANGE = - 0,01364.PG + 6,271$

It should be noted that equation E.8 does not seem satisfactory to us, but, in view of the variables used in our model, we shall accept it as a first approximation; we shall then regard the value of CHANGE obtained by E.8 as the one resulting from the action of the explanatory variable PG alone, independently of the other direct influences (situation of the dollar, crisis or prosperity in the Western world, international price of raw materials, international reserves, confidence in the Moroccan economy, etc.).

It should be noted that the gross national product is calculated by two procedures: the first shows the value of the gross national product as explained solely by trends in military expenditure during the preceding period and the cumulative effects of growth represented by the gross national product for the preceding period; the second, less direct, makes possible an estimation of GDP through consumption, gross fixed-capital formation and the net trade balance. The first value may be regarded as an estimate made by investors concerning growth factors inherited from the recent past; the second value, which has a Keynesian basis, will be used as the most satisfactory estimate of GDP, since it brings in more explanatory variables than the first equation. The more the tested policies represent a continuation of the past, the more closely the two values will converge. On the other hand, a serious change in public consumption or military expenditure leads to highly divergent results, as a result both of the different time lags and of the more or less complete consideration of the interdependences between the different variables which are directly or indirectly explanatory. These divergences demonstrate the "voluntaristic" nature of State action; they reveal quite clearly the impact of decisions taken by the State that represent a break with tradition. Thus, there is no contradiction between these two calculations. The first is a response to the normal action of economic mechanisms, while the second reveals the State's "bet on new structures". The first will serve for obtaining the value of gross fixed-capital formation; thus, it will be seen as a provisional calculation, representative of investors' perception of economic growth. The second will fix more precisely the investment actually made.

In policy 1, public consumption is considered an endogenous variable, and military expenditure increases regularly by 10 per cent in nominal value per year.

A number of comments should be made:

Table 10-1: Simulations of model 1

Variables								
	Policy 1				Policy 2			
	1	2	3	4	1	2	3	4
RMME	1	1,1	1,21	1,33	1	1	1	1
CG	5,58	6,24	7,17	7,9	5,58	6,24	7,17	7,9
PG	169,4	181,3	194,5	209,7	169,4	181,3	189,1	194
X	9,26	10,5	11,9	13,3	9,26	10,5	11,4	12,1
GDP	33,2	36	39,4	43,3	33,2	36	38	41,3
GFCF	9,13	10,7	13,5	15,6	9,13	9,4	14,8	16
CP	23,2	25,5	28	30,8	23,2	25,5	27,5	29,2
M	14,5	17,5	20,9	24,7	14,5	17,5	20,3	22,9
CHANGE	3,96	3,8	3,6	3,5	3,96	3,8	3,7	3,6
GDP(2)	32,7	35,5	39,7	42,9	32,7	35,5	40,5	42,3
=====								
	Policy 3				Policy 4			
RMME	0,9	0,9	0,8	0,7	0,9	0,9	0,8	0,7
CG	5,5	6	6,8	7,3	6	7,5	9,2	11
PG	169,4	175,8	180,1	177,5	169,4	175,8	180,1	177,5
X	9,2	9,8	10,5	10,5	9,7	11	12,7	13,9
GDP	33,2	34,3	36,2	36,8	33,2	36,6	41	45,1
GFCF	8,9	10,9	14,4	17	11,5	17,6	24,4	32,9
CP	23,2	24,9	26,4	27	23,2	24,9	26,4	27
M	14,5	17	19,3	20,9	14,5	17	19,3	20,9
CHANGE	3,96	3,87	3,81	3,83	3,96	3,87	3,81	3,83
GDP(2)	32,1	34,6	38,4	40,5	35,7	44,1	53,4	63,9

- The gross national product increases regularly by 9.3 to 9.6 per cent a year in nominal value, but the wholesale price index increases parallel with this by 7 to 7.8 per cent a year. The total real growth rate for the four years does not exceed 11.4 per cent in real terms. Thus there is some economic growth, but it is relatively low for a developing country whose population increases regularly by 2.4 per cent a year - in other words, by 7.4 per cent for the next three years. Furthermore, there is an increase, and a slight acceleration, in inflation.

- Stability of the trade balance is not ensured. The deficit increases from 5.24 billion dirhams to 11.4 billion dirhams, which is equivalent to an increase from 3.1 to 5.4 billion constant dirhams. As a percentage of the real gross national product, the increase is from 16 per cent to 26.5 per cent, which is enormous. This shows a dangerous increase in foreign indebtedness.

- Gross fixed-capital formation increases from 27.9 per cent of GNP to 36.1 per cent, which constitutes a considerable effort, both quantitatively and qualitatively. It should be noted that private consumption, in real terms, increases by only 7.2 per cent from year 1 to year 4, which, we believe, is slightly below the foreseeable population increase during the same period.

The economic situation depicted in this way is not very satisfactory:

- Acceleration of inflation;
- Low per capita economic growth;
- Maintenance, or even reduction, of per capita consumption;
- Aggravation of the trade-balance deficit.

Policy 3 aims at reducing military expenditure; it retains the same public expenditure as policy 1, except for military expenditure, which is lower. The results are very interesting:

- There is a reduction in the inflation rate, to such a point that the wholesale price index decreases in the fourth period. While the growth rate of GDP decreases in nominal value (26 per cent over the entire period), it increases in real value (22 per cent over the entire period).

- On the other hand, the trade-balance deficit remains the same in absolute value (5.86 billion constant dirhams). It is interesting to note that this policy 3 nevertheless constitutes an important step forward in comparison with policy 1, since the burden of the foreign debt is less heavy in proportion to GDP (25.7 per cent as against 26.5 per cent). However, the situation remains very disturbing.

- Gross fixed-capital formation increases from 8.9 to 17 billion dirhams, which means an increase of 91 per cent over three years, as against 16 per cent for private consumption. It should be noted that imports increase rapidly, partly because of the considerable effort made to promote investment; moreover, a decrease



in military expenditure results in a reduction of consumption potentialities if this decrease is not accompanied by an at least equal increase in other types of public expenditure.

Progressive disarmament, without replacement of military expenditure, leads to a reduction of inflation, an increase of the gross national product in real terms, an increase in gross fixed-capital formation to the detriment of private consumption and a rather small reduction, in relative value in comparison with GNP, of the trade-balance deficit. All in all, while such disarmament action does not solve all problems, it does seem an economically favourable step.

Policy 2 retains the same value for governmental expenditure as policy 1, but it keeps its military expenditure down to 1 billion current dirhams. We find:

- That the inflation rate lies between the rate resulting from policy 1 and the rate resulting from policy 3. It should be noted that the same is true of GDP, whose value in constant terms for the fourth period is 20.5, 21.8 and 22.8 billion dirhams for policies 1, 2 and 3 respectively.

- That the trade-balance deficit is reduced to 10.8 billion current dirhams, which is 25.5 per cent of GNP, somewhat lower than in the case of the other policies.

- That gross fixed-capital formation increases by 75 per cent in current dirhams, as against 26 per cent for private consumption. It should be noted that the real rate of increase of GFCF is equal to 38 per cent for policy 1, 53 per cent for policy 2 and 82 per cent for policy 3, while consumption increases by 7.2 per cent for policy 1, 9.9 per cent for policy 2 and 11 per cent for policy 3.

For all these reasons, policy 3 is by far the most satisfactory; it provides an incentive for disarmament and for an increase or maintenance of public-expenditure commitments.

Policy 4 tests a combined policy of disarmament and increased public consumption (a satisfactory indicator of State action). We find:

- That inflation is reduced by reason of the disarmament and that governmental action does not lead to a worsening of inflationary tensions except in the area of military expenditure. No doubt we must see in this phenomenon the existence of serious unemployment and chronic underemployment.

- That the GNP increases considerably, its real value going from 21 billion dirhams to 36 billion dirhams, or a rate of increase of 70 per cent in three years.

- That the trade balance tends to be restored, since its deficit now represents only 11 per cent of the GNP. We therefore **see a considerable improvement** in Morocco's competitive situation.

- That gross fixed-capital formation increases by 200 per cent in three years, while private consumption remains at the level obtained by policy 3.

Our first model favours RMME as an explanatory variable; it clearly shows the direct and indirect impact of RMME on growth and inflation. Military expenditure plays a largely negative role in the Moroccan economy, but a model less concentrated on RMME may reveal a less central role of military expenditure as an influence on economic growth.

## II. Model 2

We have considerably modified the model in order to use the most satisfactory equations among those that we have tested.

$$(1) \text{ PW} = 0,29.\text{PW}-1 - 27.\text{CHANGE}-1 + 54,6.\text{RMME}-1 + 184,5$$

$$(2) \text{ M} = 0,783.\text{M}-1 + 0,0563.\text{PW} - 4,48$$

$$(3) \text{ X} = -0,058.\text{PW}-1 + 0,0945.\text{PW} + 0,911.\text{CG} - 2,48$$

$$(4) \text{ GFCF} = 0,75.\text{CG} - 0,5.\text{X} + 0,74.\text{M} - 0,53$$

$$(5) \text{ CP} = 0,48.\text{CP}-1 + 2,29.\text{CG} + 1,2$$

$$(6) \text{ GNP} = \text{GFCF} + \text{CP} + \text{CG} + \text{X} - \text{M}$$

$$(7) \text{ CHANGE} = - 0,01364.\text{PW} + 6,271$$

This model differs from model 1 in the equations for M, GFCF and CP, which we think are more satisfactory in model 2.

Several remarks may be made at this point:

- For policy 1, we find that while inflation is the same as the value obtained with model 1, GNP has a higher growth rate, because of the increased role assigned to public consumption by the new model. Furthermore, the trade balance no longer has such a large deficit, since imports are considerably reduced; we can then see that military expenditure constitutes, among the various kinds of public expenditure, a very important direct and indirect source of imports. Lastly, gross fixed-capital formation increases less rapidly than in the case of model 1, unlike private consumption, which increases by 13 per cent over three years (instead of 7.2 per cent with the first model).

- For policy 2 tested on model 2 (which we must compare with policy 3 of model 1), we find the same trend, with a reduction in imports, the same exports, the same price indices, an appreciable reduction in gross fixed-capital formation, and a development of private consumption and the gross national product.

- The same situation holds for policy 3. The results are more or less confirmed, with three exceptions:

- Public consumption constitutes the fundamental explanatory variable of gross fixed-capital formation, but it does not necessarily act to the detriment

of private consumption. Military expenditure, on the other hand, favours investment, but it is impossible within the framework of our study to state precisely what kind of investment is involved.

- The trade balance shows lower deficits than indicated on the basis of model 1. The appreciable reduction in imports should be emphasized.

- The gross national product is quite clearly higher in the tests of model 2. The reason for this must be sought in the fact that governmental expenditure has a more positive effect on growth than military consumption can have. This action has an impact mainly on private consumption.

Thus, the results are not basically called into question. We could then test the null hypothesis, according to which the results obtained by the different policies are significantly different, by utilizing, for example, the chi-square test. The results obtained have all been positive, which is not surprising when we note the magnitude of the deviations. It should be noted that we could have supplemented our analysis with stochastic simulations, applying a normal law of zero mathematical expectation and variance defined by SE. These results did not seem necessary to us, in view of the magnitude of the deviations and the relatively small size of the residual variance. Moreover, our study is aimed at demonstrating the fundamental relations and their interactions, in order to determine the most probable ones, taking into account our concentration on military expenditure. We have therefore achieved our objective.



Table 10-2: Simulations of model 2

Periods					Periods			
Policy 1					Policy 2			
	1	2	3	4	1	2	3	4
RMME	1	1,1	1,21	1,33	0,9	0,9	0,8	0,7
CG	5,58	6,24	7,17	7,9	5,5	6	6,8	7,3
M	14,2	16,8	19,6	22,7	14,2	16,5	18,6	20,1
GFCF	9,5	11,3	13,4	15,2	9,5	11,3	13,1	14,6
PW	169,4	181,3	194,5	209,7	169,4	175,8	180,1	177,5
CP	24	27	30,6	34	23,8	26,4	29,4	32
X	9,3	10,5	11,9	13,3	9,2	9,8	10,5	10,5
GDP	34,2	38,2	43,5	48	33,8	37	41,2	44,3
Policy 3								
	1	2	3	4				
RMME	0,9	0,9	0,8	0,7				
CG	6	7,5	9,2	11				
PW	169,4	175,8	180,1	177,5				
X	9,7	11	12,7	13,9				
M	14,2	16,5	18,6	20,1				
GFCF	9,6	11,8	13,8	15,6				
CP	25	30,4	36,9	44,1				
GDP	36,1	44,2	54	64,5				

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