الجمهورية العربية المتحدة

معهد التخطيط القومي

Memo No 591

Imports Requirement For Exports Plan

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17 Aug. 1965.

القاهرة

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The following work has been done under the suggestion of Dr. Nazih Deif, the Minister of Treasury.

Contents

Introduction

In short term sectorial planning, it would be of great help to the planner to know the required foreign currency which will be necessary to implement his plan.

To be specific, we shall consider the period of short term planning to be one year and the sector under discussion to be the industrial sector.

One of the main immediate purposes of planning in a given sector is to avail given production which will enable us to meet the intermediate demand on that sector and the final demand with its various components. One of the critical components of the final demand is the export component. Exports are one of the important sources of increasing our resevoir of foreign currency and improving our creditor position.

So it is not surprising to see the planner in a given sector, especially in the industrial one, stressing very clearly the exporting power of his plans.

We must remember however that to fulfill that plan of exports, we need to avail given production for that purpose and this in turn does require certain amount of non-competitive imports and does require other intermediate demand from other sectors, which in turn press for more demand on non-competitive imports.

This means that the plan of export in given sector does require certain amount of non-competitive imports to that sector and to the other sectors of the economy. That burden on the creditor position should be considered whenever we are considering the exports plan of-given sector. The planner usually puts that in consideration and whenever he presents an exports plan for a given sector, it is usually coupled with the foreign currency required for the fulfillement of the plan.

However this foreign currency are usually that needed to that given sector and are the direct ones. The indirect effects

and the burden on the other sectors are generally not stated specifically in the request of the planner. That situation usually leads towards bottlenecks hindering the implementation of the plan. It is the purpose of this study to describe the methodology of getting these effects coupled with a pilot example to show the numerical approach involved in this methodology.

The model:

To get the direct and indirect effect on the non-competitive imports due to a given vector of the final demand is a classical problem in the domain of Input - Output analysis*.

If X'_{kh} = The technical I/O coefficient

n = No of the sectors in the I/O table

B'_h = The coefficient of the non-competitive imports in sector h

ΔD_k = Change in final demand in sector k

ΔX_h = Required production in sector h to meet the final demand vector ΔD_k

ΔB_{hk} = The non-competitive imports of sector h due to unit demand in sector k

δ_{hk} = unit matrix.

Then we have

$$\Delta X_h = \sum_{k=1}^{n} (\delta - X')^{-1}_{hk} \Delta D_k \quad \ldots \quad (1)^{**}$$

$$(\Delta B)_{hk} = B'_h (\delta - X')^{-1}_{hk} \quad \ldots \quad (2)$$

where $(\delta - X')^{-1}_{hk}$ is the inverse of the matrix $(\delta - X')_{kh}$.

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* See For example Memo No 3 To the National Planning Committe Cairo by Ragnar Frisch Dec. 1957-Memo. No. 360 by S. Hamid & F. Omar

** In equation (1), h & k indices decribing the order of the row & column respectively.

Notice that the matrix $(\Delta B)_{hk}$ can be computed once for all and it is a characteristic of our economy.

Call that matrix the import requirement matrix. The vertical sum

$$S(k) = \sum_{h=1}^{n} (\Delta B)_{hk} \qquad \ldots (3)$$

of any given column k in the import requirement matrix has a very significent meaning.

It gives the <u>total</u> non-competitive imports (direct & indirect) required to fulfill a <u>unit</u> of final demand in sector k. If that unit of final demand to be used in export, then the real exporting power of that sector is EX(k) given by

$$EX(k) = 1 - S(k) \qquad \ldots (4)$$

The exporting power EX(k) of sector k, requires non-competitive imports S(k). In other words, the non-competitive imports S(k) allocated to sector k, will produce an exporting power EX(k). This means that a unit of non-competitive imports to sector k will produce an exporting ability $EX_o(k)$ given by

$$EX_o(k) = (1 - S(k))/ S(k) \qquad \ldots (5)$$

The index $EX_o(k)$ is very important in describing the potentiality of the different sectors in exporting. In the above model, we assumed, off hand, that the different sectors of our economy have unlimited level of production, i.e. the different sectors can increase their capacities by the required level to meet the final demand or any of its components.

There are, however, some sectors in the economy which are already working at maximum capacity. In the near future, at least within the span of the period of the short plan - (in our case it is equal to <u>one</u> year) - there is no possibility of increase in the production of these sectors. One obvious example of such sectors, in our economy, is the agriculture sector. In the following section a modified model is given to allow for the fact that some of the sectors are working at maximum capacity.

The modified model-(some sectors at maximum capacity):

Let r,s,...t be the sectors whose capacities are at maximum bound. This means that

$$\Delta X_j = 0 \qquad \ldots \quad (6)$$

where $j = r,s,\ldots t$

From (6) and (1) we have

$$0 = \sum_{k=1}^{n} (\delta - X')^{-1}_{hk} \Delta D_k$$

where $h = r,s,\ldots t$ (7)

and

$$\Delta X_h = \sum_{k=1}^{n} (\delta - X')^{-1}_{hk} \Delta D_k$$

where $h = 1,2,\ldots) r,s,\ldots,t(\ldots n$ *

By successive pivoting around the pivotal elements jj where $j = r,s,\ldots t$, equations (7) can be rewritten in the following form

$$\left.\begin{aligned} \Delta Z_h &= \sum_{k=1,2,..)r,s,..t(..n,} \gamma_{hk} \Delta D_k \\ &\text{where} \quad h = 1,2,\ldots n \\ &\text{and for} \quad h = r,s,\ldots t \qquad \Delta Z_h = \Delta D_h \\ &\text{and for} \quad h = 1,2,\ldots)r,s,\ldots,t(\ldots n \qquad \Delta Z_h = \Delta X_h \end{aligned}\right\} \quad (8)$$

The set of equations (8) in this modified model corresponds to equations (1) in the original model where there were no limits on the capacities of the different sectors.

Now consider the burden in the imports due to given vector of final demand, in exports says. For simplicity let that given vector of final demand does not include those sectors working at maximum capacity.

That means, if this vector is given by ΔD_k, $k = \alpha, \beta \ldots, \delta$, then $\alpha, \beta, \ldots \delta$ do not include r,s,...t.

*) r,s,...t (means excluding r,s,...t

The original given matrix inputs, do include the non-competitive imports. Program II frees the technical coefficients derived from program 1, from the non-competitive imports content, provided we are given the non-competitive imports coefficient B'_h ($h=1 \rightarrow 29$). Program II gives as an output X'_{kh} ($k=1 \rightarrow 29$, $h=1 \rightarrow 29$), which are freed from the non-competitive imports.
Program III & IV give the matrix $(\delta - X')_{kh}$ and $(\delta - X')^{-1}_{hk}$.

In this numerical example, sectors 1 & 2 are assumed to be working at maximum capacity.
Putting that into consideration, program V gives the coefficient γ_{hk} , $h = 1 \rightarrow 29$, $k=3 \rightarrow 29$
It gives also S(k), EX(k) & $EX_o(k)$ for $k = 3 \rightarrow 29$ for both alternatives A & B.
So far the final result obtained via program V can be considered as general characteristics of our economy based on the initial input-output table & the non-competitive imports.
We can use these general results in getting the repercussion of any given policy of exports plan. For example, for given exports plan for the industrial sectors, i.e. for a given vector of export DD(k), $k = 3 \rightarrow 24$, program VI enables us to compute the non-competitive imports DS2(k) required from the industrial sectors ($k=3 \rightarrow 24$), corresponding to each export element DD(k). The program gives also the required non-competitive imports DS3(k) required from the other sectors ($k=25 \rightarrow 29$) and the final demand $DS_1(k)$ from sectors 1 & 2.

i.e. $$DS_1(k) = DD(k) \sum_{h=1,2} |\gamma_{hk}|$$

$$DS_2(k) = DD(k) \sum_{h=3 \rightarrow 24} B'_h \gamma_{hk}$$

$$DS_3(k) = DD(k) \sum_{h=25 \rightarrow 29} B'_h \gamma_{hk}$$

In the following appendix, Fortran programs 1 → 6 are given right with the coresponding symbolic tables of the various inputs & outputs.

Table 0

k \ h	1 2 3 29
99900101 02 03 ⋮ 29	X_{kh}
99900130	X_h

Table I

k \ h	1 2 3 29
99900201 02 03 ⋮ 29	$\grave{X}_{okh}$
99900230	$\grave{B}_h = 0$
99900231	$\grave{V}_h = (1 - \sum_k \grave{X}_{okh} - \grave{B}_h)$

Table II

k \ h	1	2	3	.....	29
99900301					
02					
03					
⋮			X'_{kh}		
29					
99900330			B'_h		

$$B'_h + \sum_k X_{kh} = \sum_k X'_{okh}$$ From table I and II

Table III

k \ h	1	2	3	.....	29
99900401					
02					
03					
⋮			$(\delta - X')_{kh}$		
29					

Table IV

k \ h	1	2	3	.....	29
99900501					
02					
03					
⋮					
29					

$(\delta - X')^{-1}_{hk}$

Table V a.

h \ k	ΔD_3	ΔD_4	ΔD_5	.....	ΔD_{29}
99900601 ΔD_1		γ 1k			
99900602 ΔD_2		γ 2k			
99900603					
ΔX_h		γ_{hk}			
⋮					
29					

Table V b.

k / h	3 4 5 29
99900703 ⋮ 99900729	$B'_h \gamma_{hk}$
99900899	$S_k = \sum_k B'_h \gamma_{hk}$
99900999	$EX(k) = Sl_k = (1 - \sum_k B'_h \gamma_{hk}) / \sum_k B'_h \gamma_{hK}$
99901099	$S_k = {}_k B'_h \gamma_{hk} - (\gamma_{1k} + \gamma_{2k})$ *
99901199	$EX_o(k) = Sl_k = 1 - \left[\sum_k B'_h \gamma_{hk} - (\gamma_{1k} + \gamma_{2k})\right] / \left[\sum_k B'_h \gamma_{hk} - (\gamma_{1k} + \gamma_{2k})\right]$

Table VI

k	DD(k)	Ds2(k)	Ds3(k)	Ds1(k)
3				
4				
5				
⋮				
29				
SUM				

* Taken from table V a.

E.Z.

```
C     PROGRAM TO COMPUTE TECHNICAL COEFFICIENTS FROM THE ABSOLUTE VALLUE
C     OF I/O TABLE .
      DIMENSIONX(33,33),SX(33),S(33),D(33)
    1 READ2,N,K,K1,K2
    2 FORMAT(4I3)
      DO3I=1,K
    3 READ4,(X(I,J),J=1,N)
      READ4,(SX(J),J=1,N)
    4 FORMAT(1ØX,8F8.2,6X)
      DO5I=1,K
      DO5J=1,N
    5 X(I,J)=X(I,J)/SX(J)
      DO8J=1,N
      S(J)=Ø.
      DO6I=1,K
    6 S(J)=S(J)+X(I,J)
    8 D(J)=1.-S(J)
      I1=Ø1
      DO9I=1,K
      PUNCH1Ø,K1,K2,I,I1,(X(I,J),J=1,7)
      I1=I1+7
      PUNCH1Ø,K1,K2,I,I1,(X(I,J),J=8,14)
      I1=I1+7
      PUNCH1Ø,K1,K2,I,I1,(X(I,J),J=15,21)
      I1=I1+7
      PUNCH1Ø,K1,K2,I,I1,(X(I,J),J=22,28)
      I1=I1+7
      PUNCH11,K1,K2,I,I1,X(I,29)
    9 I1=Ø1
      PUNCH7,(D(J),J=1,N)
    7 FORMAT(1ØX,7F1Ø.7)
   1Ø FORMAT(2I3,2I2,7F1Ø.7)
   11 FORMAT(2I3,2I2,F1Ø.7)
      GOTO1
      END
```

```
C       PROGRAMTO CHANGE THE NON-COMPETITIVE IMPORTS AND DISTRIBUTE THE
C       CHANGE ALONG THE COEFFICIENT OF THE INPUTS .
        DIMENSION XØPRIM(3Ø,3Ø),BØPRIM(3Ø),BPRIM(3Ø),DBH(3Ø),XPRIM(3Ø,3Ø),
       XSXØKH(3Ø)
   16 READ1,N,M,KODE1,KODE2
    1 FORMAT(2I2,2I3)
        DO5ØK 1,M
   5Ø READ2,(XØPRIM(K,KH),KH 1,N)
        READ2,(BØPRIM(KH),KH 1,N)
        READ2,(BPRIM(KH),KH 1,N)
    2 FORMAT(1ØX,7F1Ø.7)
        DO 4 KH 1,N
        SXØKH(KH) Ø.
        DBH(KH) BPRIM(KH)-BØPRIM(KH)
        DO 3 K 1,M
    3 SXØKH(KH) SXØKH(KH)+XØPRIM(K,KH)
    4 DBH(KH) 1.-DBH(KH)/SXØKH(KH)
        DO 5 K 1,M
        DO 5 KH 1,N
    5 XPRIM(K,KH) XØPRIM(K,KH)*DBH(KH)
        N1 N/7
        N2 N-(N/7)*7
        IF(N1)6,8,13
    6 PRINT 7,
    7 FORMAT(16HERROR IN MACHINE)
```

```
  8 L=1
    LF=N2
  9 DO 1Ø K=1,M
 1Ø PUNCH 11,KODE1,KODE2,K,L,(XPRIM(K,KH),KH=L,LF)
 11 FORMAT(2I3,2I2,7F1Ø.7)
    GO TO 16
 13 IF(N2)6,13Ø,15
 15 KK=2
    GO TO 2Ø
13Ø KK=1
 2Ø DO 14Ø K=1,M
    L=1
    LF=L+6
    DO 1 NT=1,N1
    PUNCH11,KODE1,KODE2,K,L,(XPRIM(K,KH),KH=L,LF)
    L=L+7
 1 LF=LF+7
    GO TO(14Ø,17),KK
 17 LF=N
    PUNCH11,KODE1,KODE2,K,L,(XPRIM(K,KH),KH=L,LF)
14Ø CONTINUE
    GO TO 16
    END
```

```
C       PROGRAM TO COMPUTE (I-X) THE UNIT MATRIX MINUS THE MATRIX OF
C       TECHNICAL COEFFICIENT .
        DIMENSIONA(3Ø,3Ø)
     1Ø READ1,LØ,L1
      1 FORMAT(2I3)
        DO2I 1,29
      2 READ3,(A(I,J),J 1,29)
      3 FORMAT(1ØX,7F1Ø.7)
        DO4I 1,29
        DO4J 1,29
        IF(I-J)5,6,5
      5 A(I,J) -A(I,J)
        GO TO4
      6 A(I,J) 1.-A(I,J)
      4 CONTINUE
        L2 Ø1
        DO7I 1,29
        PUNCH8,LØ,L1,I,L2,(A(I,J),J 1,7)
        L2 L2+7
        PUNCH8,LØ,L1,I,L2,(A(I,J),J 8,14)
        L2 L2+7
        PUNCH8,LØ,L1,I,L2,(A(I,J),J 15,21)
        L2 L2+7
        PUNCH8,LØ,L1,I,L2,(A(I,J),J 22,28)
        L2 L2+7
        PUNCH9,LØ,L1,I,L2,A(I,29)
      7 L2 Ø1
      8 FORMAT(2I3,2I2,7F1Ø.7)
      9 FORMAT(2I3,2I2,F1Ø.7)
```

```
C     PROGRAM TO COMPUTE (I-X) THE INVERSE OF A MATRIX .
      DIMENSIONC(29,29),W(29,29)
    1 READ2,L,LØ,L1
    2 FORMAT(I2,2I3)
      DO3M 1,L
    3 READ4,(C(M,J),J 1,L)
    4 FORMAT(1ØX,7F1Ø.7)
      DO9M 1,L
      DO9J 1,L
    9 W(M,J) C(M,J)
      DO1ØIK 1,L
      XDIV 1./C(IK,IK)
      C(IK,IK) 1.
      DO11J 1,L
   11 C(IK,J) C(IK,J)*XDIV
      DO1ØM 1,L
      IF(M-IK) 12,1Ø,12
   12 XDIV C(M,IK)
      C(M,IK) Ø.
      DO 13 J 1,L
   13 C(M,J) C(M,J)-C(IK,J)*XDIV
   1Ø CONTINUE
      D Ø.
      DO 14M 1,L
      DO 14J 1,L
   14 D D+W(M,J)*C(J,M)
      PRINT 15,L,D
   15 FORMAT(1ØX2HL ,I3,1ØX2HD ,F1Ø.6///)
      L2 Ø1
      DO5M 1,L
      PUNCH6,LØ,L1,M,L2,(C(M,J),J 1,7)
      L2 L2+7
      PUNCH6,LØ,L1,M,L2,(C(M,J),J 8,14)
      L2 L2+7
      PUNCH6,LØ,L1,M,L2,(C(M,J),J 15,21)
      L2 L2+7
      PUNCH6,LØ,L1,M,L2,(C(M,J),J 22,28)
      L2 L2+7
      PUNCH7,LØ,L1,M,L2,C(M,29)
    5 L2 Ø1
    6 FORMAT(2I3,2I2,7F1Ø.7)
    7 FORMAT(2I3,2I2,F1Ø.7)
      GOTO1
      END
```

```
C      PROGRAM TO COMPUTE NON-COMPETITIVE IMPORTS REQUIRED FOR UNIT
C      INCREASE IN FINAL DEMAND , SECTORS1AND2 ARE OF CONSTANT PRODUCTION.
       DIMENSIONBETA(29,29),B(29),GAMMA(29,29),S(29),S1(29)
       READ3,N,LØ,L1,L2,L3,L4,L5,L6,L7,L8,L9,L1Ø,L11
     3 FORMAT(I2,2I3,4I2,5I3,I2)
       DO2IH 1,N
     2 READ1,(BETA(IH,K),K 1,N)
     1 FORMAT(1ØX,7F1Ø.7)
       READ1,(B(K),K 1,N)
       D 1./(BETA(1,2)*BETA(2,1)-BETA(2,2)*BETA(1,1))
       DO4K 3,N
       GAMMA(1,K) D*(BETA(2,2)*BETA(1,K)-BETA(1,2)*BETA(2,K))
     4 GAMMA(2,K) -D*(BETA(2,1)*BETA(1,K)-BETA(1,1)*BETA(2,K))
       DO5K 3,N
       DO5IH 3,N
     5 GAMMA(IH,K) BETA(IH,1)*GAMMA(1,K)+BETA(IH,2)*GAMMA(2,K)+BETA(IH,K)
       JJ 1
       KK 1
   2ØØ DO6IH JJ,N
       PUNCH7,LØ,L1,IH,L2,(GAMMA(IH,K),K 3,9)
       PUNCH7,LØ,L1,IH,L3,(GAMMA(IH,K),K 1Ø,16)
       PUNCH7,LØ,L1,IH,L4,(GAMMA(IH,K),K 17,23)
     6 PUNCH7,LØ,L1,IH,L5,(GAMMA(IH,K),K 24,29)
     7 FORMAT(2I3,2I2,7F1Ø.5)
       GOTO(1ØØ,1Ø),KK
   1ØØ DO8IH 3,N
       DO8K 3,N
     8 GAMMA(IH,K) GAMMA(IH,K)*B(IH)
       JJ 3
       KK 2
       L1 L6
       GOTO2ØØ
    1Ø DO12K 3,N
       S(K) Ø.
       DO11IH 3,N
    11 S(K) S(K)+GAMMA(IH,K)
    12 S1(K) (1.-S(K))/S(K)
       MM 1
    5Ø PUNCH7,LØ,L7,L11,L2,(S(K),K 3,9)
       PUNCH7,LØ,L7,L11,L3,(S(K),K 1Ø,16)
       PUNCH7,LØ,L7,L11,L4,(S(K),K 17,23)
       PUNCH7,LØ,L7,L11,L5,(S(K),K 24,29)
       PUNCH7,LØ,L8,L11,L2,(S1(K),K 3,9)
       PUNCH7,LØ,L8,L11,L3,(S1(K),K 1Ø,16)
       PUNCH7,LØ,L8,L11,L4,(S1(K),K 17,23)
       PUNCH7,LØ,L8,L11,L5,(S1(K),K 24,29)
       GOTO(51,53),MM
    51 DO13K 3,N
       S(K) S(K)-GAMMA(1,K)-GAMMA(2,K)
    13 S1(K) (1.-S(K))/S(K)
       MM-2
       L7-L9
       L8-L1Ø
       GOTO5Ø
```

```
C      PROGRAM TO COMPUTE NON-COMPETITIVE IMPORTS REQUIRED FOR EXPORTS IN
C      THE INDUSTRIAL SECTORS .
       DIMENSIONGAMMA(29,29),B(29),DD(29),DSØ(29),DS1(29),DS2(29),DS3(29)
 9999  READ22,
       READ23,
       READ24,
       READ1,N,M,M1,LØ,L1,L2,L3,L4,L5,L6
    1  FORMAT(3I2,2I3,4I2,I3)
       DO2IH 1,N
    2  READ3,(GAMMA(IH,K),K 3,N)
    3  FORMAT(1ØX,7F1Ø.5)
       READ4Ø,(B(K),K 1,N)
   4Ø  FORMAT(1ØX,7F1Ø.7)
       READ4,(DD(K),K 3,M)
       READ4,(DSØ(K),K 3,M)
    4  FORMAT(1ØX,7F9.2)
       DO5IH 1,N
       DO5K 3,M
    5  GAMMA(IH,K) GAMMA(IH,K)*DD(K)
       KK 1
    9  DO6IH 1,N
       PUNCH7,LØ,L1,IH,L2,(GAMMA(IH,K),K 3,9)
       PUNCH7,LØ,L1,IH,L3,(GAMMA(IH,K),K 1Ø,16)
       PUNCH7,LØ,L1,IH,L4,(GAMMA(IH,K),K 17,23)
    6  PUNCH7,LØ,L1,IH,L5,(GAMMA(IH,K),K 24,M)
    7  FORMAT(2I3,2I2,7F1Ø.5)
       GOTO(17,1Ø),KK
   17  B(1) -1.
       B(2) -1.
       DO8IH 1,N
       DO8K 3,M
    8  GAMMA(IH,K) GAMMA(IH,K)*B(IH)
       L1 L6
       KK 2
       GOTO9
   1Ø  DO 11K 3,M
       DS1(K) Ø.
       DS2(K) Ø.
       DS3(K) Ø.
       DO99IH 1,2
   99  DS1(K) DS1(K)+GAMMA(IH,K)
       DO1ØØIH 3,M
  1ØØ  DS2(K) DS2(K)+GAMMA(IH,K)
       DO111H M1,N
   11  DS3(K) DS3(K)+GAMMA(IH,K)
```

```
      DDS=Ø.
      DSS1=Ø.
      DSS2=Ø.
      DSS3=Ø.
      DSSØ=Ø.
      DO12K=3,M
      DDS=DDS+DD(K)
      DSS1=DSS1+DS1(K)
      DSS2=DSS2+DS2(K)
      DSS3=DSS3+DS3(K)
   12 DSSØ=DSSØ+DSØ(K)
      IF(SENSE SWITCH1)1ØØØ,1ØØ1
1ØØØ PRINT22,
   22 FORMAT(8ØH
     X                              /8ØH
     X                                        /8ØH
     X                                                )
1ØØ1 PUNCH22,
      IF(SENSE SWITCH1)2ØØØ,2ØØ1
2ØØØ PRINT23,
   23 FORMAT(8ØH
     X                              /8ØH
     X                                        /8ØH
     X                                                )
2ØØ1 PUNCH23,
      DO26K 3,M
      IF(SENSE SWITCH1)3ØØØ,3ØØ1
3ØØØ PRINT25,K,DD(K),DS2(K),DS3(K),DS1(K),DSØ(K)
   25 FORMAT(2ØX,I2,5F9.2)
3ØØ1 PUNCH25,K,DD(K),DS2(K),DS3(K),DS1(K),DSØ(K)
   26 CONTINUE
      IF(SENSE SWITCH1)4ØØØ,4ØØ1
4ØØØ PRINT24,
   24 FORMAT(8ØH
     X                              )
4ØØ1 PUNCH24,
      IF(SENSE SWITCH1)5ØØØ,5ØØ1
5ØØØ PRINT27,DDS,DSS2,DSS3,DSS1,DSSØ
   27 FORMAT(1X,3HSUM,5F9.2)
5ØØ1 PUNCH27,DDS,DSS2,DSS3,DSS1,DSSØ
      GOTO9999
      END
```