THE COEFFICIENT OF MULTIPLIER AND THE MARGINAL PROPENSITY TO IMPORT: THE CASE OF LATVIA

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Abstract: Any changes of aggregate expenditure in national economy involve the multiplier effect. Valuing possible effects of macroeconomic policy, one must take into account the coefficient of multiplier. Value of the coefficient depends first of all on the population's marginal propensity to consume (MPC) and typically exceeds 1. But besides the MPC there are other factors that may substantially affect the value of multiplier. One of these factors is the marginal propensity to import (MPI). It is usually stated that the MPI cannot exceed 1.

The aim of the paper is to estimate the value of multiplier in Latvian economy in order to check whether this value might prove below 1 due to high MPI. Calculations of the coefficients of multiplier, MPC, and MPI for period of 1995 – 2006 are made by author on the basis of Latvian statistics. Conclusions and implications for macroeconomic policy are suggested.

Keywords: multiplier; gross domestic product (GDP); consumption function; marginal propensity to consume; imports; marginal propensity to import; Latvian economy.

1. Introduction: The Multiplier and the Marginal Propensity to Import in Theory

The concept of multiplier is an important element of macroeconomic theory. The coefficient of multiplier (***k***) shows that one money unit spent in a national economy causes an increase in GDP by more than one unit (1, p.93-119; 2; 3; 4; 5). By definition,

$k = \Delta Y / \Delta A, (1)$

where Y is real GDP, and ΔA is an increase in autonomous expenditure.

On the other hand, the coefficient of multiplier can be estimated on the basis of the marginal propensity to spend on domestic goods and services (**ε**):

$k = 1 / 1 - \varepsilon$ (2)

The multiplier effect is graphically illustrated by a typical chart as one presented on Fig. 1.

On the chart, size of the multiplier is determined by slope of the aggregate expenditure (AE) graph: the steeper is the graph, the greater proves the multiplier. In turn, the slope of the AE graph depends first of all on the consumption function, C = f (Y) and on the marginal propensity to consume (MPC) supposed by this function. In the first approximation, the size of the coefficient of multiplier (*simple multiplier*) depends on the marginal propensity to consume (MPC) which is the ratio of increase in consumer expenditures to increase in aggregate income (or GDP):

$MPC = \Delta C / \Delta Y (3)$

The idea of multiplier is of great importance for any decision making in economic policies, since the multiplier effect creates a kind of "leverage" that would "strengthen" any increase or decrease in the aggregate expenditure and lead to more substantial changes in national output, employment, and inflation. It is crucial therefore to realize how big an effect on national output may be caused, for example, changing government spending by 1 million or varying tax collections by a certain amount. Estimates of the multiplier must be taken into account at designing macroeconomic policies. How big an increase in government expenditures or cut in taxes is needed to avoid a recession? How big a cut in government spending, decrease in private investment or tax increase is needed to reduce inflation (what was especially relevant for Latvia in recent years)? Answers to questions of such kind will depend on the size of multiplier.

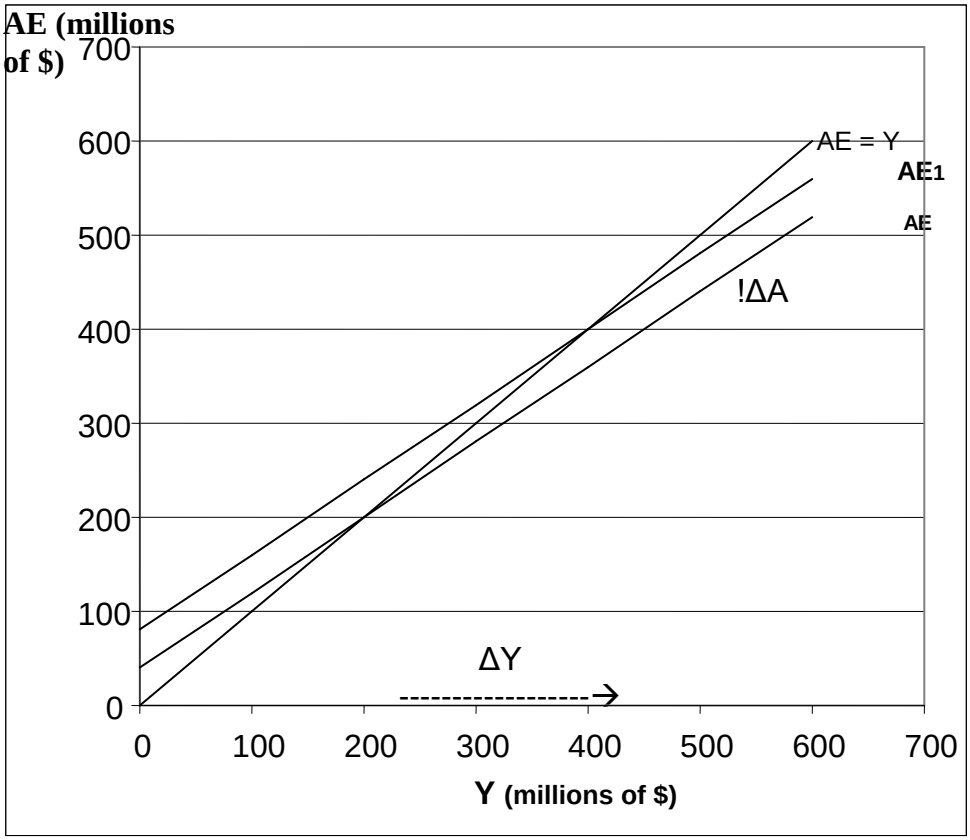

Fig. 1. A typical graphic illustration of the multiplier effect

Some common considerations concerning the coefficient of multiplier are that:

value of the multiplier exceeds 1; possibility of the multiplier having size less than 1 is seldom discussed in economic literature.

value of the multiplier is comparatively lower during economic recessions and higher within periods of economic recovery (6, p.692).

However, besides the MPC, there is other major factor affecting the size of multiplier: it is the marginal propensity to import (MPI). The marginal propensity to import is defined as ratio of change in a nation's imports to change in its GDP (7, p.512; 8, p.499 – 500):

$MPI = \Delta M / \Delta Y$ (4)

Since imports is subtracted from the sum of aggregate expenditure in national economy, the slope of the aggregate expenditure (AE) graph proves determined not just by the MPC but rather by the *marginal propensity to spend on domestic goods and services* (**ε**).

The marginal propensity to spend on domestic goods and services (or simply: marginal propensity to spend) equals the marginal propensity to consume less the marginal propensity to import:

$\boldsymbol{\varepsilon} = MPC - MPI$ (5)

Taking into account the marginal propensity to import, the formula of multiplier should be modified in the following way:

$\boldsymbol{k} = 1 / (1 - (MPC - MPI)) = 1 / (1 - \boldsymbol{\varepsilon})$, (6) or, which is actually the same,

$\boldsymbol{k} = 1 / (1 - MPC + MPI)$ (7

MPI therefore reduces the size of multiplier (8, p. 480; 9, p.1122 – 1123). As North American authors point it out, it was increase in the US imports that proved to be the main factor reducing the multiplier in the American economy within the last decades of the 20th century (6, p.693).

On graph, MPI makes the AE line more flat and, in the extreme case, very high MPI could even turn the AE graph from climbing into a downward-sloping one (compare the graphs AE1, AE2, and AE3 in Fig. 2). In the last case, the coefficient of multiplier has to drop below 1.

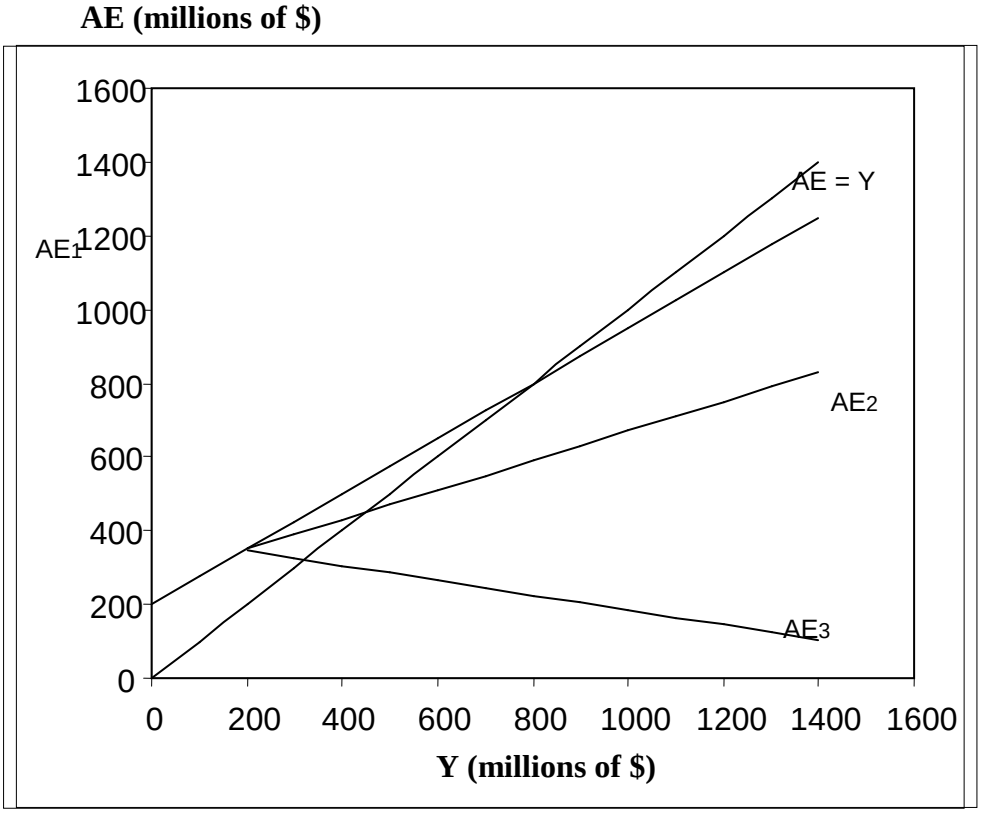

Fig. 2. Possible effects of imports on the slope of AE graph.

There are also some typical theoretical assumptions about the MPI:

it is usually believed that MPI cannot reach or, all the more, exceed 1. Even values of MPI as 0.36 are referred to as "incredibly high" (6, p.693); on can also find stated in texts on macroeconomics that it does not make sense to suppose MPI exceeding 1.

it is considered that MPI in a small country should be higher than in a big country (2, p.415 – 416).

it is stated that MPI depends on the structure of a country's imports: the marginal propensity to consume is higher if in the country's imports dominate consumer goods rather than capital goods (7, p.512).

2. Multipliers in Real World: Is Latvia an Exception?

However, data concerning actual values of the coefficient of multiplier in real economies are sporadic and seldom available in literature. It is well known, for example, that J. M. Keynes in 1930s supposed the value of multiplier in the US economy to be close to 2.5 (1, p. 106); it is possible to find some estimates of the multiplier in the US economy in selected years after 1960 (Table1).

The data of Table 1 prove, by the way, that within certain periods (namely, during the especially severe recessions of 1974 – 1975 and 1981 – 1982) the multiplier in the American economy fell below 1. It is mentioned in some economic texts that the size of multiplier in the UK by the end of 1990s could be just over 1.4 (8, p. 480). Sometimes values of the multiplier for particular countries are suggested as rather hypothetical (e.g., 1.11 for Belgium) (2, p.415 – 416).

Table 1. Historical Data: The Multiplier in the US Economy in Selected Years

Years	(Billions of 1982 dollars)			
	Change in Autonomous Expenditure (ΔA)	Change in Induced Expenditure (ΔN)	Change in real GNP (ΔY)	Multiplier (k = ΔY/ ΔA)
1960 – 87	+1121.9	+1032.4	+2154.3	1.92
1974 – 75	– 99.8	+ 65.5	– 34.4	0.34
1981 – 82	– 117.1	+ 34.3	– 82.8	0.71
1982 – 83	+ 50.3	+ 62.8	+113.1	2.25
1983 – 87	+383.3	+157.2	+540.5	1.41

Source: (6, p.692; with reference to the Economic Report of the president, 1988)

In this article, an attempt is made to estimate real value of the coefficient of multiplier for the Latvian economy in 2000 – 2006. It would be relevant, of course, to consider a longer historical period of time, but problems arise with comparability of statistical data. Because of often corrections in methodology of macroeconomic calculations in Latvian statistics, data for 2000 – 2006 are not directly comparable with data of previous periods.

Table 2. GDP of Latvia, 1999 – 2006: Expenditure of Gross Domestic Product (at constant prices of 2000, millions of Ls)

	1999	2000	2001	2002	2003	2004	2005	2006
GDP (Y)	4 444	4 751	5 133	5 465	5 858	6 367	7041	7 881
Private final consumption Expenditure (C)	2 781	2 970	3 187	3 421	3 702	4 055	4 521	5 414
Gross capital formation (Ig)	1 098	1 126	1 448	1 532	1 870	2 300	2 494	2 965
Government final consumption Expenditure (G)	1 030	988	1 016	1 038	1 057	1 080	1 108	1 153
Exports of goods and services (X)	1 777	1 978	2 126	2 241	2 358	2 581	3 104	3 268
(–) Imports of goods and services (M)	2 242	2 312	2 643	2 767	3 129	3 648	4 187	4 919

Sources: 10, p. 50 – 53; 11, p.20

Latvian statistics, similarly to statistics of other countries, provides necessary data to compute the MPC (see Table 2). On the basis of these data, the consumption function graph for after-tax consumption, C = f (Y), for the Latvian economy can be produced (Fig.3). Values of the marginal propensity to consume, as computed from the data presented in the Table 2, prove to be the following:

2000: MPC = 189 / 307 = 0.62;
2001: MPC = 216 / 382 = 0.57;
2002: MPC = 234 / 332 = 0.70;
2003: MPC = 281 / 393 = 0.72;
2004: MPC = 353 / 507 = 0.70;
2005: MPC = 463 / 652 = 0.71;
2006: MPC = 893 / 840 = 1.06 (MPC exceeds 1, which is valued in economic texts as a hardly possible outcome);
2000 – 2006 on average: MPC = 2629/3437 = 0.77

C (millions of Ls)

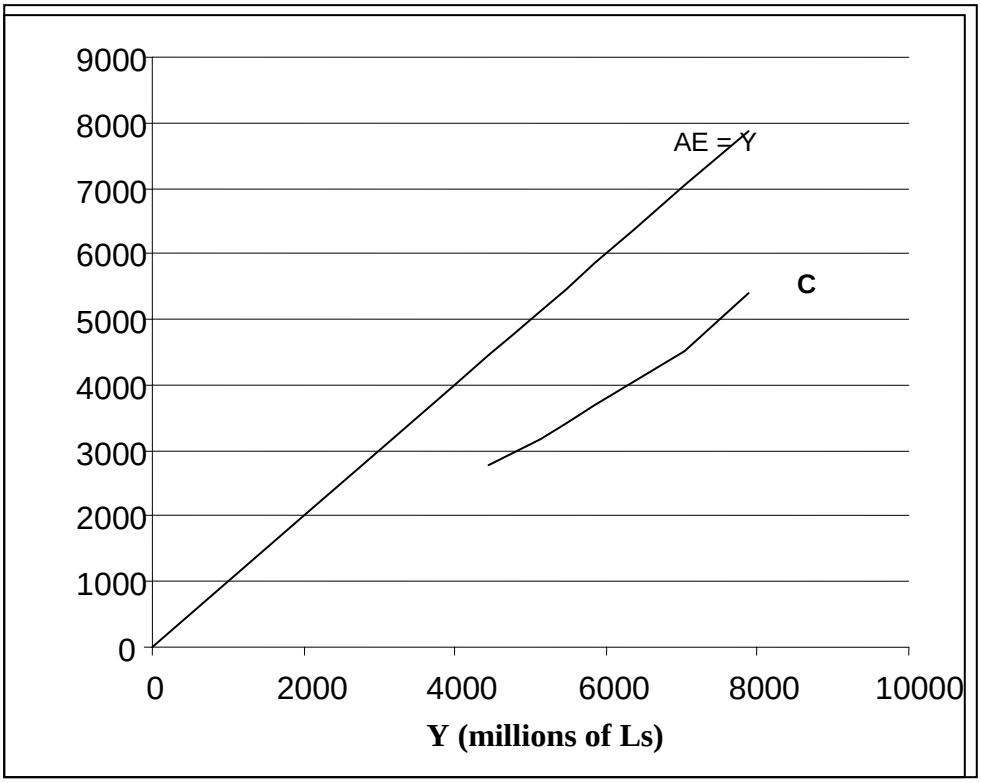

Fig.3. The consumption function in the Latvian economy, 1999 – 2000

The simple multiplier, k = 1 / (1 – MPC), as implied by the consumption function, should equal therefore:

2000: ***k*** = 1 / (1 – 0.62) = 2.63;
2001: ***k*** = 1 / (1 – 0.57) = 2.33;
2002: ***k*** = 1 / (1 – 0.70) = 3.33;
2003: ***k*** = 1 / (1 – 0.72) = 3.57;
2004: ***k*** = 1 / (1 – 0.70) = 3.33;
2005: ***k*** = 1 / (1 – 0.71) = 3.45;
2006: (a negative value of ***k,*** which does not make economic sense);
2000 – 2006 on average: k = 1 / (1 – 0.77) = 4.35.

Such estimates of the multiplier might indicate that any single lat of autonomous expenditure increased GDP of Latvia in particular years by 2.33 – 3.57 lats. In other words, one could conclude that a very strong multiplier effect took place, and it boosted the rapid growth of the Latvian economy in recent years.

On the other hand, taking into account the above-mentioned effect of MPI, we must to modify our previous calculations related to the coefficient of multiplier in Latvia.

Our main objectives will be the following:

To estimate the marginal propensity to import (MPI) in the Latvian economy;

To find out whether the value of MPI cannot exceed 1;

To value more accurately the size of multiplier, taking into account the effect of MPI;

To check whether the value of multiplier in the economy of Latvia might drop below 1, due to the MPI;

To check whether the value of multiplier is directly related to economic growth.

Latvia is a small open economy with a very significant share of imports in its GDP. Moreover, the foreign trade balance of Latvia since 1995 is characterized by enormously big and still growing deficit. The country's imports in recent years1.3 – 1.5 times exceeded

exports, and the foreign trade deficit in 2006 – 2007 was above 25% of GDP (13, p. 62). In the composition of imports, during 2002 – 2007, share of capital goods was 17 – 18%, while share of consumer goods gradually decreased from 28 to 22% (13, p.23).

Figure 4, based on the data of Table 2, presents the total volume of the Latvian imports in 1999 – 2006 in its relation to increase in the country's GDP.

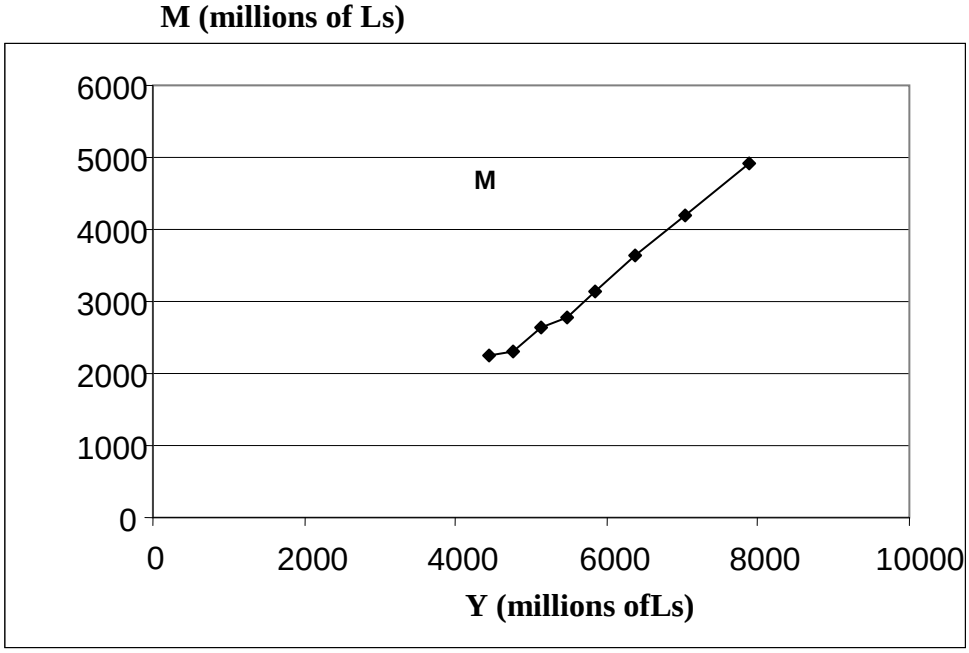

Fig. 4. The relationship between GDP and imports in Latvia, 1999 – 2006.

These data demonstrate an extremely rapid growth of the Latvian imports along with the impetuous increase in the country's GDP. It implies an enormously high value of the marginal propensity to import. Indeed, the marginal propensity to import in the Latvian economy, estimated from the data of the Table 2, was as follows:

2000: MPI = 70 / 307 = 0.23;
2001: MPI = 331 / 382 = 0.87;
2002: MPI = 124 / 332 = 0.37;
2003: MPI = 362 / 393 = 0.92;
2004: MPI = 519 / 507 = **1.02;**
2005: MPI = 539 / 652 = 0.83;
2006: MPI = 732 / 840 = 0.87;
2000 – 2006 on average: MPI = 2677 / 3437 = 0.79

It actually results in a negatively sloping graph of the aggregate expenditure on domestic goods and services (Fig.5).

In this case, the coefficients of multiplier, as they follow from the formula (7), were:

2000: k = 1 / (1 – 0.62 + 0.23) = 1 / 0.61 = 1.64;
2001: k = 1 / (1 – 0.57 + 0.87) = 1 / 1.3 = 0.77;
2002: k = 1 / (1 – 0.70 + 0.37) = 1 / 0.67 = 1.49;
2003: k = 1 / (1 – 0.72 + 0.92) = 1 / 1.2 = 0.83;
2004: k = 1 / (1 – 0.70 + 1.02) = 1 / 1.32 = 0.76;
2005: k = 1 / (1 – 0.71 + 0.83) = 1 / 1.12 = 0.89;
2006: k = 1 / (1 – 1.06 + 0.87) = 1/ 0.81 = 1.23;
2000 – 2006 on average: k = 1 / (1 – 0.77 + 0.79) =
= 1 / 1.02 = 0.98.

AE (millions of Ls)

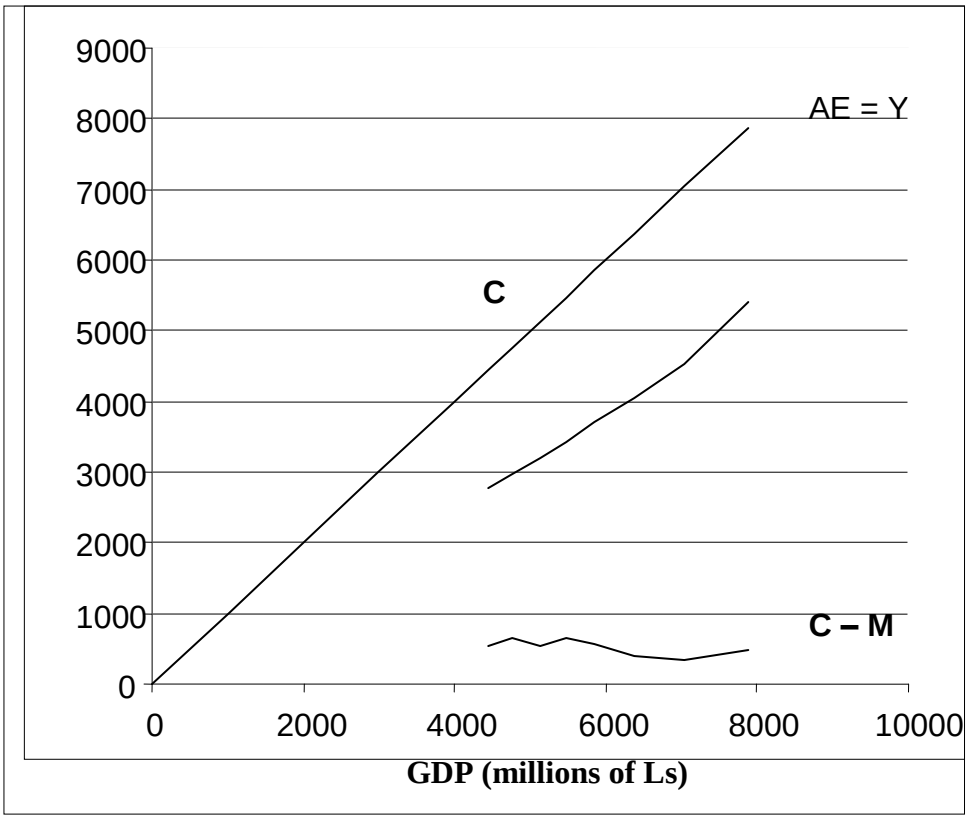

Fig.5. The consumption function (C), and the spending on domestic goods and services (C – M) in Latvia, 1999 – 2006

In order to support these findings by a more vast empirical material, one could try to use data for the preceding years, at least, those for 1995 – 1999. Unfortunately, data on total volume and structure of GDP for this period are not quite comparable to those for 2000 – 2006, and, in fact, sometimes seem somewhat doubtful. The data are presented in Table 3.

Table3. GDP of Latvia, 1995 – 1999: Expenditure of Gross Domestic Product (at constant prices of 2000, millions of Ls)

	1995	1996	1997	1998	1999
GDP (Y)	3 606.0	3 742.7	4 052.7	4 244.1	4 383.6
Private final consumption expenditure (C)	2 280.7	2 521.7	2 647.1	2 664.4	2 778.3
Gross capital formation (Ig)	500.7	611.9	685.9	1 031.4	1 058.7
Government final consumption Expenditure (G)	951.6	882.0	910.1	1 030.1	1 025.9
Exports of goods and services (X)	1 326.2	1 594.7	1 804.0	1 891.6	1 771.2
Imports of goods and services (M) (–)	1 453.3	1 867.6	1 994.4	2 373.4	2 250.5

Source: 12, p.52 - 55.

The marginal propensity to import in the Latvian economy, if calculated on the basis of these data, proves to be in some years even more impressive:

1996: 414.3 / 136.7 = **3.03;**
1997: 126.8 / 310.0 = 0.41;
1998: 379.0 / 191.4 = **1.98;**

1999: - 122.9 / 139.5 = - 0.88.

1996 – 1999 on average: 797.2 / 777.6 = **1.03**.

The values of multiplier, $\boldsymbol{k}$ = 1/ (1 – MPC + + MPI), are then as follows:

1996: $\boldsymbol{k}$ = 1 / (1 – 1.76 + 3.03) = 0.44;

1997: $\boldsymbol{k}$ = 1 / (1 – 0.4 + 0.41) = 0.99;

1998: $\boldsymbol{k}$ = 1 / (1 – 0.1 + 1.98) = 0.35;

1999: $\boldsymbol{k}$ = 1 / (1 – 0.82 – 0.88), negative value;

1996 – 1999 on average: $\boldsymbol{k}$ = 1 / (1 – 0.64 + 1.03) = = 0.72.

Though disputable, these results still can support the conclusion that the coefficient of multiplier in the Latvian economy typically was below 1.

As mentioned before, there is an alternative way to compute the coefficient of multiplier. The alternative method is based upon the concept of autonomous expenditure (A). Autonomous expenditure is the sum of those components of aggregate expenditure that are not influenced by changes in real GDP. These autonomous components of aggregate expenditure are:

autonomous consumer expenditure (Co);

gross investment (Ig);

government purchases (G);

exports (X).

For further considerations, the autonomous part of the consumer expenditure (Co) is ignored, as it is done in similar calculations made by North American authors (6, p.692). In this case,

$$A = I g + G + X \qquad (8)$$

The coefficient of multiplier, as it follows from the formulae (1) and (8), is

$$\boldsymbol{k} = \Delta Y / \Delta A = Y / (\Delta Ig + \Delta G + \Delta X) \qquad (9)$$

Using the data of Table 2 and substituting them in the formula (9), we obtain the following values of multiplier in the Latvian economy:

2000: $\boldsymbol{k}$ = 307 / (28 – 42 + 201) = 307 / 187 = 1.64

2001: $\boldsymbol{k}$ = 382 / (322 + 28 + 148) = 382 / 498 = **0.77**

2002: $\boldsymbol{k}$ = 332 / (84 + 22 + 115) = 332 / 221 = 1.50

2003: $\boldsymbol{k}$ = 393 / (338 + 19 + 117) = 393 / 474 = **0.83**

2004: $\boldsymbol{k}$ = 507 / (430 + 23 + 223) = 507 / 676 = **0.75**

2005: $\boldsymbol{k}$ = 652 / (194 + 28 + 523) = 652 / 745 = **0.88**

2006 $\boldsymbol{k}$ = 840 / (471 + 45 + 164) = 840 / 680 = 1.24;

2000 – 2006 on average: $\boldsymbol{k}$ = 3437 / (1867 + 123 + 1491) = 3437 / 3481 = **0.99**

Mathematically, indeed, these are the same figures as those obtained earlier on the basis of the formula (7). Minor differences appear just due to rounding off the numbers.

3. Conclusions:

Therefore, during all the period under discussion, values of the multiplier in the Latvian economy prove to be surprisingly low. In most part of the analyzed period the size of multiplier was below 1. Such a phenomenon cannot be regarded as unique, but still it is rather specific. Moreover, the low values of the multiplier occurred within the period of rapid economic growth. Indeed, GDP of the country increased in 2000 – 2005 at extremely high rates. The average annual growth rate of Latvia's GDP in 2004 – 2006 exceeded 10% and was the highest among the EU member states; it reached 11.9% in 2006 (13, p.15; 14, p. p. 15). However, the analysis presented in the paper suggests that this growth was not caused or supported by the multiplier effect. The high rate of economic growth took place in Latvia

rather due to extensive increase in total volume of autonomous expenditure (first of all – gross investment and export, with minor role of government expenditure). Gross investment and exports contributed nearly equally to the increase of GDP. As concerns government spending, its impact on the economic growth proved comparatively modest. Our estimates of multiplier in the Latvian economy lead to general conclusion that fiscal policy of the government could not have sufficient impact on the country's macroeconomic indices.

Low value of the multiplier implies that any changes in government spending have too weak "leverage" to substantially change the aggregate demand. It might be one of the reasons why attempts of the government fiscal policy to affect economic situation in recent years proved insufficient. A good example can be the government's counter-inflationary program carried out since 2007 but having minor effect on inflation rates in the country. In general it seems that any attempts to affect economic situation (e.g., to raise rate of economic growth or reduce inflation) in Latvia would require enormously big change in government spending, taxation, private investment, or exports. To summarize,

- The size of multiplier in the economy of Latvia within the period of 1995 – 2006 was usually below 1.
- The values of multiplier in the Latvian economy proved so low mainly because of very high marginal propensity to import (MPI).
- The case of Latvia supports the statement that the MPI in a small country should be higher than in a big country.
- The MPI in the Latvian economy in most of the years since 1995 was extremely high; contrary to the typical assumptions, its value was close to 1 and in some years even exceeded 1.
- The case of Latvia can be used to support the view that the size of MPI is dependent of the composition of imports.
- In the case of Latvian economy, it seems hardly possible to prove the general statement
- That multiplier should be small when the economy goes into recession and are larger in recovery. In fact, value of multiplier was steadily low during all the period of rapid economic growth in Latvia.
- Weak multiplier effect implies that fiscal policy has minor effect on macroeconomic situation in Latvia

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