ANALYSIS OF THE CONSUMPTION ON THE GOODS AND SERVICES MARKET IN THE CYBERNETIC MODEL OF THE 15 OLDER EU MEMBER STATES

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Abstract: The paper analyses the consumption on the goods and services market in the cybernetic model of the EU-15 (the older member states of the European Union). The theoretical basis is given by the consumption function in the short-term, the macroeconomic multiplier of the two-sector economy and the cybernetic model with the goods and services market. All the above-mentioned theory is applied to the real conditions of the 15 selected countries, which are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, and United Kingdom. A case study is shown on the example of Austria, whose consumption parameters are most similar to the median.

Keywords: Consumption Function; Macroeconomic Multiplier; Cybernetic Model.

1 Introduction

The real economy is a complex and comprehensive system with many exogenous inputs, exogenous outputs, and internal links. It needs to be simplified.

The macroeconomic model is the simplification on a macroscopic level. It has a limited count of inputs, outputs, and links. Autonomous components of consumption, investment, government purchases, and net exports are considered as the inputs to this model. Product is considered as the output of this model.

The macroeconomic model of the two-sector economy is an even greater simplification. In this case, the inputs are autonomous consumption and a mix of other non-consumption autonomous inputs. The output is the gross domestic product (GDP).

2 Data and Methods

2.1 Consumption in the Short-Term

This paper will be based on a production function that is very well researched in the literature (Keynes 1936, Keynes 1937, Friedman 1957). The Keynesian theory defines consumption function as a consumption and product relationship as shown in Formula (1).

$$C = C_0 + mpc \times Y \quad (1)$$

Where C is the total consumption
C0 autonomous consumption
mpc×Y induced consumption
mpc marginal propensity to consume
Y product (GDP)

2.2 Macroeconomic Multiplier of the Two-Sector Economy

Relationships in the system are interconnected. Increased autonomous consumption (C0) is part of the total consumption (C) that also increases. The total consumption (C) is part of the product (Y) that also increases. The product (Y) is part of the induced consumption (mpc×Y) that also increases. The induced consumption (mpc×Y) is part of the total consumption (C) that also increases. This closes the circle and repeats one impulse infinitely. This process is called the Keynesian multiplication process.

The final impact on output is determined by the strength of feedback or the value of the marginal propensity to consume (mpc). "The Keynesian multiplier process is the economist's paradigmatic positive feedback loop, in which an initial departure from full-employment equilibrium cumulates instead of being corrected" (Howitt 2006).

The mathematical representation of the Keynesian multiplication process is shown in Formula (2).

$$\Delta Y = \Delta(C_0 + A_0) \times \frac{1}{1-mpc} \quad (2)$$

Where Y is the product (GDP)
C0 autonomous consumption
A0 autonomous non-consumption inputs
mpc marginal propensity to consume

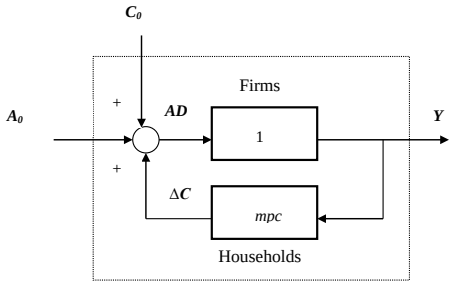
2.3 Cybernetic Model with the Goods and Services Market

Thy cybernetic model with the goods and services market has the following parameters:

- Inputs
  - Autonomous consumption (C0)
  - Autonomous non-consumption inputs (A0)
- Internal feedback
  - Marginal propensity to consume (mpc)
- Output
  - Product (Y)

The graphical explanation of the above is shown in Fig. 1.

Fig. 1. Cybernetic Model of a Static Economy with the Goods and Services Market.



Source: Máče, Rousek 2013

3 Results and Discussion

3.1 Consumption in the Older EU Member States

The consumption function is determined by two variable parameters: autonomous consumption (C0) and marginal propensity to consume (mpc). In view of the state of these two variables, several possible forms of consumption function can theoretically be defined. Autonomous consumption can be positive or negative.

Marginal propensity to consume may fall between - ∞ and 0; from 0 to 1; or from 1 to ∞. By combining the above, there are six possible forms of the consumption function. Only three of these are actually achieved on the data of older EU Member States.

The consumption and product data used for modelling are shown in Table 1.

Tab. 1. Consumption and Product Data of the 15 Older EU Member States (in billion PPS)

	Product	Consumption
Austria, 2007	269	135
Austria, 2017	336	168
Belgium, 2007	323	159
Belgium, 2017	396	198
Denmark, 2007	175	81
Denmark, 2017	216	98
Finland, 2007	164	76
Finland, 2017	180	93
France, 2007	1 799	941
France, 2017	2 092	1 088
Germany, 2007	2 471	1 327
Germany, 2017	3 046	1 563
Greece, 2007	267	169
Greece, 2017	216	144
Ireland, 2007	170	76
Ireland, 2017	265	83
Italy, 2007	1 637	961
Italy, 2017	1 736	1 051
Luxembourg, 2007	33	10
Luxembourg, 2017	45	13
Netherlands, 2007	587	267
Netherlands, 2017	654	285
Portugal, 2007	223	141
Portugal, 2017	237	150
Spain, 2007	1 215	682
Spain, 2017	1 287	730
Sweden, 2007	306	131
Sweden, 2017	368	157
United Kingdom, 2007	1 784	1 102
United Kingdom, 2017	2 078	1 309

Source: Eurostat 2019

Three real forms of consumption function in case, of older EU Member States:

1. Typical consumption function with positive C0 and mpc between 0 and 1
   - Austria
   - Denmark
   - France
   - Germany
   - Greece
   - Ireland
   - Luxembourg
   - Netherlands
   - Sweden
2. Untypical consumption function with negative C0 and mpc between 0 and 1
   - Belgium
   - Italy
   - Portugal
   - Spain
   - United Kingdom
3. Exceptional consumption function with negative C0 and mpc greater than 1
   - Finland

Austria was chosen as a representative of the 15 countries analyzed because it is approximately in the middle of values.

Marginal propensity to consume of the countries analyzed is in the range of 0.075 (Ireland) to 1.091 (Finland). Most countries are located near the median of 0.492 (Austria).

Autonomous consumption of the countries analyzed is in the range of -516 (Italy) to 314 (Germany). The largest group of countries has slightly positive values (such as Austria with a value of 3).

Consumption function parameters of Austria are mpc = 0.492 and C0 = 3. The complete consumption function is given in equation (3).

$$C = 3 + 0.492 \times Y \quad (3)$$

Where C is the total consumption
3 autonomous consumption
0.492×Y induced consumption
0.492 marginal propensity to consume
Y product

3.2 Macroeconomic Multipliers in the Older EU Member States

The Keynesian multiplier is based on the marginal propensity to consume. The Keynesian multiplier of the countries analyzed is in the range of 1.081 (Ireland) to 10.242 (Italy). Most countries are located near the median of 1.968 (Austria). The example of Austria shows the calculation method (4) and the multiplier value (5).

$$\Delta Y = \Delta(3 + A_0) \times \frac{1}{1-0.492} \quad (4)$$

$$\Delta Y = \Delta(3 + A_0) \times 1.968 \quad (5)$$

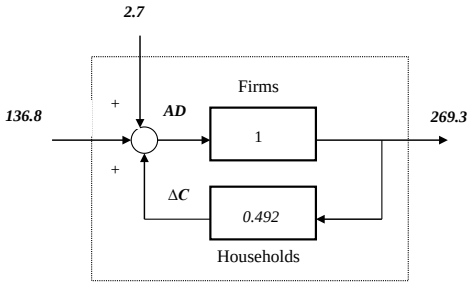
Where Y is the product (GDP)
3 autonomous consumption
A0 autonomous non-consumption inputs
0.492 marginal propensity to consume
1.968 Keynesian multiplier

3.3 Cybernetic Model of the Older EU Member States

The general cybernetic model Austria is based on values of autonomous consumption C0 = 2.7 and marginal propensity to consume mpc = 0.492. This means that the change in any autonomous inputs (autonomous investments, autonomous government spending, net exports) will be projected 1.968 times in the economic output.

Figure 2 shows an actual cybernetic model of Austria with the goods and services market. There are also included the values from 2007 in the figure: autonomous non-consumption inputs A0 = 136.8 and product Y = 269.3.

Fig. 2. Cybernetic Model of Austria in 2007 with the Goods and Services Market.



Source: Author

3.4 Complex Dataset of the Older EU Member States

Older EU Member States can be described from the point of view of consumption, the Keynesian multiplier and cyber model by the parameters in Table 2.

Individual values were obtained as follows:
- Y – real data
- C – real data

- C0 + A0 as the total input of the cybernetic model
- C0 as one parameter of the consumption function
- A0 as the difference between the cybernetic model and consumption function data

Tab. 2. Cybernetic Model Data of the 15 Older EU Member States (in billion PPS)

	Product Y	Total Consumption C	Total Autonomous Inputs C0+A0	Autonomous Consumption C0	Non-consumption Autonomous Inputs A0
Austria, 2007	269	135	137	3	134
Austria, 2017	336	168	171		168
Belgium, 2007	323	159	150	-14	164
Belgium, 2017	396	198	184		198
Denmark, 2007	175	81	100	6	95
Denmark, 2017	216	98	123		117
Finland, 2007	164	76	N/A	-103	N/A
Finland, 2017	180	93	N/A		N/A
France, 2007	1 799	941	896	38	858
France, 2017	2 092	1 088	1043		1004
Germany, 2007	2 471	1 327	1459	314	1144
Germany, 2017	3 046	1 563	1798		1483
Greece, 2007	267	169	137	39	98
Greece, 2017	216	144	111		72
Ireland, 2007	170	76	157	63	94
Ireland, 2017	265	83	245		182
Italy, 2007	1 637	961	160	-516	676
Italy, 2017	1 736	1 051	170		686
Luxembourg, 2007	33	10	26	3	23
Luxembourg, 2017	45	13	36		32
Netherlands, 2007	587	267	428	108	320
Netherlands, 2017	654	285	478		369
Portugal, 2007	223	141	79	-4	83
Portugal, 2017	237	150	84		88
Spain, 2007	1 215	682	403	-130	533
Spain, 2017	1 287	730	427		557
Sweden, 2007	306	131	178	4	175
Sweden, 2017	368	157	214		211
United Kingdom, 2007	1 784	1 102	530	-151	681
United Kingdom, 2017	2 078	1 309	618		769

Source: Author

4 Conclusion

The consumption function in the short-term, the Keynesian multiplier of the two-sector economy, and the cybernetic model with the goods and services market have been used to draw conclusions of this paper. Concrete results are based on the consumption data in the 15 older EU Member States.

There are three occurring forms of consumption function: typical with positive C0 and mpc between 0 and 1, untypical with negative C0 and mpc between 0 and 1, and exceptional with negative C0 and mpc greater than 1.

Most of the older EU Member States are similar to Austria with marginal propensity to consume mpc about 0.5 and multiplier values about 2. However, there are exceptions in both ways. For example, Ireland has a low mpc and a low multiplier. On the other hand, countries like Italy and Finland have a high mpc and a high multiplier.

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