ANALYSIS OF SOME ECONOMIC VARIABLES IN SLOVENIAN FARMS USING FADN DATASET

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Abstract

Slovenian farms scattered in small rural villages are characterised by poor utilizable agricultural areas (UAA) which are lower than the average value assessed in the European Union countries. The assessment of the economic consequences of financial subsidies allocated by the Common Agricultural Policy (CAP) towards farmers is made by an annual survey in a sample of farms belonging to the Farm Accountancy Data Network (FADN). The purpose of this paper was to investigate by a quantitative approach, over the time 2004-2013, in the FADN dataset main correlations among different economic variables, such as financial subsidies allocated by the CAP on Slovenian farms stratified in function of the main typology of farming which is a dummy variable of the productive specialization. Summing up, funds allocated by the first and second pillar of the CAP have acted on the farm level of income hence, the European Union by specific funds should implement the level of investments stimulating also the level of land capital pivotal in getting better the technical and economic efficiency in Slovenian farms.

Key words: typology of farming, rural development, financial subsidies, crop specialization

INTRODUCTION

The average value of utilizable agricultural areas (UAA) in Slovenian farms equal to 8 hectares is relatively poor comparing it to the average agrarian surface in 28 European Union states and in the same time it is under the average amount equal to 14.2 hectares assessed in the European Union (EU), 50.1 hectares pointed out in the European north-western regions and 12.0 hectares assessed in countries located in the southern European countries [6] [7].

After the enlargement of the European Union in 2004 and in 2007 statistical data have highlighted as in new comers member states of the EU such as Cyprus, Slovenia and Malta, the average value of utilizable agricultural area is approximately close to 7.10 hectares which is under the average value observed in the nearest countries as Italy and in other ones located in the basin of the Mediterranean sea [6]. According to the data published by the Slovenian National Institute of Statistics, since the early 2000s there has been a significant increase of the utilizable agricultural areas (UAA) which has reached the peak of almost 7 hectares [16].

Comparing statistical data in the Agricultural Census carried out in 2000 and in 2010, there has been an increase of utilized agricultural areas predominately characterised by permanent grassland from 5.6 hectares to 7.00 with Slovenian regions such as Osrednjeslovenska, Savinjska, Podravska and Pomurska (Fig. 1) where in 2010 the agricultural surface was close to 13 hectares or more [16].

According to the data published by the Eurostat in 2016, more than 40,000 Slovenian farms have a surface lower than 5 hectares and only one thousand have an agrarian surface above 100 hectares located predominantly in plane areas, even if since 2000 to 2013 the large farms arose by 10%. In general, as a consequence of the economic crises and recession in the middle 2000, the number of Slovenian farmers declined by 14,000 units and this phenomenon has involved manly small agrarian enterprises managed by family farms [3].

In Slovenia the primary sector has been able to express a poor buffer effect in contrasting the unemployment, in halting the rural out-emigration from the countryside and socio-economical marginalization [5][15][19]. In

some new comer Member States of the EU the primary sector has been a buffer tool to adsorb workforce even if many farms classified as semi subsistence enterprises did not carry out a positive action in lessening the poverty in rural areas [5]; hence, the impact of financial subsidies has been positive in implementing job opportunities and also in stimulating a socio-economic development in rural areas by the L.e.a.d.e.r. initiatives, which have implied a revitalization of rural areas by new enterprises and job chances [8; 9; 10; 11].

Fig. 1. Evolution of Usable Agricultural Areas in Slovenian regions throughout the Agricultural Census.
Source: http://www.stat.si/TematskaKartografija

Before the enlargement of the European Union in 2004 Slovenian farms have received significant and specific financial supports in order to face the phase of transition from a centralized economy to an open one using specific programmes such as Sapard (Special Accession Programme for Agriculture & Rural Development) which has allocated more than 500 million Euros during a six year time

2000-2006 able to restructure the productive context and socio-economic fabric [12] [17].
Several studies have been carried out in order to assess if there is a nexus between dimension of farm, in terms of usable agricultural areas, and technical, allocative and economic efficiency in different European countries [4] [13] [14] with some effects on the level of farm net income and financial subsidies allocated by the CAP.
In general, findings have corroborated the theoretical framework according to which the level of efficiency and consequently the level of income is correlated both to the farm dimension (land capital) and also to the productive specialization. In fact, the level of specialization, in terms of typology of farming, is able to act on the level of investments and assets and on an efficient use of factors of production.
The Farm Accountancy Data Network (FADN) is an instrument established by the Council Regulation 79 in 1965 aimed at assessing the income of agricultural holdings and specifically some impacts of the Common Agricultural Policy actions towards farmers. FADN has been set up to gather accounting data in a sample of European farms.

Aim of the research
The main research question was addressed to investigate, using a quantitative approach, over the time 2004-2013 in Slovenian farms part of FADN dataset, the role and function of financial subsidies allocated by the CAP in the first and second pillar and other variables such as Utilized Agricultural Areas (UAA), total inputs, total assets, payments allocated by the CAP to stayed behind rural areas (LFA payments), on the level of farm net income. An another stage of this study has been focused on an analysis of the main descriptive statistics in different types of farming (TF) such as defined and grouped by the European Commission in the Regulation 1242/2008. In Slovenia FADN dataset covers a field of observation close to 62% of total farms stratified 14 TF clusters as proposed by the Commission Decision (CE) 2003/369.
The source of data has investigated only the balanced types of farming (TF) or rather whole Slovenian cross section FADN dataset
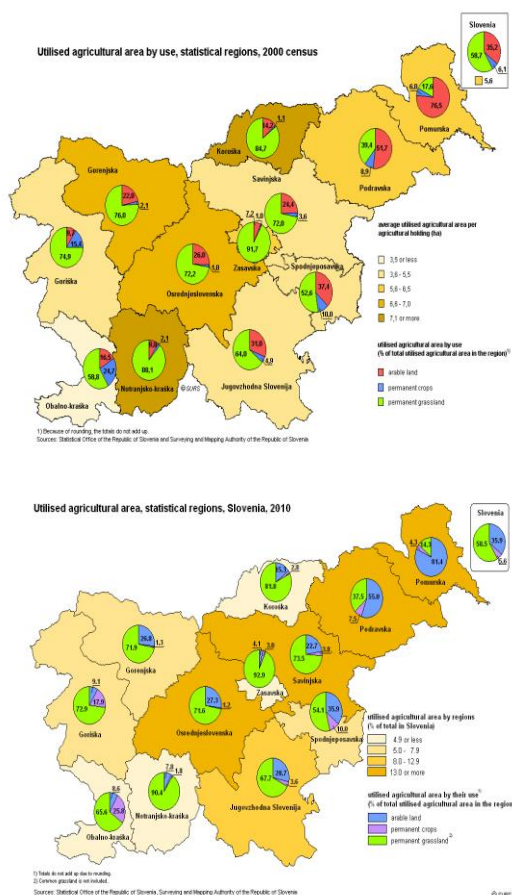
made up by complete data for each year since 2004 to 2013 omitting TF without data investigated in some years.

MATERIALS AND METHODS

Using a quantitative approach and different source of data from 2004 to 2013 published by the European Union in the FADN dataset and by the Slovenian Institute of Statistics, this research has estimated by a multiple regression model main correlations among the dependent variable farm net income in Slovenian rural areas and the independent variables financial subsidies allocated by the first and second pillar of the CAP, payments towards disadvantaged rural areas (LFA payments) and financial aids disbursed by the Common Agricultural Policy in the second pillar aimed at stimulating Rural Development initiatives.

In this study it has used a multiple regression model, estimating parameters by the Ordinary Least Square (OLS) throughout the open source software GRETL 1.8.6. In its algebraic form of matrix, the multiple regression models can be so expressed [18]:

$$y = X\beta + \varepsilon \qquad (1)$$

where y is the dependent variable and ε is the statistical error but both are vectors with n-dimensions; hence, X is a matrix of independent variables which has a dimension n x k.

In analytical terms, the model of multiple regression in its general formulation can be written in this way [1] [2] [18]:

$$y = \alpha_0 + \alpha x_1 + \beta x_2 + \gamma x_3 + \delta x_4 + \varepsilon_{jt} \qquad (2)$$

where y is the dependent variable or rather the level of farm net income in Slovenian farms part of the FADN dataset,
α_0 is a constant term,
x_1, x_2, x_3, x_4 independent variables such as total subsidies allocated by the CAP, payments for Less Favored Areas (LFA), total support for rural development, total assets, total inputs and capital land in term of utilised agricultural areas.

α, β, γ, δ estimated parameters of the model,
ε_{jt} term of statistic error.
Basis assumptions, to use a multiple regression model, are [1] [2]:
(i) statistic error u_i has conditional average zero that is $E(u_i|X_i) = 0$;
(ii) (X_i, Y_i), $i = 1 .... n$ are extracted as distributed independently and identically from their combined distribution;
(iii) X_i, u_i have no fourth moment equal to zero.
There is no correlation among regressors and random noise if the value between β expected and β estimated is the same; in order to analyze if there is also heteroschedasticity on standard errors in the multiple regression model, it has used White's test on the error terms [18].
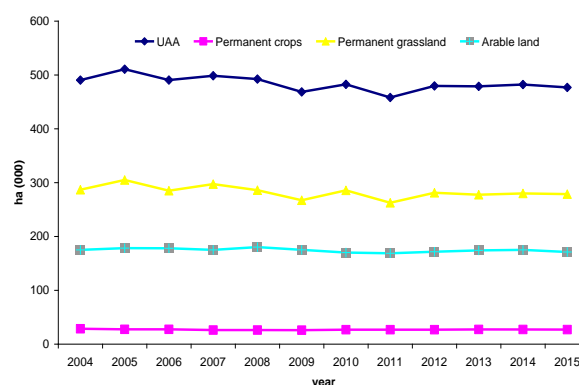

Fig. 2. Utilizable Agricultural Areas and different distribution of the main crops in Slovenia.
Source: Own elaboration on data Eurostat.

RESULTS AND DISCUSSIONS

Since 2004, in Slovenia the Utilized Agricultural Area has had some fluctuations which depended upon the actions of agro-forestation, financed by the CAP, and a growth of permanent grassland and permanent crops supported by national authorities and by the European Union (Fig. 2) even if permanent crops have been lower than 30,000 hectares. Findings have pointed out a stable value from 2004 to 2015 of arable crops in Slovenian rural areas.
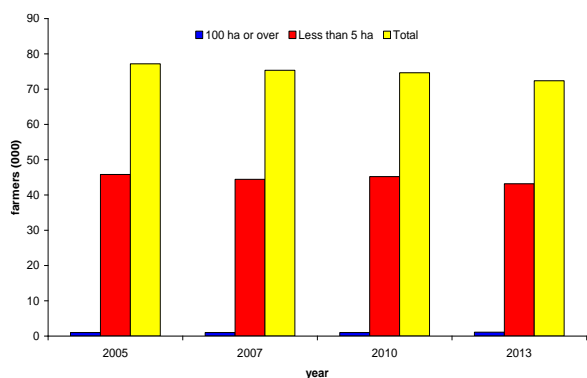
Fig. 3. Dimension of Slovenian farms and its evolution over the time.
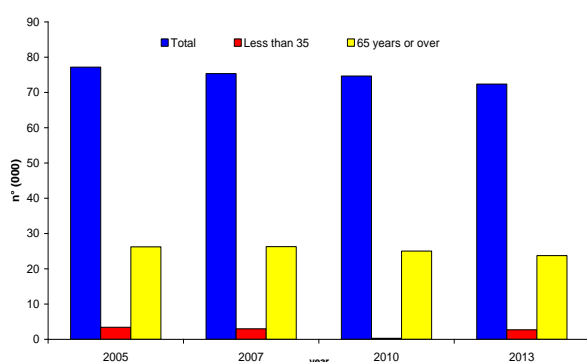Source: Own elaboration on data Eurostat.

Fig. 4. Age of owners in Slovenian farms.
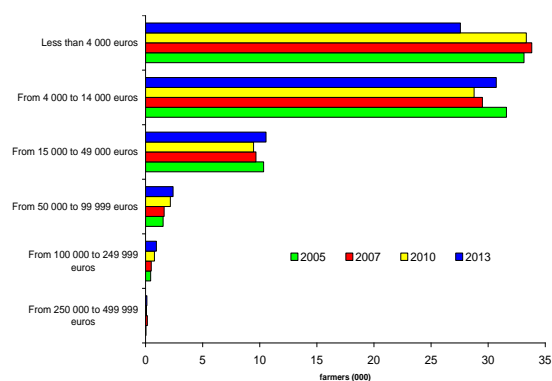Source: Own elaboration on data Eurostat.

Fig. 5. Evolution over the time of Slovenian farms stratified in function of the variable standard output.
Source: Own elaboration on data Eurostat.

Focusing the attention on the dimension of farms, in terms of hectares of usable agricultural areas, the data published by Eurostat have highlighted as more than 50% of Slovenian farms have a poor surface which is lower than 5 hectares and no more than 1,000 farms have an agrarian surface above the threshold of 100 hectares (Fig. 3). This trend, stable over the time of investigation,

has corroborated the need of farmers in implementing the land capital in order to ameliorate the level of investments and efficiency.

The bottleneck and the main downside in the management of Slovenian farms is the age of owners; in fact, more than one fourth, value stable over the time 2005-2013, of farmers has an age above 65 years and the main percentage of farmers is managed and owned of agrarian entrepreneurs with an age between 55-64 years and less than 2,000 farms are managed by farmers under 35 years old (Fig. 4).

In current price, Slovenian farms, stratified in function of their own level of standard output, have pointed out as more 30,000 of agrarian enterprises have got less than 4,000 euro and this value is increased sharply in 2007 and it is diminished in 2013 (Fig. 5). Addressing the attention on the other clusters of standard output, findings have highlighted a significant increase of this variable comparing the values of standard output in 2013 to some of them assessed in 2010.

Table 1. Average of specific costs in different typology of farming assessed in Slovenian farms over the time 2004-2013

Typology of farming	Specific crop costs (€/ ha)
Specialist wine	1,024.18
Specialist orchards fruits	1,096.48
Specialist milk	183.47
Specialist sheep and goats	39.90
Specialist cattle	77.44
Specialist granivores	297.21
Mixed crops farms	565.63
Mixed livestock farms	172.63
Mixed crops and livestock farm	252.05
Total in all FADN farms	220.63

Source: Own elaboration on data FADN published on the website
http://ec.europa.eu/agriculture/rica/database/database_en.cfm

According to the data published by the FADN dataset, the average value of crop costs over the time 2004-2013 has pointed out as farmers specialized in orchard and other fruits have had the highest level of specific costs such as farmers specialized in producing wine (Table 1). In all Slovenian farms belonging to the

FADN dataset, the average value of specific cost has been close to 220 euro per hectare even if specialized agrarian enterprises in cattle-breeding and sheep-goats farming have highlighted the lowest levels of crop costs.

Table 2. Main correlations among investigated variables in Slovenian farms part of FADN dataset over the time 2004-2013

Variable correlation	Value
Labour input and total output	6.25E-19 ***
Labour input and Utilized Agricultural Areas	4.37E-88 ***
Total input and total output	n.s.
Utilized Agricultural Areas and total costs	4.50E-14 ***
Farm Net Income and total specific costs	0.026 **
Farm Net Income and total assets	1.38E-38 ***
Farm Net Income and financial subsidies allocated by the CAP	n.s.
Farm Net Income and Less Favoured Areas subsidies	4.68E-11 ***
Utilized Agricultural Areas and Less Favoured Areas subsidies	5.48E-39 ***

** 5%; *** 1%; n.s. not significance
Source: Own elaboration on data FADN published on the website
http://ec.europa.eu/agriculture/rica/database/database_en.cfm

The main correlations among labour input and total output and utilized agricultural areas in all farms belonging to the FADN dataset, during the ten year time of investigation, have pointed out a significant nexus of correlation (Table 2).

A correlation has been found between the variables farm net income and total assets and between the variables farm net income and financial subsidies allocated towards stayed behind rural areas; in the same time, the impact of payments disbursed by the first and also by second pillar of the CAP did not act on the level of farm net income in Slovenian farms.

The farms specialized in granivores have pointed out the highest levels of labour costs, usable agricultural areas and specific costs (Table 3). Findings have highlighted as fertilizers costs in typology of farming as granivores have been higher than other typologies of farming and this is correlated to their own activity of production, which has a

nexus to the highest level of farm net income (Table 3).

Table 3. Average values of variable investigated over the time 2004-2013 in Slovenian farms part of FADN dataset

Typology of farming	Labour input (€)	UAA (ha)	Total output (€)
Wine	3,678.47	4.59	29,510.22
Orchards fruits	3,826.29	5.96	31,625.17
Dairy cows	3,874.07	15.57	40,715.40
Sheep and goats	2,723.53	12.54	11,650.10
Specialist cattle	2,899.57	10.72	13,754.00
Granivores	3,525.77	23.14	79,886.00
Mixed crops	2,817.18	7.04	18,817.25
Mixed livestock	3,164.86	9.04	15,348.30
Mixed crops and livestock	2,919.13	9.37	15,428.60
Total in all FADN farms	3,174.56	10.95	22,166.50
Typology of farming	Crop protection cost (€)	Farm Net Income (€)	Total assets (€)
Wine	1,424.00	11,986.00	191,861.67
Orchards fruits	3,170.67	9,961.00	156,726.67
Dairy cow	329.90	11,378.50	258,787.00
Sheep and goats	82.90	746.30	236,900.30
Specialist cattle	104.10	2,683.80	196,335.20
Granivores	1,382.00	25849.56	367,786.00
Mixed crops	781.38	6,425.13	152,300.63
Mixed livestock	291.00	1,790.20	142,451.50
Mixed crops and livestock	495.30	3,631.60	148,910.70
Total in all FADN farms	472.30	5,930.70	191,507.90
Typology of farming	Total inputs (€)	Total specific costs (€)	Total fixed assets (€)
Wine	19,888.33	4,857.89	167,233.56
Orchards fruits	27,957.00	6,890.67	146,531.33
Dairy cow	39,121.50	20,026.80	244,449.70
Sheep and goats	16,773.50	4,287.50	229,951.80
Specialist cattle	17,536.80	6,509.50	186,768.30
Granivores	73,705.78	42,850.44	333,650.67
Mixed crops	16,495.00	5,092.50	145,689.75
Mixed livestock	18,493.90	8,304.80	132,666.30
Mixed crops and livestock	17,836.70	7,085.50	140,081.80
Total in all FADN farms	23,026.50	9,570.20	180,628.30
Typology of farming	Total subsidies by CAP (€)	LFA subsidies (€)	Support for rural development (€)
Wine	2,518.78	300.89	1,851.67
Orchards fruits	4,667.83	605.67	2,273.50
Dairy cow	9,015.90	1,571.50	3,167.20
Sheep and goats	6,339.00	1,688.70	4,228.30
Specialist cattle	6,691.20	1,470.50	3,156.10
Granivores	14,216.33	1,207.33	5,926.78
Mixed crops	4,111.13	554.88	2,038.75
Mixed livestock	5,170.00	836.20	2,048.30
Mixed crops and livestock	6,018.70	742.60	2,771.10
Total in all FADN farms	6,621.10	1,108.90	2,960.00
Typology of farming	Seeds and Plants (€)	Fertilizers Cost (€)	Total crops output / ha (€)
Wine	97.11	360.56	6,382.943
Orchards fruits	543.50	1,035.67	4,871.352
Dairy cow	654.30	1397.10	663.088
Sheep and goats	133.80	133.80	323.209
Specialist cattle	221.00	357.50	466.693
Granivores	2,003.22	3,117.00	1,095.633
Mixed crops	1,250.13	1,013.38	2,357.293
Mixed livestock	424.60	692.80	761.940
Mixed crops and livestock	545.20	896.20	954.904
Total in all FADN farms	520.40	869.90	942.261

Source: Own elaboration on data FADN published on the website
http://ec.europa.eu/agriculture/rica/database/database_en.cfm

Slovenian agrarian enterprises specialized in sheep and goats breeding have pointed out the poorest levels of labour costs, output and inputs even if these latter farms have got significant amount of financial subsidies allocated in terms of LFA payments and also in terms of financial aids disbursed by the

second pillar of the CAP.

Drawing the attention on the financial subsidies allocated by the European Union throughout the Common Agricultural Policy in the first and second pillar, findings have pointed out as agrarian enterprises specialized in granivores such as pig breeding and chicken farming have got the highest level of total subsidies by the CAP such as dairy farms (Fig. 6). Farms specialized in sheep and goats as a consequence of the large dimension of agricultural areas, scattered predominantly in disadvantaged rural areas, have received the highest level of LFA payments close to 1,700 euro.
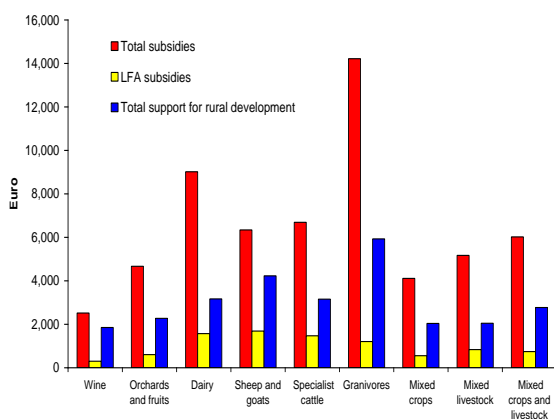

Fig. 6. Average value of financial subsidies allocated by the CAP towards Slovenian farms.
Source: Own elaboration on data FADN published on the website
http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

The multiple regression model fits well with the purpose of the research because the level of R^2 and adjusted R^2 have been equal to 0.73 and 0.71.

The level of farm net income has been directly correlated to the independent variables agricultural areas, total inputs and payments allocated by the second pillar of the CAP (Table 4). Total assets, payments disbursed in favour of disadvantaged rural areas (LFA aids) and total subsidies allocated by the Common Agricultural Policy correlate indirectly to the independent variable farm net income; hence, farms with the highest level of subsidies allocated by the CAP and by the LFA supports, located predominantly in Slovenian stayed behind rural areas, have had

the poorest level of farm net income corroborating the hypothesis according to which agrarian enterprises in mountainous and hilly areas have to be supported by the public aids in order to reduce the socio-economic marginalization of rural areas.

Table 4. Main results in the multiple regression model over the time 2004-2013 in Slovenian farms part of FADN dataset. Dependent variable Farm Net Income

Dependent variables	Coefficient	Standard error	t value	p-value	Significance
Constant	5,452.07	1438.65	3.7897	0.00030	***
Utilized Agricultural Areas	897,705	274.61	3.2690	0.00163	***
Total inputs	0.44	0.0806	5.5098	<0.00001	***
Total assets	-0.05	0.0086	-6.395	<0.00001	***
LFA payments	-5.60	1.7696	-3.168	0.00222	***
Rural Development Plan payments	1.93	0.7204	2.687	0.00886	***
Total subsidies allocated by the CAP	-1.25	0.5528	-2.276	0.02568	**

** 5%; *** 1%
Source: Own elaboration on data FADN published on the website
http://ec.europa.eu/agriculture/rica/database/database_en.cfm.

Table 5. Main correlations in Slovenian farms between economic size and land capital.

Variable	Years		
	2007	2010	2013
Economic size versus UAA	0.26 *	0.48 **	0.66 **
Economic size versus livestock units	0.79***	0.89***	0.93***
Economic size versus Annual Working Units	-0.4***	0.37***	0.27***

* significance at 10%, ** significance at 5% ; significance at 1%
Source: Own elaboration on data published on the website http://www.stat.si/StatWeb/en

Economic size and the variable utilized agricultural areas increased over the height year time of investigation and these two variables have pointed out to be directly correlated (Table 5). Findings have pointed out as there is a direct nexus between livestock units and economic size hence, large

size farms have had the most significant level of income, which is increased since 2007 to 2013.

CONCLUSIONS

Findings have pointed out as the size of farms, in terms of usable agricultural areas, is a pivotal variable able to act on the level of farm net income and investments. In general, both in Slovenia and also in many other European countries a new generation of farmers has taken over farms halting the aging phenomenon typical of rural areas.

Furthermore, local and national authorities in order to face the out emigration and rural marginalization in Slovenian countryside have to address their efforts in allocating more financial resources towards a growth of land capital with the consequence to stimulate an high specialization in agricultural enterprises by technical intensive investments linked to an adequate and efficient level of land capital.

In general, it is important also to address enterprise's attempts towards a diversification of activities inside the farm rather than the productive diversification in a perspective of multifunctional farms able to get the most by the environment and the peculiarities of Slovenian farms. In fact, specialized farms have had the best results in farm net income and in terms of economic and technical results compared to mixed farms.

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