

Economic aspects of rural areas sustainable development

Ekonomické aspekty udržitelného rozvoje rurálních oblastí

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Abstract: The article deals with problems of different development of rural areas and their factors. In usual analysis of rural development, the position of agriculture is interpreted in broad range of opinions from the neglectable role to its non-substitutability in rural economics. The article follows strong sides of these concepts at simultaneous reduction of their weaknesses and is focused on problems of investigation of the mutual influence of endogenous as well as exogenous industries on rural regions. Applied approach leads to setting up model of economic base and deriving of multipliers of rural development. It is obvious from the analysis that nonagricultural subsidy programs supporting development of the others industries in region have indirect influence upon its agriculture too. In different regions, this influence varies due to the factors investigated in the paper.

Key words: regional economics, economic base models, multipliers of economic development, employment, inter industries relationships

Abstrakt: Článek se zabývá problémy různého rozvoje venkovských oblastí a jejich faktory. V obvyklé analýze je pozice venkovského rozvoje zemědělství v široké paletě názorů od zanedbatelné role až k její nezastupitelnosti ve venkovské ekonomice. V práci jsou uvedeny silné stránky těchto pojetí při současné redukci jejich slabých stránek a je zaměřená na problémy výzkumu vzájemného vlivu endogenních a exogenních odvětví na venkovské regiony. Aplikovaný přístup vede k vytvoření modelu ekonomické báze a odvození multiplikátorů venkovského rozvoje. Z analýzy je zřejmé, že nezemědělské dotační programy podporující rozvoj jiných odvětví v regionu mají nepřímý vliv také na zemědělství. V různých regionech je tento vliv různý v závislosti na sledovaných faktorech.

Klíčová slova: regionální ekonomiky, model ekonomické báze, multiplikátory ekonomického rozvoje, zaměstnanost, mezi-odvětvové vztahy

INTRODUCTION

In the last ten years of transformation of the economy, Czech agriculture has been experiencing a number of positive changes in building up of background for efficient market agrarian sector. However, the present model of economy was formed in a different historical context, i.e. in different economic, social and civilization conditions – in times when there seemed to be enough resources and space for unlimited growth, for unlimited consumption of the resources and unlimited production of waste. According to the present knowledge, however, the mankind is already facing and exceeding the limits of the Planet bearing capacity which makes this economic system unsustainable and replacing it with an alternative system that respects sustainable development principles is an important

precondition for preserving diversity of life forms and favorable environment for life of the humans. More and more economists realize the limitation and finiteness of the resources that economy uses for growth of production, cash-flows and consumption. According to some economists, economy is interpreted as non-growing system and its quantitative growth cannot continue forever. It does not mean going back to simple civilization habits but efficient management of natural resources, taking from the nature only as much as it is able to regenerate, using eco-effective technologies, recycling wastes to the maximum extent and reducing useless consumption.

The state of natural resources is significantly influenced by agricultural activities which are not equally spread over the area of state, but differently in individual regions. Nevertheless, agricultural production is

a part of industries mix almost in every region. From this viewpoint, agriculture industry is in interactions with the other industries in each region. The types of those interactions are multidimensional, but for the limited scope of this article only two, but basic relationships will be analyzed.

AIMS AND METHODOLOGY

The main goal of the paper is to investigate mutual interdependency between agriculture and other industries in different regions in the Czech Republic on the base theory of regional development (Tvrdoň 1994).

The working hypothesis follows these assumptions:

- Rural areas are part of all administrative regions of the Czech Republic
- Economic and environmental performance of agriculture is interlinked with the total region economic and environmental performance
- For explanation of this relationship, model of economic base can be used
- Level of employment in regions depends on the national rate of employment and structure of industries in that region.

Joint background for these assumptions is explained by (Isard 1990) and others (Stillwell 1992) who suppose that growth in one regional industry is the function of growth of all industries in that region. If the rest of economy operates well, one industry in a role of input from those industries is predetermined to operate successfully too and vice versa. Due to the lack of data of rural regions, data published by the Czech Statistical Office for 13 administrative regions were used (Statistická ročenka 2003).

Applied methods were predetermined by investigated the problems which were according to the above mentioned structure, but in all parts it was dealt, even though in a different rate, with qualitative analysis, quantitative analysis, synthesis, comparison, method of analogical conclusions, norm method, interviewing, elaboration of documents and others.

RESULTS OF ANALYSIS

Specification of Economic Base Model (EBM)

In the EBM, all industries of given region are divided into two groups on the hypothesis of high dependency of regional performance measured by income and employment upon the basic sector which delivers

its product and services to buyers of others regions. Non-basic sector provides products and services first of all inside of the given region. To this definition, agricultural industry fits the most.

To derive the multiplier of economic base, total income of region can be divided into two parts:

$$T = S + B \quad (1)$$

T = total income of region

S = Income of non basic sector

B = Income of basic sector

The amount of income created by non-basic sector depends on income created by region as a total. The greater the income, the greater the demand for products and services provided in framework of given region.

$$S = sT \quad (2)$$

From (1) and (2) it can be derived

$$T = \frac{1}{1-s} \times B. \quad (3)$$

where $1/(1-s)$ is multiplier of economic base. If for example $T/B = 1.5$, income increase in basic sector by 100 CZK will stimulate total income increase of region by 150 CZK.

Multiplier of employment can be derived similarly by substitution data of employment for data of income. Where considering also influence of other factor on the total region income, the previous model can be adjusted:

$$S = s_0 + s_1T \quad (4)$$

From (1) and (4), it can be derived:

$$T = \frac{s_0}{1-s_1} + \frac{1}{1-s_1} \times B \quad (5)$$

For deriving both multipliers, regression models can be applied.

Specification of regional structure of employment analysis (RSEA)

Under the hypothesis that economic situation of region significantly influences its agriculture, the following analysis can specify the impact of industry structure upon employment development.

Application of the RSEA follows these relationships

1. Regional employment growth (g_r)

$$g_n = \frac{\sum_i n_i^t - \sum_i n_i^0}{\sum_i n_i^0} \times 100 \quad (6)$$

r_i = regional employment in industry "i"
 $\sum_i r_i$ = number of employed in all industries in given region
 t, o = last and reference year of analyzed time period

2. National employment growth (g_n)

$$g_r = \frac{\sum_i r_i^t - \sum_i r_i^0}{\sum_i r_i^0} \times 100 \quad (7)$$

Specification of variables and indices is the same as in (6) only instead of regional level, variables are from the macro level.

3. Regional employment growth in nationwide employment growth rate

$$g_{rn} = \frac{\sum_i \left(r_i^0 n_i^t / n_i^0 \right) - \sum_i r_i^0}{\sum_i r_i^0} \times 100 \quad (8)$$

Variable (g_{rn}) expresses growth of regional employment if each industry had the same growth rate as that on the nationwide scale.

From these relationships, it follows:

Regional employment growth = Growth induced by other factors + Growth following industry mix + Nationwide growth rate impact

$$g_r = (g_r - g_{rn}) + (g_{rn} - g_n) + g_n \quad (9)$$

The higher the component g_n the higher the growth of employment in regions.

Expression ($g_{rn} - g_n$) manifests structural component impact of industry structure in given region on employment. If industry structure supports employment, the expression is positive ($g_{rn} > g_n$). The opposite means that industry structure is not suitable for employment development.

Expression ($g_r - g_{rn}$) manifests that part of growth which was induced by other factors not included in the model. Positive values mean that employment in region is faster than it would be if employment growth in every industry were the same as at the national level.

Deriving and analysis of the model's parameters

Impact analysis of regional economic development on income level in agriculture

For the analysis, models (2) and (4) were specified with parameters enabling to rank regions according to the influence of the total region income level upon the income level in agriculture considered as non-basic sector (Tvrdň 2003). Table 1 presents the output.

Results of calculations are ranked up according to size of "t" at row 1. Figures at row 2 are multipliers "m" according to equation 3 explaining total income change in the given region induced by unit change of income in basic sector. From it, row 3 is calculated and the results express what will induce income change by 100 CZK of basic enterprises in agriculture. In the region Vysočina for example, income will decrease by 403 CZK and it will increase income in agriculture of the Liberec region by 44 CZK. If regional economy improves, income level of agriculture industry goes up by t times – specially in the Vysočina and Jihočeský regions. The other results are documented by following Figure 1.

More reliable model is the relationship (4) which admits also other influences expressed by "t₀" values for individual regions. For the restricted size of the article, "t₀" values are not presented and only "t₁" parameters are analyzed according to Table 2.

Table 1. Structural parameter "t" of equation $S = tT$, multipliers and income changes

Region	$t = s$	$1/(1 - t) = m$	Income change in S
Vysočina	1.3292	-3.0376	-403
Jihočeský	1.0214	-46.7289	4 772
Plzeňský	0.8967	9.6805	868
Pardubický	0.8284	5.8275	482
Olomoucký	0.8249	5.7110	471
Středočeský	0.7631	4.2211	322
Královéhradecký	0.7234	3.6150	261
Jihomoravský	0.6275	2.6845	168
Zlínský	0.5300	2.1276	112
Karlovarský	0.3744	1.5984	59
Ústecký	0.3314	1.4956	49
Moravsko-slezský	0.3172	1.4645	46
Liberecký	0.3058	1.4405	44

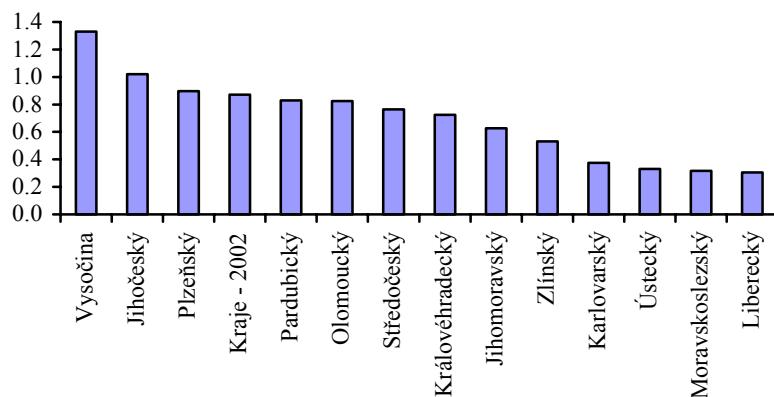


Figure 1. Parameter t of equations $S = tT$ (asix $x - t$, asix $y - \text{region}$)

Table 2. Structural parameter " t_1 " of equations $S = t_0 + t_1T$, multipliers, income changes

Region	$t_1 = s_1$	$1/(1 - t_1) = m_1$	Income change in S
Vysočina	1.7384	-1.3542	-235.41
Jihomoravský	1.5359	-1.8660	-286.0
Plzeňský	1.5026	-1.9896	-298.96
Středočeský	1.3908	-2.558	-355.8
Olomoucký	1.3091	-3.2351	-423.51
Jihočeský	1.3004	-3.3288	-432.88
Pardubický	1.2647	-3.7778	-477.78
Liberecký	0.9156	11.8483	1084.83
Karlovarský	0.8414	6.305	530.5
Moravsko-slezský	0.5866	2.4189	141.89
Ústecký	0.4889	1.9565	95.65
Zlínský	0.1456	1.1704	17.04
Královéhradecký	0.1309	1.1506	15.06

The analysis of the results is analogical to model (2) but for all equations, R^2 indicators is created to the level 0.75–0.95. Income increase by 100 CZK in basic industries has symmetrical impact upon income level in agriculture – aprox. half of regions manifest decrease of agricultural income whereas the second half shows income increase. For example in the region Vysočina, there is decrease of 235.4 CZK in agricultural income, whereas the region Královéhradecký and Zlínský manifest an increase of agricultural income by 15.06 CZK, respective Zlínský, 17.04 CZK.

Parameters " t_1 " for all regions are presented in Figure 2.

Income level $m_0 = t_0/(1 - t_1)$ which remains on that level even though income level of basic sector will go up fall down. For explanation of changes in the region ranking, it would be necessary to analyze more comprehensive database than those which are available and a wider scope of the paper.

Impact analysis of regional industry structure upon employment development

Region economic performance can be analyzed according to many indicators but at least two of them

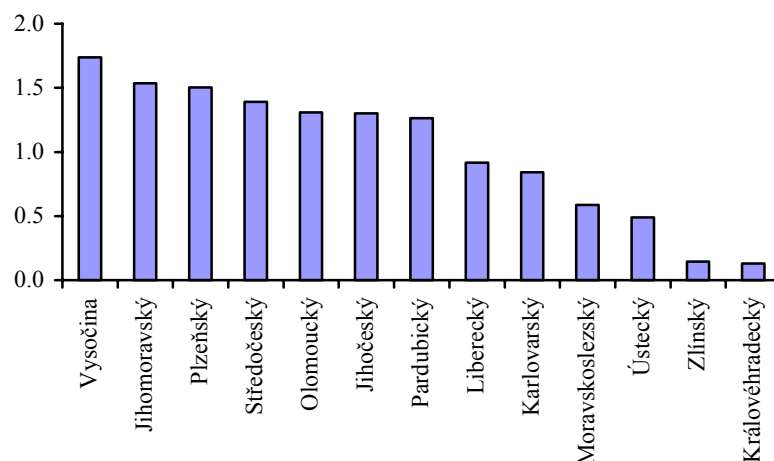


Figure 2. Parameter t_1 of equation $S = t_0 + t_1T$ (asix $x - gt$, asix $y - \text{region}$)

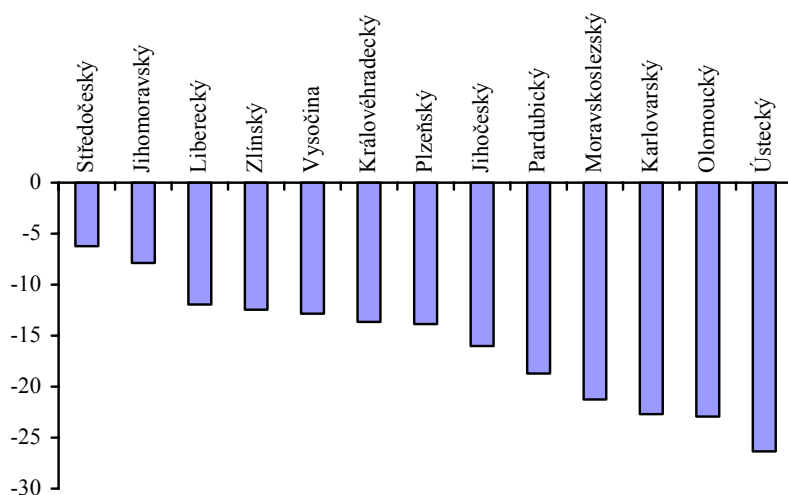


Figure 3. Region growth rates (asix x – gt , asix y – region)

play a non-substitutable role. One of them – income level – is investigated in previous chapter, second one – employment development during time period 1995–2002 and its determinants – are analyzed in the following part of the paper.

For that aim, indicators (6), (7), (8) were calculated and used for decomposition of employment growth according to model (9).

Specification of employment growth in regions

According to relation (6), indicator g_r for time period 1995–2002 was calculated and when ranked from the viewpoint of its size following results are presented.

From the Table 3, it is obvious that the number of employed people fell down in all regions but with large differences. In the Středočeský region for example,

employment decrease is 6.24% whereas in the Ústecký region it was 26.35%. Growth rates for all regions are presented in Figure 3.

Specification of potential employment growth in regions

According to relation (8) indicator g_{rn} in the given time period was calculated and when ranked from the viewpoint of its size following results are presented.

The Table 4 illustrates significant differences in the potential region employment growth. In the region Karlovarský employment growth could be 27.55%, whereas in the Moravskoslezský only 5.65%.

Potential growth rates for all regions can be clearly seen in Figure 4.

Table 3. Regional growth rate g_r

Region	g_r
Středočeský	-6.2419
Jihomoravský	-7.8611
Liberecký	-11.9573
Zlínský	-12.4435
Vysočina	-12.8469
Královéhradecký	-13.6574
Plzeňský	-13.8605
Jihočeský	-16.0283
Pardubický	-18.6980
Moravskoslezský	-21.2663
Karlovarský	-22.7047
Olomoucký	-22.9413
Ústecký	-26.3589

Table 4. Potential employment growth

Region	g_{rn}
Karlovarský	27.5500
Liberecký	19.9413
Vysočina	15.8528
Pardubický	15.7295
Královéhradecký	14.7680
Zlínský	14.3882
Plzeňský	14.3064
Olomoucký	12.9545
Jihočeský	12.9496
Ústecký	9.5637
Středočeský	8.3311
Jihomoravský	6.9369
Moravskoslezský	5.6509

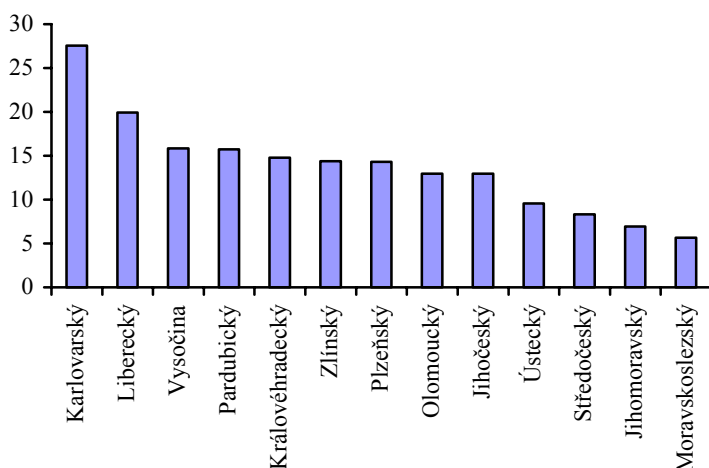


Figure 4. Potential growth rates (axis x – gr_n , axis y – region)

Specification of national economy employment growth

According to relationship (7), indicator g_n was calculated in the given time period and its value is equal to -1.69%

When indicators (6), (7), and (8) were specified, determinants of employment growth according to relationship (9) can be analyzed. For that purpose, three components of growth rate were calculated and all of them are presented in the Table 5.

From the Table 5, it is obvious that industry restructuring in all regions has taken place successfully and, if

no other negative factors comprehensively quantified in column A would operate, in all regions the rate of employment could be positive – see column B – and relatively at a very high level.

The weakest impact of the other factors is in the Středočeský region (-14.57%) whereas in the Karlovarský region is more than three times higher (-58.25%).

Results for all regions are included in Table 6.

Except first two regions – Středočeský and Jihomoravský – differences between the real and potential growth rates are more or less the same – around 30%. A more illustrative views in inter-regional differences is provided by Figure 5.

Table 5. Decomposition of regional growth rates

Region	Regional employment growth	Growth induced by other factors	+	Growth following industry mix	+	Nationwide growth rate impact
	g_r	$(g_r - g_{rm})$	+	$(g_{rm} - g_n)$	+	g_n
	$g_r =$	A	+	B	+	C
Středočeský	-6.2419	-14.5730		10.0180		-1.6869
Pardubický	-18.6980	-34.4276		17.4164		-1.6869
Liberecký	-11.9573	-31.8986		21.6281		-1.6869
Vysočina	-12.8469	-28.6996		17.5396		-1.6869
Jihomoravský	-7.8611	-14.7980		8.6238		-1.6869
Ústecký	-26.3589	-35.9225		11.2506		-1.6869
Plzeňský	-13.8605	-28.1669		15.9933		-1.6869
Zlínský	-12.4435	-26.8317		16.0751		-1.6869
Jihočeský	-16.0283	-28.9780		14.6365		-1.6869
Karlovarský	-22.7047	-50.2547		29.2369		-1.6869
Moravskoslezský	-21.2663	-26.9171		7.3378		-1.6869
Královéhradecký	-13.6574	-28.4254		16.4549		-1.6869
Olomoucký	-22.9413	-35.8958		14.6414		-1.6869

Table 6. Growths of employment induced by other factor

Region	$g_r - g_{rn}$	Region	$g_r - g_{rn}$
Středočeský	-14.5730	Jihočeský	-28.9780
Jihomoravský	-14.7980	Liberecký	-31.8986
Zlínský	-26.8317	Pardubický	-34.4276
Moravskoslezský	-26.9171	Olomoucký	-35.8958
Plzeňský	-28.1669	Ústecký	-35.9225
Královéhradecký	-28.4254	Karlovarský	-50.2547
Vysočina	-28.6996		

On the other hand in the Karlovarský region, there is relatively very suitable industry composition, but this potential is severely devaluated by other factors. The lowest potential growth due to industry structure is in the Moravskoslezský region. The following table brings results of calculation for all regions.

The data of the table bring more information in the graph form which follows.

In similar sequence of regions, it can be expected that agriculture growth in regions will follow. If growth

of employment brings income into the regions and if negative impact of the other factor is minimized, agricultural income, as it was proved in part 3, will rise as well.

DISCUSSION

Previous analyses documented that the position and economic results of agriculture depend upon the

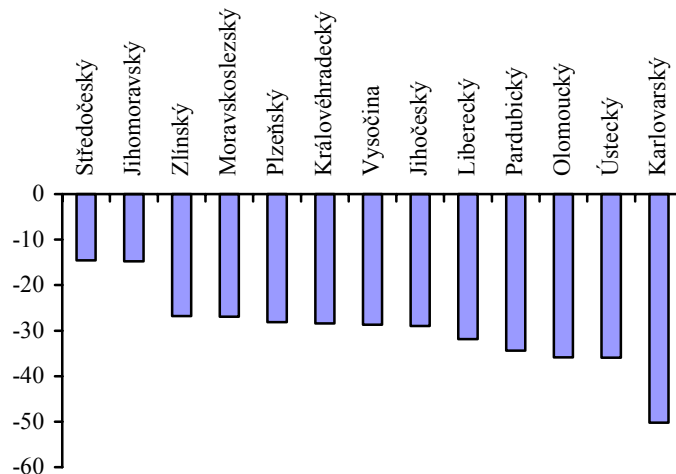


Figure 5. Growth of employment induced by other factors (asix x - $g_r - g_{rn}$, asix y - region)

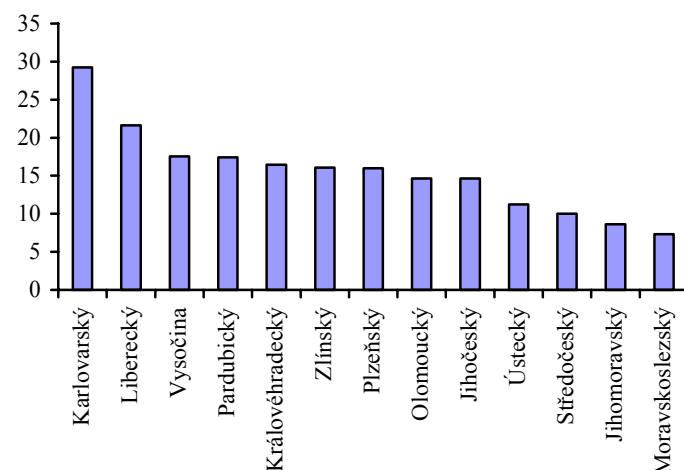


Figure 6. Growth induced by industry mix (asix x - $g_r - g_{rn}$, asix y - region)

Table 7. Growth following industry mix

Region	$g_{rn} - g_n$
Karlovarský	29.2369
Liberecký	21.6281
Vysočina	17.5396
Pardubický	17.4164
Královéhradecký	16.4549
Zlínský	16.0751
Plzeňský	15.9933
Olomoucký	14.6414
Jihočeský	14.6365
Ústecký	11.2506
Středočeský	10.0180
Jihomoravský	8.6238
Moravskoslezský	7.3378

region economy as a total. The presented analysis is based on the hypothesis of high correlation between income level per labor force and real regional GDP. For further analysis, it will be necessary to have data for regional GDP and simultaneously of its splitting into basic and non-basic industries including labor force distribution into these two sectors. That data base enables also deriving input – output model and investigation of the components of GDP on their level and interactions.

CONCLUSION

The analysis documented high dependency of agriculture economic performance upon the region-wide development. If no negative factors operate,

the best condition for agriculture development are in the Karlovarský and Liberecký regions and the weakest are in the Jihomoravský and Moravskoslezský regions. The position of other regions in agricultural development fits to the Table 7 and it means that the best conditions for agriculture development fall down from the Karlovarský region to Liberecký, and after that in the following ranking. Regional agriculture future economic performance can be therefore classified in this order: Region Kralovarský, Liberecký, Vysočina, Pardubický, Královéhradecký, Zlínský, Plzeňský, Olomoucký, Jihočeský, Ústecký, Středočeský, Jihomoravský and Moravskoslezský. Positive values of the potential growth rate diminished by the national economy growth mean that industry restructuring creates background for favorable development also in future and for sustainable agriculture in perspectives.

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