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HOW STICKY IS THE PER CAPITA INCOME?

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ABSTRACT

In our settlement-level study using the Markov chain method and dynamic regression panel models, we found that in the period 2011-2021, income in the previous year strongly affects income status, i.e., income shows high persistence. Despite the steady increase in per capita income over the period under study, the spatial structure of the income distribution shows a fixed state, with a high degree of stability: poor municipalities remain poor, while rich municipalities remain rich. Only in the Central and Western Transdanubian regions is there a greater chance of a municipality's population moving into a higher income category. The results of the regression models show that, in addition to the income level of previous years, the higher number of self-employed, the greater distance of settlements from cities and Budapest, the employment structure and the higher share of job seekers have a significant impact on the income of the population.
Keywords: income persistence, income distribution, factors affecting income, Markov chain, dynamic panel model

INTRODUCTION

In our study, we seek to answer two interrelated questions. By exploring the spatial structure of income in Hungary between 2011 and 2021, we want to investigate the stability of the spatial pattern of income (income persistence) and to shed light on the extent to which the income level of previous years affects the current income level, i.e. to get a picture of income „inertia". If income inertia (ϱ) is significant, then factors specific to the geographical unit are less important.

Researchers in the field of income studies have repeatedly demonstrated spatial autocorrelation, i.e. that the income position of spatial units strongly influences the income level of neighbouring areas. This time, in addition to the spatial dimension, we incorporate the time dimension in our research and investigate whether the impact of past incomes and other variables on the income level of the population of Hungarian municipalities in 10 years can be statistically detected. These results may help to better understand why some regions cannot escape from the income trap.

Literature review

In the international literature, the issue of income distribution is closely linked to the convergence process. Related to this, the main question is whether per capita income

in poor countries/regions increases faster than in rich countries/regions during periods of economic development (beta convergence). Another strand of convergence studies investigates whether the dispersion of per capita income of different groups decreases over time (sigma convergence) (*Barro & Sala-i-Martin*, 1992; *Caselli et al.*, 1996; *Glaeser et al.*, 1995; *Islam*, 1995; *Mankiw et al.*, 1992). The process of convergence can also be studied within the framework of club convergence (*Baumol,* 1996, cited in *Dusek-Kotosz,* 2017). According to this approach, each territorial unit converges to its group- or club-specific equilibrium state (e.g. the EU Member States converge to the EU average). According to club convergence theory, it is the initial conditions for each group of countries that determine the convergence processes.

Empirical research on income distribution has been conducted for many countries around the world at different levels of aggregation. What their results have in common is that they generally conclude that the spatial units under study fall into convergence clusters with stable income status, be it Turkey (*Ursavaş & Mendez,* 2022), China (*Luo et al.*, 2021; *Cheong & Wu*, 2013), India (*Mishra & Kumar*, 2018) or Europe (*Cosci & Sabato*, 2007; *Hierro & Maza*, 2009). *Dall'erba* (2005) explains the non-random, distinctive patterns of income levels by geographical spillover effects. He points out, when examining the spatial distribution of income, that rich (poor) regions tend to cluster near other rich (poor) regions.

A large number of foreign studies focus on China, examining whether there has been a change in the relative income patterns of regions and counties in the course of economic development since 1978. The results show that there is a high probability that the studied spatial units will remain in the current income group, convergence is excluded for some spatial groups, and the persistence of income levels is very high. (*Villaverde et al.*, 2010; *Cheong & Wu*, 2013).

According to research on Europe, there are past examples of territorial units changing their income positions. *Hierro & Maza* (2009), looking at the 15 Member States of the European Union, conclude that income polarisation rates declined sharply between 1980 and 1993 (i.e. there were significant shifts in income distribution), but that between 1993 and 2005, they found stable polarisation levels and a declining probability of shifts. *Cosci & Sabato* (2007) studied differences in the distribution of per capita income in 99 regions of 12 European countries. They also found that regional income disparities persist, with the probability of a region remaining in the same income bracket ranging from 55% to 85%.

Among the studies on Hungary, *Győri & Mikle* (2017) showed that over more than 100 years (their data are from 1910, 1970, 2001 and 2011), the development maps of the Austro-Hungarian Empire, the period of socialism and the decades after the regime change are very similar. By examining the values of a composite index of development (of which income is one component), the authors conclude that the differences in the West-East division of the country have not changed in a century and that the marked separation of centre-periphery, developed and underdeveloped areas, has persisted. Spatial development interventions have been ineffective, failing to address some of the difficult-to-remedy handicaps, such as geographical location. Their results show that strong spatial stability means that there is little chance for individual spatial units to change their development status upwards or downwards.

Spatial structural stability of income is also observed over shorter periods and at lower territorial units. *Egri* (2022a), in his study at the municipal level, finds that between 2012 and 2019, the spatial position of centres and peripheries (regardless of income business cycles) can be considered mostly stable. In our country, spatial clubbing of incomes also appears at lower territorial levels. The income distribution can be considered stable, with an overall share of immobile municipalities of 85.1% over the period under study. The stability and immobility are most pronounced in municipalities at the two ends of the income scale. Both the lowest and the highest income groups have a probability of more than 90% that they will not be able to change their income situation. For the less well-off municipalities, this reflects the poverty trap phenomenon (*Egri*, 2023).

In another work, *Egri* (2022b) points out that absolute convergence is not observed in the 2010s, and that the catching-up of less developed districts is not typical. What is typical, however, is the convergence clustering of districts, which *Quah* (1996) shows is a pattern typical of countries around the world, i.e. polarising income inequalities. Inequality is particularly pronounced in the most income-poor areas, while a more emptying catching-up process is observed in the richest districts.

MATERIALS AND METHODS

In our research, the outcome variable of the regression models is the total domestic income per working-age resident (aged 15-64). This is income subject to personal income tax, so it excludes social and other income. The data were obtained from the TEIR database.

The explanatory variables of the regression models include the lagged variable of income, economic (presence of sole proprietorships and partnerships, EU subsidies, employment structure by FEOR) and social (population, proportion of job seekers), and geographical (distance from Budapest and cities with at least 20,000 inhabitants) variables.

The income data and the explanatory variable for the EU subsidy have been adjusted by the consumer price index and are presented in 2021 real prices. EU subsidies include subsidies paid out under the operational programmes of the New Hungary Development Plan and the New Hungary Rural Development Programme during 2011 and 2016, and subsidies paid out under the Széchenyi 2020 and Széchenyi Plan Plus programmes during 2015-2021. The aid data are available in include all aid paid, regardless of the type of beneficiary organisation, by place of implementation. Descriptive statistics for the variables are presented in *Table 1*.

In our database, variables are available for 3155 municipalities for 11 consecutive years (2011-2021), resulting in a balanced panel database.

For the analysis, we used Arellano-Bond and Blundell-Bond dynamic panel models, which work well when we have many observations and the time parameter is finite (large N, small T sample). The model defined by *Arellano & Bond* (1991) uses the GMM estimator, which is the fdf ferential, which allow for the elimination time-dependent settlement-specific (η_i) feet (*Hirsch & Gschwandtner*, 2013). The model used in r analysis can be expressed as follows:

$$Pi\pi_{i,t} = \Sigma_j \alpha_j\left(X_{j,i,t}\right) + \lambda\pi'_{i,t-1} + \varepsilon_{i,t}, \text{were } \varepsilon_{i,t} = \eta_i + \nu_{i,t} \quad (1)$$

Table 1: Descriptive statistics

Variable	Mean	p50	SD	Min	Max
Income per capita aged 15-64 (HUF/persons)	1 432 391	1 345 065	580 726.800	73 986.450	6 863 752
Population (15-64 years) (persons)	2310.576	613	22 426.729	6	1 240 407
Sole proprietorships per 1000 persons aged 15-64 (number/1000 persons)	47.702	44.321	25.981	0	546.667
Partnership business per 1000 persons aged 15-64 (number/1000 persons)	39.843	28.112	112.680	0	7925.000
Jobseekers per 1000 persons aged 15-64 (number/ 1000 persons)	67.968	54.387	51.725	0	444.444
EU subsidies per 1000 persons aged 15-64 (HUF/1000 persons)	241 566 556	76 279 000	142 658 949	-671 535 826	111 060 492 121
Distance to a city of at least 20 thousand inhabitants (km)	30.509	27.570	17.194	0	110.420
Distance to Budapest (km)	170.854	180.070	66.174	0	332.130
Employed in FEOR-08-0 per 1000 employees (persons/1000 persons)	6.657	4.975	7.921	0	200.000
Employed in FEOR-08-1 (employees/1000 employees)	45.036	38.828	32.779	0	666.667
Employed in FEOR-08-2 (employees/1000 employees)	70.739	64.643	44.267	0	1000.000
Employed in FEOR-08-3 (employees/1000 employees)	111.400	111.111	41.793	0	500.000
Employed in FEOR-08-4 (employees/1000 employees)	52.763	52.326	25.725	0	1000.000
Employed in FEOR-08-5 (employees/1000 employees)	111.072	110.345	38.888	0	500.000
Employed in FEOR-08-6 (employees/1000 employees)	16.895	10.000	23.990	0	1000.000
Employed in FEOR-08-7 (employees/1000 employees)	111.364	109.106	43.950	0	581.921
Employed in FEOR-08-8 (employees/1000 employees)	144.735	135.514	66.856	0	666.667
Employed in FEOR-08-9 (employees/1000 employees)	328.647	300.885	141.604	0	1000.000

The FEOR codes cover the following: FEOR-08-0: Employed in the occupations of the armed forces; FEOR-08-1: Economic, administrative and lobbyist managers, legislators; FEOR-08-2: Employed in occupations requiring the independent use of tertiary education; FEOR-08-3: Employed in occupations requiring other tertiary or secondary education; FEOR-08-4: Clerical and administrative (customer relations) occupations; FEOR-08-5: Trade and service occupations; FEOR-08-6: Agricultural and forestry occupations; FEOR-08-7: Industrial and construction occupations; FEOR-08-8: Machine operators, assemblers, drivers; FEOR-08-9: Employed in unskilled (elementary) occupations.

The GMM estimate is considered consistent if there is no second-order autocorrelation in the error factors and the instruments are appropriate. Hansen and Sargan tests were performed to test the instruments.

The *Blundell-Bond* (1998) model assumes that there is no autocorrelation between the individual error factors, and to work properly, the panel effect must be independent of the first difference of the first observation of the dependent variable.

The coefficient of the lagged variable of income is the most important variable to observe in the regression models. The higher this number is, the closer it is to 1, the more determinant the income of the previous years is for the income of the current year. The result is a picture of income persistence, which shows how much past income changes over the years, and how stable income values are over time. We also observe the effect of other variables on income.

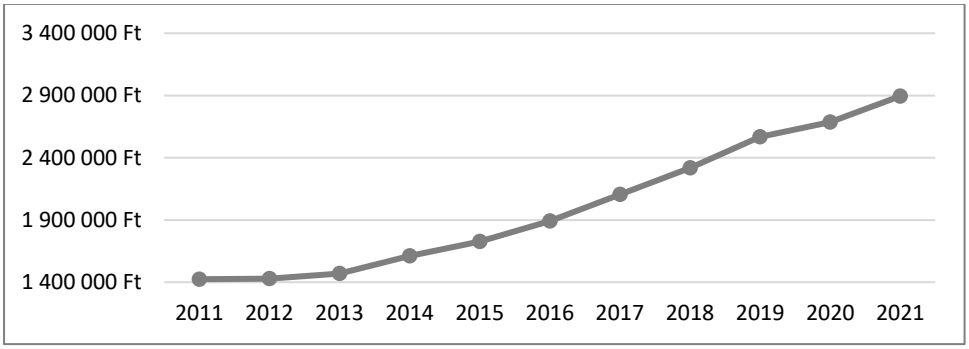
Markov chains allow us to study the dynamics and the population distribution of income (*Major*, 2008). We are looking for explanations for the temporal variation of the population distribution observed at different points in time. To do this, we have to divide our population of interest, in our case the total domestic income per working-age resident, into categories by discretisation. In this case, we have divided the municipalities into 5 categories each year so that the same number of municipalities are placed in each category. The analysis yields a stochastic transition probability matrix. Its values indicate the conditional probability that an item in a given category at the current time will be in a different category at the next time. The closer the main diagonal of the matrix is to 1, the greater the probability that an item will remain in its original category at each observation time, so the main diagonal gives the probability of 'non-movement' (*Major*, 2008; *Stokey & Lucas*, 1989).

STATA 18.0 was used for the statistical analysis and GeoDa 1.20 for the map representation.

RESULTS AND DISCUSSION

Figure 1 shows that incomes in Hungary have grown dynamically over the past 10 years. Growth started in 2013 and wages nearly doubled by 2021. A similar increase is also shown by the change in gross monthly income, in this case, the increase from 2013 to 2021 is 1.87 times (*KSH*, 2024). It can be said that incomes have increased steadily over this period, at an almost unchanged rate (*Figure 1*).

Figure 1: Total domestic income per resident of working age (2011-2021)



Source: Based on *KSH* (2024)

General statements about incomes always bring with them the question of whether they are average incomes and whether the average masks or embellishes reality. The dynamic growth in wages is not equally true for developed and more developed regions, for physical and mental employment, etc. Figure 2 shows incomes by indicating the income at the level of the municipality in different colours. A darker colour indicates a higher income. In 2011, it is clear that incomes were higher in the north and north-west of the country, essentially in the capital Budapest, its surrounding area and the road segment to Austria. In the rest of the country, higher income levels are mainly scattered in the larger cities. Looking at the 2021 map, we do not see any significant change compared to 2011. As shown in *Figure 1*, wages have risen significantly, but *Figure 2* suggests that the „status quo" has not been broken, that there has been no significant improvement in the wages of the municipalities, i.e. no area has been a major winner from this intensive income growth.

Tables 2-4 confirm this observation. In these tables are the transition probability matrices, which show the probability that a municipality will move from its current income situation to another (better or worse) income situation. The municipalities have been divided into 5 income categories, as in *Figure 2*, so that each category contains the same.

Figure 2: Distribution of total domestic income per working-age resident (2011 and 2021)

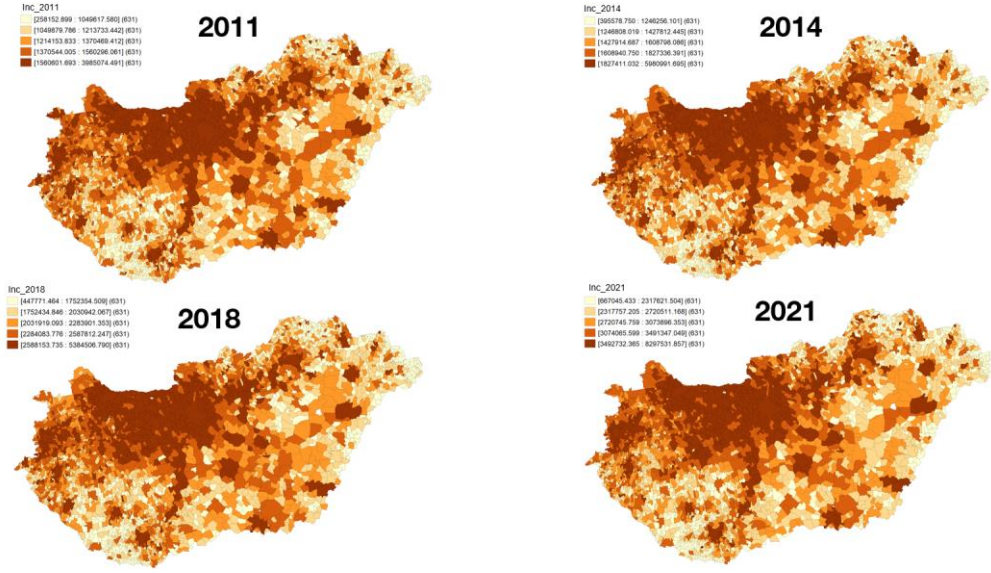


Table 2 includes all settlements in Hungary, with no geographical delimitation. One of the most important parts of the transition probability matrices is the diagonal, which shows the probability that a municipality in a given income category in 2011 will be in the same income category in 2021. Municipalities in the lowest and highest income

categories have a probability of more than 90% of remaining in their current category. So, 9 out of 10 of the most affluent and poorest municipalities will not change their income position. For the middle-income categories (2-3-4), there is an 80% probability of no change in income ranking. For the middle-income category (3), the probability of moving up (10.84%) or down (10.38%) is almost the same. In contrast, category 2 is slightly more likely to move up than to move down (10.71% vs 8.42%), and the opposite is true for category 4, where the probability of moving up to category 3 is slightly higher than for moving down to category 5 (8.94% vs 10.49%).

Table 2: Transition probability matrices for Hungary (N=3155)

		2021					
		1	2	3	4	5	Total
2011	1	91.24	8.46	0.19	0.06	0.05	100.00
	2	8.42	80.48	10.71	0.30	0.10	100.00
	3	0.30	10.38	78.18	10.84	0.30	100.00
	4	0.03	0.59	10.49	79.95	8.94	100.00
	5	0.02	0.10	0.43	8.84	90.62	100.00
	Total	20.00	20.00	20.00	20.00	20.00	100.00

The transition probability matrix shown in *Table 3* is for the Central Transdanubian region, which includes a high proportion of the highest-income municipalities (*Figure 2*). In this case, the interpretation of the income categories 1 to 5 is different. 1 continues to denote the lowest-income municipalities, but whereas in *Table 2* we observe a national situation, here the municipalities with the highest incomes are included in the analysis. In other words, category 1 is the group of the least high-income municipalities among the high-income municipalities. The probabilities in *Table 3* are slightly lower than those in *Table 2*, but the proportions are similar. Here again, the high and low categories have the largest „stickiness", i.e. the probability of changing category is lowest here. The dynamics between municipalities in the highest income categories are almost identical to the national trends, except for the middle categories where the probabilities of persistence are about 10 percentage points lower.

Table 3: Transition probability matrices for Central Transdanubia (N=401)

		2021					
		1	2	3	4	5	Total
2011	1	86.38	12.50	0.75	0.25	0.12	100.00
	2	12.00	70.50	15.62	1.50	0.38	100.00
	3	1.12	15.00	69.62	14.00	0.25	100.00
	4	0.38	1.75	13.50	74.38	10.00	100.00
	5	0.12	0.25	0.49	9.75	89.38	100.00
	Total	19.95	19.95	19.95	19.95	20.20	100.00

The transition probability matrix for Western Transdanubia is shown in *Table 4*. The municipalities in this area also belong to the higher income groups (*Figure 2*), but there are also municipalities with slightly lower incomes compared to Central Transdanubia. In national terms, however, this is an outstanding area. The results here are almost identical to the results in *Table 3*, with very similar dynamics.

Table 4: Transition probability matrices for Western Transdanubia (N=657)

		2021					
		1	2	3	4	5	Total
2011	1	85.65	12.75	1.22	0.38	0.00	100.00
	2	12.44	70.38	15.73	1.22	0.23	100.00
	3	1.60	15.34	65.95	15.95	1.15	100.00
	4	0.15	1.15	16.11	70.53	12.06	100.00
	5	0.15	0.38	0.98	11.73	86.77	100.00
	Total	19.94	19.94	19.94	19.94	20.24	100.00

If we look at the transition probabilities in the poorest region, South Transdanubia, after the two richer regions mentioned above (*Table 5*), we see that the main diagonal values are closer to the national values. We see higher probability values than in the two richer regions (Central and Southern Transdanubia). Thus, in line with the literature (*Egri*, 2022b), poorer regions have a higher probability of no change in the income situation.

It can also be observed that in Central and Western Transdanubia (*Table 3 and Table 4*), the probability of the population improving their income situation by one category (diagonal above the main diagonal) is higher than in the data without geographical delimitation (*Table 2*) and in the data for the Southern Transdanubia (*Table 5*). The chances of a municipality's population moving up by more than one category are about the same in any region.

Table 5: Transition probability matrices for Southern Transdanubia (N=656)

		2021					
		1	2	3	4	5	Total
2011	1	88.63	10.84	0.31	0.23	0.00	100.00
	2	10.46	73.89	15.11	0.38	0.15	100.00
	3	0.69	14.65	72.23	12.36	0.08	100.00
	4	0.23	0.53	11.83	79.24	8.17	100.00
	5	0.00	0.08	0.53	7.73	91.66	100.00
	Total	19.97	19.97	19.98	19.97	20.11	100.00

The Markov matrices show that there is poor mobility between municipalities in each income category. Over the past decades, a state of affairs has emerged where municipalities are characterised by high incomes and low incomes. Moving out of

these categories is very difficult if there is also a shift then the results suggest that there is an equal probability of getting better or worse.

If we want to interpret our results more deeply, we need to uncover the underlying causes of income stickiness. While it is not the purpose of this paper to explore these deeper relationships due to restrictions on the length (in this section we have only explored the dynamics of income distribution), it is important to note that the present spatial distribution of income and development is based on enduring, cumulative benefits and drawbacks. This fixed spatial structure is the result of variables that do not change over time (e.g. geographical location) or change only very slowly (educational attainment, presence of business companies, infrastructure provision). To change this fixed situation, long-term development policies would be needed, spanning several decades, to give priority support to disadvantaged areas, even in the event of economic recession or shocks. These measures have not been implemented or have not been sufficiently implemented.

Table 2-5 show that incomes are sticky. *Table 6* shows the results of the dynamic panel models. While the Markov matrices work with probabilities, the dynamic panel results also show the stickiness of incomes with concrete numbers, the effect of the diagonal of the transition probability matrices. The following results are for the whole country, with no regional delimitation.

In *Table 6*, the results are obtained using two different estimation procedures, one is the Arellano-Bond estimation and the other is the Blundell-Bond estimation. In presenting the results, the Arellano-Bond procedure is used as a basis, the Blundell-Bond estimation is used to provide robustness of the results. We indicate if there is a difference between the results of the two estimation procedures.

The income persistence variable (*income* (*lagged*)) is positive and significant, approaching 1 (0.952) for Arellano-Bond and 0.754 for Blundell-Bond, suggesting that incomes are highly sticky. The income situation of a municipality depends almost entirely on the income situation of the previous year. In such a situation, it is very difficult to make active decisions to improve or worsen the income situation of a municipality from one year to the next. It is less of a problem if the municipality is in a high-income category, it is more problematic that the break-out of municipalities in a difficult situation is subject to serious obstacles. These results are consistent with the high probabilities in the main diagonal of the Markov matrix.

The research extended to include additional control variables. One important determinant of income may be the working-age population (*population* (*15-64 years*)). The results suggest that an increase in the working-age population increases the income field, while the other model suggests that it decreases the income field, but in neither case is there a significant effect ($p<0.1$). A significant determinant of income is a municipal economic indicator. *Sole proprietorships* and *partnerships* show different dynamics. While the increasing presence of sole proprietors increases the income of the municipality, the effect is the opposite for partnerships. Based on the Blundell-Bond model, the variable of joint ventures is not significant and this estimation procedure does not confirm this effect. The increase in the number of *job seekers* reduces the income situation of the municipalities, this is natural, the unemployment benefit is always lower than the previous income, and after a certain

period, the benefit is no longer paid. The geographical location of the municipality may also be important. The capital city is of major economic importance in all countries, and this is particularly true in Hungary. The *distance to Budapest is a* negative and significant variable, i.e. the further a municipality is located from the capital, the lower the income of the municipality.

Table 6: Results of the dynamic panel model

Variable	Arellano–Bond	Blundell–Bond
Income (lagged)	0.952***	0.754***
	(0.009)	(0.034)
Population (15-64 years)	0.760	-11.419
	(1.311)	(8.240)
Sole proprietorships	2419.476***	6560.646***
	(744.131)	(90.286)
Partnership business	-82.680**	-97.958
	(33.600)	(91.783)
Jobseekers	-949.832***	-1605.247***
	(228.973)	(69.585)
EU subsidies	0.000	0.000
	(0.000)	(0.000)
Distance to a city of at least 20 thousand inhabitants	-2115.598***	3155.077***
	(791.693)	(603.727)
Distance to Budapest	-377.811***	-1279.090**
	(107.024)	(516.937)
Employed in FEOR-08-0	107105.810*	-651.128
	(63876.747)	(432.634)
Employed in FEOR-08-1	107695.952*	443.841**
	(64276.241)	(192.886)
Employed in FEOR-08-2	108123.314*	1016.987***
	(64179.627)	(330.077)
Employed in FEOR-08-3	107478.497*	477.462***
	(64090.706)	(175.812)
Employed in FEOR-08-4	106925.221*	467.469**
	(64.506.177)	(184.353)
Employed in FEOR-08-5	107143.720*	-119.621
	(64142.868)	(161.505)
Employed in FEOR-08-6	106194.695*	18.454
	(64428.504)	(328.003)
Employed in FEOR-08-7	107260.584*	-485.110***
	(64.090.115)	(153.505)
Employed in FEOR-08-8	107725.104*	555.357***
	(64.219.824)	(144.569)
Employed in FEOR-08-9	108615.274*	312.846**
	(64.308.337)	(131.913)
Intercept	-1.076e+08*	95656.429
	(64232949)	(151124)
Observations	31550	31500
AR(2)	0.373	0.100
Sargan test	0.082	
Hansen test	0.086	

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$ (In parentheses the standard errors)

The variable distance from a city of *at least 20,000 inhabitants* is also negative and significant, with a higher coefficient on this variable than distance from Budapest. In other words, not only is Budapest important, but the proximity of a large city has a positive effect on the income of municipalities. This effect of a city distance of 20,000 is not confirmed by the results of the Blundell-Bond model.

Another important characteristic of settlement incomes is the occupation of the people living in the settlement. This effect is captured by the different FEOR-08 (Standard Classification of Occupations) variables. According to both estimation procedures, almost all of these occupational categories are significant, i.e. they have an impact on municipal incomes.

The stickiness of per capita incomes is the central issue of the research and is best captured by the first leg of the dynamic panel models, as shown in *Table 5*. *Table 6* provides a regional analysis, the models in *Table 5* are calculated at the regional level. Two of the Arellano-Bond models and four of the Blundell-Bond models pass the specification tests. The income stickiness is 0.952 for the Arellano-Bond model and 0.754 for the Blundell-Bond model (*Table 6*). In *Table 7*, the income stickiness of the Arellano-Bond regional models is close to the national average in all regions, with the only exception being the Pest region (with Budapest), where the capital is located, where the value is slightly lower (0.879). For Blundell-Bond, the regional values are similar to the national average, with the Pest region being significantly lower, and with other effects, not only income stickiness, being strong for the municipalities located here. (However, only in the bold regions do the models meet the specification tests.)

In *Table 8*, we have tested the robustness of the model for all municipalities in the country. The model in *Table 5* was patched with additional lags. For the Arellano-Bond model, the inclusion of lag 2 reduced the income stickiness to 0.866, and the inclusion of additional lags (models 3 and 4) no longer significantly affects it. The strongest effect is still the carry-over effect from the previous year. For the Blundell-Bond model, the inclusion of the second lag reduces the persistence of income more, and the inclusion of the third and fourth lags further reduces the coefficient. Under the Blundell-Bond model, earnings not only depend on previous years, but also the previous 2-3 years have an impact on the present.

Table 7: Values of the lagged variable in each region

	Arellano–Bond						
	Southern Great Plain	Southern Transdanubia	Northern Great Plain	Northern Hungary	Central Transdanubia	Western Transdanubia	Pest (with Budapest)
income (lagged)	0.984*** (0.008)	1.025*** (0.010)	**0.966*** (0.019)**	**0.930*** (0.022)**	0.982*** (0.010)	0.982*** (0.011)	0.879*** (0.107)
Obs.	2540	6560	**3890**	**6100**	4010	6570	1880
AR(2)	0.974	0.601	**0.710**	**0.095**	0.038	0.707	0.321
Sargan test	0.000	0.000	**0.635**	**0.939**	0.000	0.007	0.000
Hansen test	0.000	0.000	**0.055**	**0.815**	0.000	0.008	0.000
	Blundell–Bond						
income (lagged)	**0.814*** (0.020)**	**0.765*** (0.062)**	0.871*** (0.012)	**0.737*** (0.057)**	0.799*** (0.027)	**0.785*** (0.023)**	0.414 (0.293)
Obs.	**2540**	**6560**	3890	**6100**	4010	**6570**	1880
AR(2)	**0.242**	**0.676**	0.030	**0.061**	0.023	**0.147**	0.007

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$ (In parentheses the standard errors)

Table 8: Additional lagged variable values in each region

	Arellano–Bond			
	Model 1	Model 2	Model 3	Model 4
income (lagged_1)	0.952***	0.866***	0.858***	0.865***
	(0.009)	(0.043)	(0.037)	(0.034)
income (lagged_2)		0.103**	0.123**	0.138**
		(0.043)	(0.053)	(0.078)
income (lagged_3)			-0.058	0.001
			(0.055)	(0.087)
income (lagged_4)				-0.137
				(0.092)
Observations	31550	28395	25240	22085
AR(2)	0.373	0.089	0.817	0.694
Sargan test	0.082	0.102	0.001	0.000
Hansen test	0.086	0.277	0.360	0.083
	Blundell–Bond			
income (lagged_1)	0.754***	0.576***	0.506***	0.427***
	(0.034)	(0.054)	(0.067)	(0.066)
income (lagged_2)		0.221***	0.192***	0.208***
		(0.042)	(0.055)	(0.038)
income (lagged_3)			0.105***	0.134***
			(0.028)	(0.023)
income (lagged_4)				0.027
				(0.044)
Observations	31550	28395	25240	22085
AR(2)	0.100	0.057	0.874	0.201

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$ (In parentheses the standard errors)

CONCLUSIONS

The research examines the dynamics of incomes in Hungary over ten years, with a particular focus on differences at the settlement level. The results show that between 2013 and 2021, wages have increased steadily and significantly, but this is not applied equally in different regions of the country. The analysis shows that income gaps between the most and poorest municipalities have remained stable and income mobility between municipalities is low. Both the dynamic panel models and Markov matrices used in the research confirm the stickiness of incomes, i.e. that the income position of municipalities is largely dependent on the income position in previous years. Although income has increased significantly at the national level, regional differences persist. The capital and the western regions continue to have higher incomes, while the rest of the country has seen less of an increase. Analysis shows that income mobility between municipalities is low. Municipalities in the low and high-income categories are more likely to maintain their position, suggesting that regional economic disparities are persistent. The results of the dynamic panel models suggest that municipal incomes are highly sticky, implying that the income position of a municipality depends almost entirely on the income position in previous years. This can be particularly problematic for low-income municipalities, as it is difficult for them to break out of this situation. Research has shown that proximity to the

capital and large cities has a positive effect on the incomes of municipalities. Increasing distance from Budapest and other large cities reduces the income level of municipalities. The presence of sole proprietorships increases, while the presence of partnerships decreases the income of municipalities. An increase in the number of job seekers naturally reduces income levels, while changes in the working-age population do not show a significant effect.

To reduce income inequalities, targeted support should be provided to low-income municipalities, including infrastructure improvements, and education and business development programmes. It is important to launch labour market and entrepreneurial training, as well as transport and digital infrastructure development to improve access to economic centres. Support for research and development and agricultural modernisation can also help to diversify and grow the local economy. Social measures such as affordable housing programmes and strengthening social safety nets, as well as tourism development, are also important for the economic development of regions. These actions can increase municipal income mobility and regional development.

Among the limitations of the present research, it is important to note that our models are subject to the possibility of omitted variable bias. All relevant variables that are available at the municipal level for each year have been included in the models, however, there may be other relevant factors that affect income persistence (e.g. informal economic activities, regional policies and specific local economic shocks), for which statistical data are not available. Therefore, other possible dynamic relationships and causal links may remain hidden. A further problem is that data on a very important variable, educational attainment at the level of the municipality, are only available at 10-year periods (from the census data) instead of annual data, which does not allow us to include this variable in our panel models.

Based on the results of the research, it would be important to further investigate the development of regional economic policies and strategies to reduce income inequalities between municipalities and increase economic mobility.

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