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REGIONAL TRANSMISSION OF MACROECONOMIC SHOCKS AND THE DYNAMICS OF ECONOMIC CONVERGENCE

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Abstract. This article examines whether the regions of Uzbekistan converged economically after the exchange rate unification of 2017. The analysis draws on official regional accounts for the Republic of Karakalpakstan, twelve regions and Tashkent city from 2010 to 2025, and it combines sigma and beta convergence measures with an exact decomposition of regional variance. Real output per capita increased in every region after the reform, yet the gaps between regions widened rather than narrowed. This divergence is largely associated with the rapid growth of Tashkent city, whereas among the other regions the change is modest and sensitive to the choice of base-year prices. The regional hierarchy remained almost unchanged, and initial income levels show no reliable link with subsequent growth. The decomposition reveals why the convergence measures diverge, since a weak catching-up tendency among less developed regions was outweighed by persistent differences in growth rates. As the reform was introduced nationwide alongside other policy changes, the findings describe regional development paths and do not identify a causal effect of the reform. The study underlines the importance of real regional indicators and of firm-level data on exposure to exchange rate changes for future policy evaluation.

Keywords: regional growth; sigma convergence; beta convergence; exchange rate reform; Uzbekistan.

Annotatsiya. Ushbu maqolada 2017-yilda valyuta kursining unifikatsiya qilinishidan so'ng O'zbekiston hududlarida iqtisodiy konvergentsiya yuz bergan-yuz bermagani tadqiq etilgan. Tahlil Qoraqalpog'iston Respublikasi, o'n ikki viloyat va Toshkent shahrining 2010–2025-yillardagi rasmiy hududiy hisob ma'lumotlariga asoslanadi hamda sigma va beta konvergentsiya ko'rsatkichlarini hududiy dispersiyaning aniq dekompozitsiyasi bilan uyg'unlashtiradi. Islohotdan keyin barcha hududlarda aholi jon boshiga real ishlab chiqarish hajmi oshgan bo'lsa-da, hududlar o'rtasidagi tafovutlar qisqarish o'rniga kengaygan. Mazkur divergentsiya, asosan, Toshkent shahrining jadal o'sishi bilan izohlanadi, boshqa hududlar orasida esa o'zgarish nisbatan mo'tadil bo'lib, bazaviy yil narxlarini tanlashga sezgir hisoblanadi. Hududiy ierarxiya deyarli o'zgarmagan, dastlabki daromad darajalari esa keyingi o'sish bilan ishonchli bog'liqlikni namoyon etmagan. Dekompozitsiya konvergentsiya ko'rsatkichlarining nima sababdan turlicha natija berishini ko'rsatadi, chunki kam rivojlangan hududlar orasidagi zaif yetib olish tendensiyasi o'sish sur'atlaridagi barqaror tafovutlar ta'sirida ustun kelgan. Islohot boshqa siyosiy o'zgarishlar bilan bir qatorda mamlakat miqyosida joriy etilganligi sababli, natijalar hududlarning rivojlanish yo'nalishlarini tavsiflaydi va islohotning sababiy ta'sirini aniqlamaydi. Tadqiqot kelgusidagi siyosatni baholash uchun real hududiy ko'rsatkichlar hamda valyuta kursi o'zgarishlariga duchor bo'lish bo'yicha firma darajasidagi ma'lumotlarning muhimligini ta'kidlaydi.

Kalit so'zlar: hududiy o'sish; sigma konvergentsiya; beta konvergentsiya; valyuta kursi islohoti; O'zbekiston.

Аннотация. В статье исследуется, произошла ли экономическая конвергенция между регионами Узбекистана после унификации обменного курса в 2017 году. Анализ основан на официальных данных региональных счетов Республики Каракалпакстан, двенадцати областей и города Ташкента за 2010–2025 годы и сочетает показатели сигма- и бета-конвергенции с точной декомпозицией региональной дисперсии. После реформы реальный выпуск на душу населения увеличился во всех регионах, однако различия между регионами не сократились, а, напротив, расширились. Данная дивергенция в значительной степени обусловлена быстрым ростом города Ташкента, тогда как среди остальных регионов изменения являются умеренными и чувствительными к выбору базисных цен. Региональная иерархия осталась практически неизменной, а исходные уровни доходов не продемонстрировали надёжной связи с последующим ростом. Декомпозиция показывает, почему показатели конвергенции дают различающиеся результаты, поскольку слабая тенденция догоняющего развития менее развитых регионов была перекрыта устойчивыми различиями в темпах роста. Поскольку реформа была введена в масштабах всей страны одновременно с другими изменениями в политике, полученные результаты характеризуют траектории регионального развития и не позволяют определить причинный эффект реформы. Исследование подчёркивает важность использования реальных региональных показателей и данных на уровне фирм о подверженности изменениям обменного курса для последующей оценки политики.

Ключевые слова: региональный рост; сигма-конвергенция; бета-конвергенция; реформа обменного курса; Узбекистан.

INTRODUCTION

An exchange rate reform reaches regions through the firms and households located in them. Exporters gain from higher receipts in national currency, while producers that rely on imported inputs may face higher domestic-currency input costs following depreciation. Where such activities are concentrated geographically, a single national reform can either widen or narrow regional differences, and national averages conceal which of the two occurs.

In September 2017, Uzbekistan the official exchange rate was sharply depreciated and unified with the parallel-market rate, unified it with the parallel market rate, abolished foreign exchange surrender requirements for companies, and eased access to currency for individuals. Restrictions on daily rate movements and on purchases by individuals remained until August 2019 [1, p. 3]. The reform applied to all regions at once and coincided with tax, trade, and price changes, so no region can serve as an untreated comparison. This article therefore asks a descriptive question. Did regional output per capita converge after 2016, and how far does the answer depend on the capital and on the price convention used to compare regions?

The contribution is twofold. The article combines growth, rank mobility, and dispersion within a single vintage of official statistics, and it uses an exact variance decomposition to reconcile beta and sigma convergence measures that point in different directions in the Uzbek data.

LITERATURE REVIEW

Barro and Sala-i-Martin distinguish beta convergence, the tendency of initially poorer economies to grow faster, from sigma convergence, a decline in the dispersion of output levels [2]. Quah showed that a negative cross-sectional slope does not imply falling dispersion [3], and Young, Higgins, and Levy found with US county data that beta convergence can coexist with the absence of sigma convergence [4]. Agglomeration offers one reason why the two measures diverge, since increasing returns and access to a large market can let established centres grow faster than catching-up arguments predict [5].

Studies of national reforms show that regional economic structure shapes their effects. Topalova found that Indian districts more exposed to the 1991 tariff cuts experienced slower declines in poverty [6], and Dix-Carneiro and Kovak showed that Brazilian regions facing larger tariff cuts suffered employment losses that deepened over two decades [7]. Exchange rate shocks add financial and price channels. After Mexico's 1994 devaluation, exporters outperformed other firms in sales, while firms with large foreign-currency debt invested relatively little [8], and the cost of living of poorer households rose considerably more than that of richer ones [9].

Research by Uzbek economists places these channels in the national context. Ruziev shows that Uzbekistan's gradual, state-led transition delivered average annual growth of about 5% in 1996–2016 and left sound macroeconomic fundamentals for the reforms launched in late 2016 [10]. Ruziev and Majidov find that Kazakhstan, the Kyrgyz Republic, and Uzbekistan were affected very differently by the 2008–2009 global financial crisis because their reforms, integration into world markets, and resource endowments had diverged [11]. The same reasoning applies to regions that face a common shock with different structures. At the subnational level, Valiev and Meylikov find that investment in Kashkadarya rose after 2017 but remained concentrated in a few districts [12]. Among the studies reviewed here, none examines convergence across all regions of Uzbekistan using a single consistent statistical vintage.

RESEARCH METHODOLOGY

The analysis uses two official series published on the SIAT portal of the National Statistics Committee, nominal GRP per capita [13] and the real per capita growth index [14], for the Republic of Karakalpakstan, twelve regions, and Tashkent city over 2010–2025. This gives 224 region-year observations per series. Both series were retrieved on the same date, so the analysis rests on one publication vintage. The metadata mark recent years as preliminary, and the regressions are therefore repeated with 2024 as the final year.

Regional levels are compared with an anchored volume measure. Let $l(i,t)$ denote the real per capita growth index of region i chained to 2016 = 100, and $y(i,2016)$ its nominal output per capita in 2016. The anchored level $\tilde{y}(i,t) = y(i,2016) \cdot l(i,t) / 100$ keeps each region's 2016 level and applies its subsequent real growth, which removes later region-specific price movements from the comparison. To test the role of the base year, the same paths are also anchored to nominal levels in 2010 and 2013. Sigma convergence is measured by the population standard deviation of log output per capita across regions, with equal regional weights:

$$\sigma_t = \sqrt{\frac{1}{N} \sum_{i=1}^N (\ln \tilde{y}_{i,t} - \overline{\ln \tilde{y}_t})^2} \quad (1)$$

Beta convergence is estimated by regressing average annual log growth after 2016 on the log of 2016 nominal output per capita:

$$\bar{g}_{i,T} = \frac{100}{T-2016} \ln \left(\frac{I_{i,T}}{100} \right) = a + b \ln y_{i,2016}^{nom} + u_i \quad (2)$$

A negative b indicates unconditional catching up. With only 12 to 14 observations, the regressions use HC3 standard errors, which adjust for influential observations in small samples [15], and 95% intervals based on a t distribution with $N - 2$ degrees of freedom. To reconcile the two convergence measures, the change in the variance of log output between 2016 and year T is decomposed exactly into the covariance of the initial log level x with cumulative log growth G and the variance of growth:

$$\text{Var}(x + G) - \text{Var}(x) = 2\text{Cov}(x, G) + \text{Var}(G) \quad (3)$$

ANALYSIS AND RESULTS

Growth slowed sharply after the reform and recovered only partly (Table 1). Mean regional growth fell from 6.03 log percentage points per year in 2011-2016 to 3.34 in 2017-2019, dropped to 0.52 in 2020 and recovered to 4.85 in 2021-2025. The slowdown was uneven. In 2017 alone real per capita growth ranged from -5.2% in Syrdarya to 9.5% in Tashkent city, and Kashkadarya's average fell from 4.24 to 0.40 points between the first two periods, whereas Andijan's rose slightly. Overlapping reforms and the pandemic prevent attributing these differences to currency unification (Table 1.).

Table 1.
Average annual growth of real GRP per capita by period, log points

Region	2011-2016	2017-2019	2020	2021-2025
Karakalpakstan	9.26	5.01	-0.40	3.39
Andijan	4.87	5.07	0.20	4.36
Bukhara	7.01	3.47	0.40	4.17
Jizzakh	6.75	3.91	1.49	4.12
Kashkadarya	4.24	0.40	0.10	4.19
Navoi	3.47	1.97	4.78	5.12
Namangan	6.16	4.06	2.47	5.73
Samarkand	6.40	1.37	-1.71	5.15
Surkhandarya	6.04	2.37	1.09	3.72
Syrdarya	5.57	1.57	-2.12	4.73
Tashkent region	4.73	3.95	1.49	6.07
Fergana	5.44	2.34	3.34	4.39
Khorezm	6.17	3.46	-1.01	5.28
Tashkent city	8.34	7.81	-2.84	7.55
Mean of regions	6.03	3.34	0.52	4.85

Source: calculated by the author from [14].

Every region ended 2025 above its 2016 volume, but the size of the gain varied widely (Figure 1). Tashkent city reached an index of 179.3, against a regional median of 139.2, while Kashkadarya reached only 124.9. Indexing also hides large differences in levels. Namangan grew relatively fast, yet its 2016 output per capita of 5,731.6 thousand UZS was about one third of Tashkent city's, so it remained far behind the capital (Fig.1.).

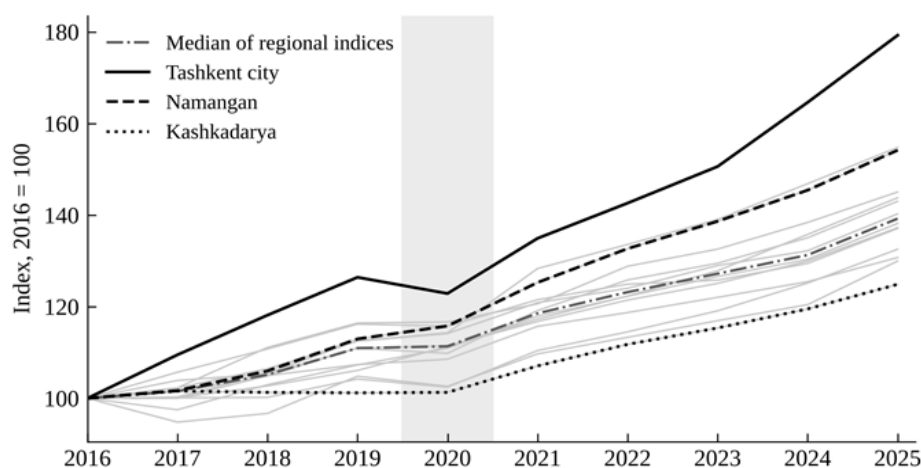


Figure 1. Real GRP per capita, 2016-2025 (2016 = 100)

Source: calculated by the author from [14]. Grey lines show the remaining regions; the shaded band marks 2020.

The regional hierarchy barely moved. Eight of the fourteen regions held the same volume rank in 2025 as in 2016, and the Spearman correlation between the two rankings is 0.974. Namangan rose from thirteenth to eleventh and Samarkand fell two places, while the six highest-ranked regions kept their positions.

Dispersion widened rather than narrowed. Across all regions, the standard deviation of log output per capita rose from 0.327 in 2016 to 0.382 in 2025 (Figure 2). Without Tashkent city it first fell from 0.246 to 0.235 in 2019 and then rose to 0.258, ending only slightly above its starting level. Anchoring prices to 2010 or 2013 leaves the full-sample increase between 0.052 and 0.056, whereas outside Tashkent city and Navoi the increase shrinks to between 0.001 and 0.009 and depends on the anchor (Table 2). Divergence is therefore clear for the regional system as a whole, but among the remaining regions it lies within the range that measurement choices can produce (Fig.2.).

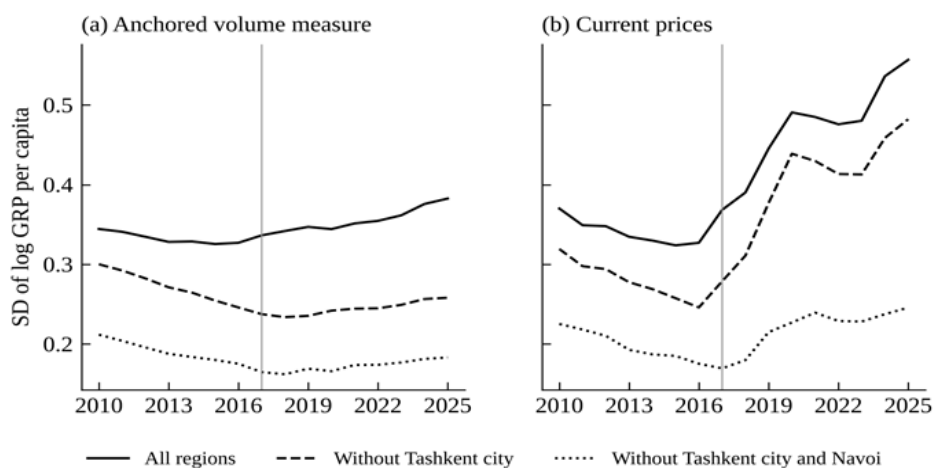


Figure 2. Dispersion of log GRP per capita across regions, 2010-2025

Source: calculated by the author from [13; 14]. The vertical line marks 2017.

Table 2.

Dispersion of log GRP per capita under alternative price anchors

Sample	σ 2016	σ 2019	σ 2025	$\Delta\sigma$, 2010 anchor	$\Delta\sigma$, 2013 anchor	$\Delta\sigma$, 2016 anchor	σ 2025, current prices
All regions	0.327	0.347	0.382	+0.0521	+0.0557	+0.0555	0.557
Without Tashkent city	0.246	0.235	0.258	+0.0077	+0.0130	+0.0122	0.482
Without Tashkent city and Navoi	0.175	0.169	0.183	+0.0013	+0.0091	+0.0079	0.246

Source: calculated by the author. Columns 2-4 use the 2016 anchor; $\Delta\sigma$ is the change over 2016-2025 under each anchor.

Nominal figures exaggerate the divergence. At current prices dispersion reached 0.557 in 2025, and the ratio of the highest to the lowest regional output per capita rose from 3.08 to 6.85, compared with 4.23 under the volume measure. Navoi illustrates the gap, since its nominal output per capita rose by a factor of 11.18 between 2016 and 2025 while its real output rose by 1.44. Common inflation cannot explain this difference, because multiplying every region's output by the same price factor leaves dispersion unchanged. Relative regional prices and sector composition are plausible contributors to the remaining difference.

The beta regressions do not show catching up in the full sample (Table 3, Figure 3). The 2017-2025 slope is positive at 1.646, but its interval includes zero. The positive sign depends on Tashkent city. Without it the slope falls to 0.220, and without Navoi as well it becomes slightly negative. Ending the period in 2024 gives a full-sample slope of 1.604 (−1.774 to 4.981) (Table 3.).

Table 3.

Beta regressions and variance decomposition, 2016-2025

Sample	N	Slope b	HC3 95% interval	R ²	2Cov(x, G)	Var(G)	ΔVar
All regions	14	1.646	[−1.692; 4.983]	0.303	0.03166	0.00773	0.03939
Without Tashkent city	13	0.220	[−1.613; 2.053]	0.006	0.00239	0.00373	0.00613
Without Tashkent city and Navoi	12	−0.203	[−4.643; 4.237]	0.003	−0.00112	0.00394	0.00283

Source: calculated by the author. Beta: OLS of average annual log growth over 2017-2025 on log 2016 GRP per capita. Decomposition in squared log points.

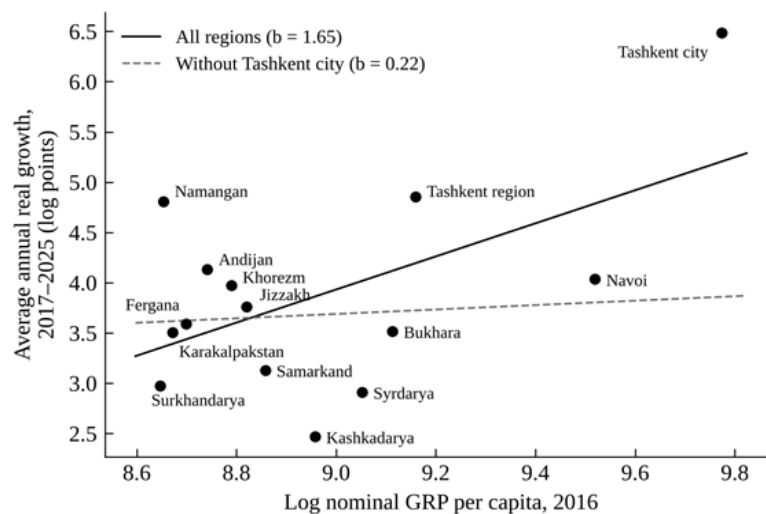


Figure 3. Initial GRP per capita and average annual real growth, 2017-2025

Source: calculated by the author from [13; 14]. Lines are OLS fits.

The decomposition explains why a negative slope among the smaller regions coexists with rising dispersion. For the twelve regions other than Tashkent city and Navoi, the covariance term is −0.00112, which records a small growth advantage for initially poorer regions. The variance of growth rates contributes 0.00394, so output variance still rises by 0.00283. Differences in growth rates thus outweighed the catching-up tendency. In the full sample both terms are positive, and the covariance term, driven by the capital's fast growth from a high base, accounts for about four-fifths of the increase.

CONCLUSIONS AND RECOMMENDATIONS

Real output per capita increased in every region of Uzbekistan between 2016 and 2025, while regional differences became more pronounced. This change was largely associated with the performance of Tashkent city, whereas the overall regional ranking remained relatively stable. Among the remaining regions, a moderate

catching-up tendency was observed alongside differences in growth rates. Nominal indicators suggest a considerably stronger divergence than that reflected in real terms. As the reform was implemented nationwide and coincided with other economic changes, these findings characterize regional trajectories rather than directly measuring the causal effect of currency unification. The relatively small number of regions and the use of production data rather than household income data also provide important context for interpreting the results.

Three recommendations follow. First, regional performance should be monitored with real rather than nominal indicators, which requires the statistics authority to publish regional price deflators. Second, support for lagging regions should state an explicit objective, such as output per resident, employment or access to public services, because faster growth in some of these regions has not changed their relative position. Third, a causal assessment of the reform requires data on firms' pre-reform imports, exports and foreign-currency debt by region, which would allow regions to be compared by their actual exposure to the exchange rate change.

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