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# REGIONAL ASSESSMENT OF THE OPENNESS OF SPECIAL ECONOMIC ZONES IN UZBEKISTAN BASED ON A SYNTHETIC INDICATOR

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**Abstract.** This study conducts a two-level analysis based on Ferrieri's Openness Synthetic Indicator (OSI) methodology for all 14 administrative-territorial units of the Republic of Uzbekistan. The two levels examined are: (1) the overall economic openness of each region and (2) the openness of the special economic zones (SEZs) located within each region. The analysis covers the period from 2018 to 2024. The results show that Tashkent city, with an average OSI of 0.930, and Tashkent region, with an average OSI of 0.429, consistently exhibit the highest levels of regional openness. At the SEZ level, the SEZ OSI remained below the regional OSI in all 14 territories, resulting in a negative openness gap throughout the study period. This finding indicates that Uzbekistan's SEZs have not yet fully fulfilled their mandate of enhancing economic openness relative to their respective regions.

**Keywords:** Openness Synthetic Indicator, Ferrieri index, special economic zone, region, subnational analysis, Uzbekistan, investment, employment.

**Annotatsiya.** Ushbu tadqiqotda O'zbekiston Respublikasining 14 ta ma'muriy-hududiy birligi bo'yicha Ferrieri ochiqlik sintetik indikatori (OSI) metodologiyasi asosida ikki darajali tahlil o'tkazildi. Bular viloyatning umumiy iqtisodiy ochiqligi va viloyatdagi maxsus iqtisodiy zonalar (MIZlar) ochiqligidir. 2018–2024-yillar davrini qamrab olgan tahlil natijalariga ko'ra, Toshkent shahri (o'rtacha OSI = 0.930) va Toshkent viloyati (0.429) barqaror ravishda eng yuqori hududiy ochiqlikni namoyon etdi. MIZ darajasida esa barcha 14 ta hududda MIZ OSI viloyat OSI'dan past saqlanib, ochiqlik tafovuti manfiy bo'ldi. Bu holat O'zbekiston MIZlarining viloyat iqtisodiyotiga nisbatan ochiqlikni oshirish vazifasini hali to'liq bajarmayotganini ko'rsatadi.

**Kalit so'zlar:** ochiqlik sintetik indikatori, Ferrieri indeksi, maxsus iqtisodiy zona, viloyat, submilliy tahlil, O'zbekiston, investitsiya, bandlik.

**Аннотация.** В данном исследовании проведён двухуровневый анализ на основе методологии синтетического индикатора открытости (OSI) Ферриери по 14 административно-территориальным единицам Республики Узбекистан. Рассматриваются общая экономическая открытость области и открытость специальных экономических зон (СЭЗ), расположенных в области. По результатам анализа, охватывающего период 2018–2024 годов, город Ташкент (средний OSI = 0,930) и Ташкентская область (0,429) стабильно демонстрируют самый высокий уровень региональной открытости. На уровне СЭЗ во всех 14 регионах OSI СЭЗ оставался ниже регионального OSI, а разрыв в показателях открытости был отрицательным. Это свидетельствует о том, что СЭЗ Узбекистана ещё не в полной мере выполняют свою задачу по повышению открытости экономики региона.

**Ключевые слова:** синтетический индикатор открытости, индекс Ферриери, специальная экономическая зона, регион, субнациональный анализ, Узбекистан, инвестиции, занятость

## INTRODUCTION

Special economic zones (SEZs) serve as an important instrument of state economic policy aimed at attracting investment, expanding exports, and creating employment (Farole, 2011; Wang, 2013). The number of SEZs established in Uzbekistan since 2008 exceeded 30 by 2024, and they are distributed across all 14 administrative-territorial units of the country (Ahn, Juraev, and Gu, 2024).

However, the measurement of SEZ performance within the context of regional economies remains insufficiently addressed in the existing literature. The traditional openness index  $(X+M)/GDP$  is unable to capture

the distinction between regional and SEZ-level openness at the subnational level (Squalli and Wilson, 2011). By contrast, the Openness Synthetic Indicator (OSI), developed by Ferrieri (2006, 2010, 2012), integrates capacity, weight, and scale factors, enabling a more accurate measurement of the true openness of each unit.

The aim of this article is to apply the OSI methodology at two levels — regional and SEZ — for all 14 regions and territories of Uzbekistan, compare the results with the national average, and construct a territorial openness map.

## LITERATURE REVIEW

Wang (2013), in a difference-in-differences analysis of Chinese municipalities, demonstrated that SEZs increase foreign direct investment by an average of 21.7 percent and raise total factor productivity growth by 0.6 percentage points per year. Farole (2011) conducted a large-scale survey covering more than 600 companies across African SEZs and proposed a standard evaluation framework comprising export volume, employment, number of firms, and investment levels. Frick, Rodríguez-Pose, and Wong (2019) analysed 346 SEZs across 22 developing countries and found that zone performance is contingent on proximity to markets and the pre-existing industrial structure.

Squalli and Wilson (2011) criticised the traditional trade openness measure and proposed a composite trade intensity formula that also accounts for a country's share in world trade. Gygli, Haelg, Potrafke, and Sturm (2019) expanded the globalisation index to 43 variables, distinguishing between de facto and de jure measures. Huber, Stiller, and Dur (2023) constructed a subnational trade competitiveness dataset covering 6,475 regions across 63 countries.

Ferrieri (2006) developed the OSI methodology, which combines the capacity effect and the size effect of economic phenomena. Ferrieri (2010) applied the methodology to merchandise exports and provided a full algebraic exposition of the formula. In addition, Ferrieri (2012) successfully applied the index to remittances flowing to developing countries, thereby confirming the methodology's adaptability to various economic phenomena.

Ahn, Juraev, and Gu (2024) analysed the geographic distribution and sectoral orientation of 23 free economic zones in Uzbekistan. Lee, Chernikov, and Nagy (2021) empirically examined the location determinants of foreign direct investment in CIS countries and highlighted the significant role of Korean capital in Uzbekistan's SEZs. This article is the first study to simultaneously compare SEZ and regional openness across all regions of Uzbekistan.

## RESEARCH METHODOLOGY

The adapted OSI is calculated in five steps:

**Step 1 – Trade share:**  $(\text{Region/SEZ exports} + \text{imports}) / (\text{National exports} + \text{imports})$   
**Step 2 – Fixed capital investment share:**  $\text{Region/SEZ fixed capital investment (UZS, million)} / \text{National total FCI (USD, million)}$   
**Step 3 – Employment share:**  $\text{Number of employed persons in the Region/SEZ} / \text{Total national employment}$   
**Step 4 – Weight coefficient (w):**  $\text{Region/SEZ output volume} / \text{National GDP (USD, million)}$   
**Step 5 – OSI:**  $((\text{Trade share} + \text{FCI share} + \text{Employment share}) / 3)^{(1 - w)}$ ; subsequently normalised to the range 0–1.

For each region, two OSI values are calculated: the **Regional OSI**, based on aggregate regional indicators of trade, fixed capital investment, and employment, and the **SEZ OSI**, based on the aggregated indicators of all SEZs located within that region. The openness gap is defined as: **SEZ OSI – Regional OSI**. A positive gap indicates that the SEZs are more open than the region as a whole, while a negative gap signals that the full potential of the SEZs has not been realised.

Here, the weight coefficient **w** represents the relative share of the territory in the national economy — in other words, how “large” the territory is. For regions, **w** is obtained as the ratio of gross regional product (GRP) to national GDP, whereas for SEZs, **w** is derived as the ratio of SEZ output volume to national GDP.

The following data from the National Statistics Committee of Uzbekistan for the period 2018–2024 were used: regional exports and imports (USD million); exports and imports of SEZ participants (USD thousand); gross regional product (UZS billion); SEZ output volume (UZS million); fixed capital investment (UZS billion); SEZ fixed capital investment (UZS million); number of employed persons (thousand persons); and number of jobs in SEZs (persons). All figures denominated in Uzbek soums were converted into US dollars using the official annual average exchange rates of the Central Bank.

## ANALYSIS AND RESULTS

Table 1 presents the normalised regional OSI (scaled from 0 to 1) and the national traditional openness index for all 14 administrative-territorial units.

**Table 1. Normalised Regional OSI and National Comparison by Region (2018–2024)**

| Region                      | 2018  | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | Avg.         |
|-----------------------------|-------|-------|-------|-------|-------|-------|-------|--------------|
| Republic of Karakalpakstan  | 0.158 | 0.139 | 0.125 | 0.123 | 0.124 | 0.117 | 0.123 | <b>0.130</b> |
| Andijan region              | 0.254 | 0.248 | 0.274 | 0.271 | 0.295 | 0.288 | 0.269 | <b>0.271</b> |
| Bukhara region              | 0.207 | 0.180 | 0.177 | 0.214 | 0.203 | 0.204 | 0.219 | <b>0.201</b> |
| Jizzakh region              | 0.091 | 0.110 | 0.145 | 0.110 | 0.110 | 0.124 | 0.137 | <b>0.118</b> |
| Kashkadarya region          | 0.313 | 0.297 | 0.255 | 0.223 | 0.203 | 0.201 | 0.225 | <b>0.245</b> |
| Navoi region                | 0.208 | 0.216 | 0.197 | 0.168 | 0.167 | 0.171 | 0.170 | <b>0.185</b> |
| Namangan region             | 0.222 | 0.206 | 0.203 | 0.201 | 0.200 | 0.195 | 0.255 | <b>0.212</b> |
| Samarkand region            | 0.284 | 0.264 | 0.282 | 0.282 | 0.291 | 0.289 | 0.269 | <b>0.280</b> |
| Surkhandarya region         | 0.184 | 0.183 | 0.163 | 0.164 | 0.152 | 0.157 | 0.135 | 0.163        |
| Syrdarya region             | 0.067 | 0.081 | 0.089 | 0.086 | 0.100 | 0.095 | 0.066 | <b>0.083</b> |
| Tashkent region             | 0.398 | 0.418 | 0.432 | 0.457 | 0.448 | 0.421 | 0.429 | <b>0.429</b> |
| Fergana region              | 0.251 | 0.243 | 0.259 | 0.266 | 0.268 | 0.254 | 0.235 | <b>0.254</b> |
| Khorezm region              | 0.106 | 0.114 | 0.113 | 0.122 | 0.125 | 0.124 | 0.121 | <b>0.118</b> |
| Tashkent city               | 0.814 | 0.860 | 0.919 | 1.000 | 0.970 | 0.970 | 0.975 | <b>0.930</b> |
| Uzbekistan (traditional OI) | 0.545 | 0.642 | 0.517 | 0.520 | 0.536 | 0.619 | 0.556 | 0.562        |

Source: Author's calculations based on data from the National Statistics Committee of Uzbekistan.

Tashkent city recorded the highest regional OSI values throughout the study period, rising from 0.814 in 2018 to a peak of 1.000 in 2021 before stabilising at approximately 0.970 in subsequent years. The average figure stands at 0.930. Tashkent region ranked second, with an average of 0.429, which can be attributed to high trade and investment activity.

Samarkand region (0.280), Andijan region (0.271), and Fergana region (0.254) constitute the middle tier. These regions are characterised by a relatively developed industrial base and elevated trade activity. Kashkadarya region ranked third in 2018, with a value of 0.313, but declined to 0.201 in subsequent years.

Syrdarya region (0.083), Jizzakh region (0.118), and Khorezm region (0.118) recorded the lowest regional OSI values. These territories are characterised by relatively small economic size and low trade integration.

The national traditional openness index, measured as trade/GDP, ranged from 0.517 to 0.642, averaging 0.562. The normalised OSI values for all regions, with the exception of Tashkent city, fell below the national traditional index, indicating that trade and investment integration remains insufficient relative to these regions' economic potential.

Table 2 presents the normalised SEZ OSI values by region.

**Table 2. Normalised SEZ OSI by Region (2018–2024)**

| Region                     | 2018  | 2019  | 2020  | 2021  | 2022  | 2023  | 2024  | Avg.         |
|----------------------------|-------|-------|-------|-------|-------|-------|-------|--------------|
| Republic of Karakalpakstan | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | <b>0.000</b> |
| Andijan region             | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | <b>0.000</b> |
| Bukhara region             | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.014 | <b>0.002</b> |
| Jizzakh region             | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.003 | <b>0.001</b> |
| Kashkadarya region         | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | <b>0.000</b> |
| Navoi region               | 0.001 | 0.004 | 0.007 | 0.003 | 0.003 | 0.011 | 0.004 | <b>0.005</b> |
| Namangan region            | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 | <b>0.001</b> |
| Samarkand region           | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | 0.002 | 0.006 | <b>0.003</b> |
| Surkhandarya region        | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | <b>0.000</b> |

|                 |       |       |       |       |       |       |       |              |
|-----------------|-------|-------|-------|-------|-------|-------|-------|--------------|
| Syrdarya region | 0.000 | 0.003 | 0.004 | 0.004 | 0.004 | 0.002 | 0.001 | <b>0.003</b> |
| Tashkent region | 0.007 | 0.007 | 0.007 | 0.007 | 0.005 | 0.005 | 0.004 | <b>0.006</b> |
| Fergana region  | 0.001 | 0.001 | 0.001 | 0.005 | 0.001 | 0.001 | 0.001 | <b>0.002</b> |
| Khorezm region  | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000        |
| Tashkent city   | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | <b>0.000</b> |

Source: Author's calculations based on data from the National Statistics Committee of Uzbekistan.

The SEZ OSI values were found to be markedly lower than the regional OSI across all regions. The highest average SEZ OSI was recorded in Tashkent region (0.006). Navoi region ranked second (0.005), driven by a sharp rise in investment activity in 2023. Its SEZ output volume remained relatively stable throughout the study period, while the employment share grew steadily.

In Samarkand region, the SEZ OSI rose to 0.006 in 2024 as a result of significant investment inflows during that year. In Bukhara region, the SEZ OSI reached 0.014 in 2024, which can be explained by a sharp increase in SEZ fixed capital investment observed in that year. The SEZ OSI values in Kashkadarya region and Khorezm region remained close to zero. In these territories, trade, investment, and employment indicators within the SEZs continued to record very low values.

Table 3 presents the openness gap (SEZ OSI – Regional OSI) for each administrative-territorial unit. A negative value indicates that the SEZs operate at a lower level of openness than the regional economy.

**Table 3. Openness Gap by Administrative-Territorial Unit (SEZ OSI – Regional OSI)**

| Region                     | 2018   | 2019   | 2020   | 2021   | 2022   | 2023   | 2024   | Avg.          |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Republic of Karakalpakstan | -0.158 | -0.139 | -0.125 | -0.123 | -0.124 | -0.117 | -0.121 | <b>-0.130</b> |
| Andijan region             | -0.254 | -0.248 | -0.274 | -0.271 | -0.295 | -0.288 | -0.267 | <b>-0.271</b> |
| Bukhara region             | -0.207 | -0.180 | -0.177 | -0.214 | -0.201 | -0.203 | -0.205 | <b>-0.198</b> |
| Jizzakh region             | -0.089 | -0.109 | -0.144 | -0.109 | -0.109 | -0.123 | -0.134 | <b>-0.117</b> |
| Kashkadarya region         | -0.313 | -0.297 | -0.255 | -0.223 | -0.203 | -0.201 | -0.225 | <b>-0.245</b> |
| Navoi region               | -0.207 | -0.212 | -0.190 | -0.165 | -0.164 | -0.160 | -0.166 | <b>-0.181</b> |
| Namangan region            | -0.222 | -0.206 | -0.203 | -0.201 | -0.199 | -0.194 | -0.253 | <b>-0.211</b> |
| Samarkand region           | -0.282 | -0.262 | -0.280 | -0.281 | -0.288 | -0.287 | -0.263 | <b>-0.278</b> |
| Surkhandarya region        | -0.184 | -0.183 | -0.163 | -0.164 | -0.152 | -0.157 | -0.134 | <b>-0.162</b> |
| Syrdarya region            | -0.067 | -0.078 | -0.085 | -0.082 | -0.096 | -0.093 | -0.065 | <b>-0.081</b> |
| Tashkent region            | -0.391 | -0.411 | -0.425 | -0.450 | -0.443 | -0.416 | -0.425 | <b>-0.423</b> |
| Fergana region             | -0.250 | -0.242 | -0.258 | -0.261 | -0.267 | -0.253 | -0.234 | <b>-0.252</b> |
| Khorezm region             | -0.106 | -0.114 | -0.113 | -0.121 | -0.125 | -0.124 | -0.121 | <b>-0.118</b> |
| Tashkent city              | -0.814 | -0.860 | -0.919 | -1.000 | -0.970 | -0.970 | -0.975 | <b>-0.930</b> |

Source: Author's calculations based on data from the National Statistics Committee of Uzbekistan.

The openness gap was negative in all 14 administrative-territorial units across all seven years of the study period. This pattern appears to be common across Uzbekistan, indicating that SEZs have been unable to ensure a higher level of openness than the regional economy.

The largest negative gap was recorded in Tashkent region (-0.423) and Samarkand region (-0.278). It is appropriate to exclude Tashkent city from this comparison on the grounds that no SEZ was operational there until 2024, which explains its extreme gap value. Although the regional OSI in these territories is high, the SEZs have not developed to a level commensurate with the regional economy. The smallest negative gap was observed in Syrdarya region (-0.081) and Jizzakh region (-0.117), which is related to the equally low regional OSI values in these territories.

Table 4 presents a ranking of regions by their average Regional OSI alongside the corresponding SEZ OSI.

**Table 4. Regional Ranking by Average Regional OSI**

| Rank | Region           | Region OSI (avg.) | SEZ OSI (avg.) | Gap (avg.) |
|------|------------------|-------------------|----------------|------------|
| 1    | Tashkent city    | 0.930             | 0.000          | -0.930     |
| 2    | Tashkent region  | 0.429             | 0.006          | -0.423     |
| 3    | Samarkand region | 0.280             | 0.003          | -0.278     |

|    |                            |       |       |        |
|----|----------------------------|-------|-------|--------|
| 4  | Andijan region             | 0.271 | 0.000 | -0.271 |
| 5  | Fergana region             | 0.254 | 0.002 | -0.252 |
| 6  | Kashkadarya region         | 0.245 | 0.000 | -0.245 |
| 7  | Namangan region            | 0.212 | 0.001 | -0.211 |
| 8  | Bukhara region             | 0.201 | 0.002 | -0.198 |
| 9  | Navoi region               | 0.185 | 0.005 | -0.181 |
| 10 | Surkhandarya region        | 0.163 | 0.000 | -0.162 |
| 11 | Republic of Karakalpakstan | 0.130 | 0.000 | -0.130 |
| 12 | Jizzakh region             | 0.118 | 0.001 | -0.117 |
| 13 | Khorezm region             | 0.118 | 0.000 | -0.118 |
| 14 | Syrdarya region            | 0.083 | 0.003 | -0.081 |

Source: Author's calculations based on data from the National Statistics Committee of Uzbekistan.

The findings of the study lead to several important conclusions.

First, the fact that the SEZ OSI falls below the regional OSI in all regions points to the existence of a systemic problem. This finding contradicts the results reported by Wang (2013) and Farole (2011), in whose studies SEZs in China and Africa performed considerably above national or regional averages. One plausible explanation for this divergence is the relatively low export orientation of Uzbekistan's SEZs.

Second, the near-zero trade share of SEZs in most regions may reflect incompleteness in statistical recording. Huber, Stiller, and Dur (2023) also identified gaps in the collection of subnational trade statistics as a principal methodological challenge. Introducing a system that records SEZ trade flows separately from aggregate regional exports would substantially improve the accuracy of this analysis.

Third, the investment indicator was identified as the primary driver of SEZ OSI dynamics. The investment surges observed in Navoi region in 2023 and in Bukhara region in 2024 directly translated into OSI growth in those years. Frick, Rodríguez-Pose, and Wong (2019) similarly emphasised investment volume as a decisive determinant of zone performance.

Fourth, while the steady growth in the employment share, particularly in Jizzakh, Tashkent, and Namangan regions, represents a positive trend, its contribution to the overall SEZ OSI remains modest in comparison with trade and investment shares. This underscores the need to develop more labour-intensive industries within the SEZs.

## CONCLUSION AND SUGGESTIONS

This study applies Ferrieri's Openness Synthetic Indicator to all 14 administrative-territorial units and their respective SEZs in Uzbekistan. The main conclusions are as follows:

In terms of regional openness, Tashkent city and Tashkent region maintain a consistent lead. Samarkand, Andijan, and Fergana regions form the middle tier. Syrdarya, Jizzakh, and Khorezm regions record the lowest values and require additional policy attention.

At the SEZ level, a common structural limitation was identified across all territories: in no region did the SEZ OSI exceed the Regional OSI. This result suggests the need for further improvement of Uzbekistan's SEZ policy. Zones need to be upgraded not only in terms of tax incentives but also with respect to export orientation, international partnerships, and integration into global production chains.

Three directions are recommended for future research. First, it would be beneficial to establish a system that records SEZ trade flows separately from regional statistics. Second, a panel analysis linking the OSI to changes in SEZ policy, such as the opening of new zones or the introduction of tax incentives, should be conducted. Third, the OSI indicator should be analysed in conjunction with the sectoral composition within each zone in order to identify which industries contribute most to enhancing openness.

## References

1. Ahn, Y.-J., Juraev, Z., & Gu, J.-Y. (2024). Analyzing free economic zones in Uzbekistan for sustainable growth. *Indonesian Journal of Geography*, 56(1), 44–51. <https://doi.org/10.22146/ijg.84351>
2. Farole, T. (2011). *Special Economic Zones in Africa: Comparing Performance and Learning from Global Experiences*. Washington, DC: World Bank. <https://documents1.worldbank.org/curated/en/996871468008466349/pdf/600590PUB0ID181onomic09780821386385.pdf>

3. Ferrieri, G. (2006). A method for measuring international openness. *Social Indicators Research*, 77(2), 245–255. <https://doi.org/10.1007/s11205-005-2904-9>
4. Ferrieri, G. (2010). Measuring openness. *Journal of Modern Applied Statistical Methods*, 9(1), Article 17, 172–180. <https://doi.org/10.22237/jmasm/1272687360>
5. Ferrieri, G. (2012). Ferrieri's index of openness applied to remittances to developing countries. *Journal of Modern Applied Statistical Methods*, 11(2), Article 21. <https://doi.org/10.22237/jmasm/1351743600>
6. Frick, S. A., Rodríguez-Pose, A., & Wong, M. D. (2019). Toward economically dynamic special economic zones in emerging countries. *Economic Geography*, 95(1), 30–64. <https://doi.org/10.1080/00130095.2018.1467732>
7. Gygli, S., Haelg, F., Potrafke, N., & Sturm, J.-E. (2019). The KOF Globalisation Index — revisited. *The Review of International Organizations*, 14(3), 543–574. <https://doi.org/10.1007/s11558-019-09344-2>
8. Huber, R. A., Stiller, Y., & Dür, A. (2023). Measuring subnational trade competitiveness. *Scientific Data*, 10, Article 331. <https://doi.org/10.1038/s41597-023-02205-z>
9. Lee, H.-S., Chernikov, S. U., & Nagy, S. (2021). Motivations and locational factors of FDI in CIS countries: Empirical evidence from South Korean FDI in Kazakhstan, Russia, and Uzbekistan. *Regional Statistics*, 11(4), 79–100. <https://doi.org/10.15196/RS110404>
10. Squalli, J., & Wilson, K. (2011). A new measure of trade openness. *The World Economy*, 34(10), 1745–1770. <https://doi.org/10.1111/j.1467-9701.2011.01404.x>
11. Wang, J. (2013). The economic impact of special economic zones: Evidence from Chinese municipalities. *Journal of Development Economics*, 101, 133–147. <https://doi.org/10.1016/j.jdeveco.2012.10.009>

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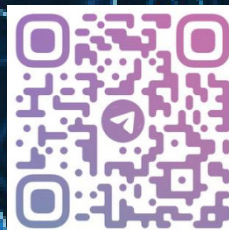
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