Wage Inequality in Institutions: A Great Divergence in the Democratic Republic of Congo

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Abstract

The aim of this paper is to study the extent of inter-institutional inequalities in the Democratic Republic of Congo (DRC). More specifically, we document the dynamics of inter-institutional inequalities in public administration in the DRC. To do this, we first construct series on average salaries in each institutional entity in the DRC covering the period 2010-2022. On the basis of this data, we studied the evolution of wage dynamics within congolese institutions. More specifically, we used the Phillips and Sul (2007)'s convergence test method that involves identifying convergence clubs. It begins by testing for overall convergence and then applies a club merging algorithm to form initial clubs. These clubs represent groups of observations that exhibit similar convergence patterns, providing insights into the dynamics of regional or sectoral convergence. We find that that institutional wages do not converge into a single common equilibrium. However, there are four significant convergence clubs grouped based on Functional Similarities.

Keywords: Wage inequality, Institution, Convergence.

JEL classification: D63, P37,

1 Introduction

The issue of inequalities has truly gained prominence in academic literature in recent years, at least since the works of Piketty and Saez (2003) but the literature on inequalities is extensive (e.g. Anand and Segal, 2008; Cowell and Kerm, 2015; Edmans et al., 2017; Nolan et al., 2019). This issue has been approached from various perspectives in the literature, including wage inequalities between skilled and unskilled workers (Katz and Murphy, 1992; Chusseau et al., 2008), top incomes (Atkinson et al., 2011; Alvaredo et al., 2013; Saez and Zucman, 2020; Piketty et al., 2022) , business incomes at the top (Kopczuk and Zwick, 2020) , executive compensation (Gabaix and Landier, 2008; Frydman and Saks, 2010; Bizjak et al., 2011; Bivens and Mishel, 2013; Keller and Olney, 2021), the contribution of firms to the increase in earnings inequality or inter-industry differentials (e.g. Krueger and Summers, 1988; Du Caju et al., 2010; Song et al., 2019; Bloom et al., 2022), the pay of financial professionals (e.g. Philippon and Reshef, 2012; Bivens and Mishel, 2013), gender (e.g. Atkinson et al., 2018, 2011), and so on.

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However, this literature has not paid much attention to what happens within public institutions, particularly in developing countries. This is where this research comes in, with the aim of studying the extent of inter-institutional inequalities within the Democratic Republic of Congo (DRC). More specifically, we document the dynamics of inter-institutional inequalities. The idea is that in developing countries, public spendings are often distorted by corruption or rent-seeking behavior (Gupta et al., 2001; Delavallade, 2006; de la Croix and Delavallade, 2007; Blackburn et al., 2008). Based on this premise, since salary is an instrument at the disposal of politicians in such an environment, it should reflect significant disparities from one institution to another. Beyond the capture of rents through salary, this instrument also serves as a lever to directly reward the most loyal individuals (Cox and McCubbins, 1986; Cruz and Keefer, 2015; Kroeger, 2020; LeVan and Assenov, 2016). This reward can also be carried out by hiring new administrative staff, which can influence the average salary.

To shed light on the issue of inter-institutional inequalities, we first construct series on average salaries within each institutional entity in the DRC, covering the period from 2010 to 2022. These series come primarily from the Ministry of Budget of the DRC. In order to generate these series, we collected from this Ministry the exact number of individuals being paid within each institution, as well as the actual wage bill for the respective institutions. These pieces of information allowed us to have, to the best of our knowledge, an annual series on average salaries for each institution. This information, which we emphasize, constitutes an initial element of originality in this study.

Secondly, with this information,we used a series of tests to study convergence within public institutions in the DRC. Precisely, we use the Phillips and Sul (2007) 's convergence test method that involves identifying convergence clubs. It begins by testing for overall convergence and then applies a club merging algorithm to form initial clubs. These clubs represent groups of observations that exhibit similar convergence patterns, providing insights into the dynamics of regional or sectoral convergence. We find that that institutional wages do not converge into a single common equilibrium. However, there are four significant convergence clubs grouped based on Functional Similarities, Policy Cohesion, Sector Interdependencies, and Security and Governance Focus. The trend of clubs' transition path (cf. Figure 1) shows rapid divergence in institutional wage. Club 1 shows a clear and strong upward trend, while Club 2 shows a very slight upward trend. Club 3 exhibits a slight decline while Club 4 sows a downward trend.

This article, therefore, makes a significant contribution to the literature. Firstly, similar to the literature on wage or income disparities (e.g. Piketty and Saez, 2003; Philippon and Reshef, 2012), this article generates new insights that highlight an important stylized fact in developing countries, which can lead to further studies and stimulate public debate. Secondly, this article goes beyond the literature that focuses on the distortion of public expenditure structures as a whole in corrupt countries like the DRC (Gupta et al., 2001; Delavallade, 2006; de la Croix and Delavallade, 2007; Blackburn et al., 2008). By assuming that the allocation of nominal wages or the number of staff in various administrative institutions is a function of power equilibrium, we refine previous conclusions regarding expenditure structures, particularly remuneration expenses in this case. Thirdly, this article builds upon the work of Kodila-Tedika et al. (2020), which focuses on the actors at the head of each administrative institution in the DRC. However, instead of solely defining the leaders of these administrative institutions, as done in Alexiadou and Gunaydin (2019) and Gerring et al. (2019) . Rather, it focuses on what happens there.

The remainder of the article is organized as follows. In the section (2), we present the data, specifically focusing on the statistical approach employed to highlight inter-institutional inequalities. The section (3) is dedicated to the empirical results we have obtained. Finally, we draw our conclusions.

2 Data and Methodology

2.1 Data

There is no database listing salaries in the Congolese administration. To address the research question at hand, it was therefore necessary to start by constructing a database. to achieve this, we collected information on remuneration allocations for each administrative entity considered in this study, as well as the actual number of individuals who receive payment within these aforementioned administrative entities. These details were sourced from the Ministry of Budget in the Democratic Republic of Congo, which is responsible for maintaining such information. On the basis of this data, we computed the average salaries for each administrative/institutional entity. Furthermore, our database does not include all administrative institutions. In fact, due to data availability constraints, we only retained institutions (cf. Table 2) with sufficiently long data series, covering the period from 2010 to 2022. Consequently, recently established institutions do not appear in our analysis.

2.2 Latent Factor Representation and Convergence Test

To examine the convergence of wages over time, we adopt a latent factor representation for the panel data X_{it}, as specified in Equation (1):

$$X_{it} = \delta_{it}\mu_t \tag{1}$$

Here, X_{it} represents the average wage for institution i in year t. The term μ_t captures the growth trend for dynamic changes across institutions, while δ_{it} represents the time-varying factor loadings derived from the trend of μ_t, reflecting the transition pattern of each institution. Additionally, δ_{it} can contain all the idiosyncratic changes in the original panel data X_{it}. Equation (1) assumes that certain factors contribute to achieving a dynamic balance in the wage within each institution. If δ_{it} converges to a constant as t approaches infinity, it indicates convergence of institution over time, with a reduction in the typical variance. The non-stationary transitional trend of δ_{it} is specified as follows (Equation 2), following Phillips and Sul (2007) :

$$\delta_{it} = \delta_i + \frac{\sigma_i}{t^{\alpha}\log(t)}\xi_{it} \tag{2}$$

Here, ξ_{it} represents independent and identically distributed random variables between 0 and 1 for the samples, which are weakly dependent on t. σ_i denotes the idiosyncratic scale parameter, and α represents the decay rate, explaining the form of δ_{it} and the slow speed of convergence to a constant as t tends to infinity. The logarithmic term $\log(t)$ allows for a smooth change in the process.
To test the convergence hypothesis, we specify the null and alternative hypotheses as follows:
Null Hypothesis (H_0): $\delta_i = \delta$ for all i and $\alpha \geq 0$
Alternative Hypothesis (H_1): $\{\delta_i = \delta$ for all i with $\alpha \geq 0\}$ or $\{\delta_i \neq \delta$ for some i with $\alpha \geq 0$, or $\alpha < 0\}$

The null hypothesis assumes overall convergence among institutions, implying a balanced and equally developed wage distribution with sustainability and inclusivity. In contrast, the alternative hypothesis suggests no convergence or the existence of convergence clubs. It indicates that different groups of institutions exhibit similar dynamic convergence towards equilibrium, while at least one diverging region exists. This alternative hypothesis aligns with the complexities of the DRC wage path.

2.3 Log(t) Test and Club Convergence Process

To estimate the factor loadings δ_{it}, we require additional structure on δ_{it} and μ_{it}, following Phillips and Sul (2007). We introduce a coefficient h_{it} that utilizes information from δ_{it} and is designed to capture the transitional trend of institutions relative to the overall panel average:

$$h_{it} = \frac{X_{it}}{N^{-1}\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}}{N^{-1}\sum_{i=1}^{N} \delta_{it}} \tag{3}$$

Equation (5) estimates the relationship between the panel mean and δ_{it} at time t, while accounting for the growth factor μ_{it}. When δ_{it} converges to a constant within a certain range, the following condition (Equation 6) can be satisfied:

$$\lim_{t\to\infty} H_t = \frac{1}{N}\sum_{i=1}^{N}(h_{it}-1)^2 \to 0 \tag{4}$$

Equation (6) measures the deviation of institution level performance from the general limit. When the condition of convergence is reached, H_{it} will converge to 0 as time approaches infinity. Conversely, if convergence cannot be achieved, H_{it} will persistently deviate from 0. The log(t) test is employed to examine the null hypothesis of convergence status among all institutions' wage within the dataset. The regression equation is specified as follows:

$$\log\left(\frac{H_1}{H_t}\right) - 2\log(\log(t)) = a + b\log(t) + \mu_t \tag{5}$$

The log(t) test is conducted under the assumption that t follows the pattern $t = [rT], [rT]+1, ..., T$, where r is a fraction parameter larger than zero. For sample sizes T not exceeding 50, r is recommended to be set at 0.3, following Phillips and Sul (2007). The non-linear time-varying approach captures the dynamic changes in specific groups, representing their transition from initial conditions to a steady state, as convergence typically implies a progressive process with a certain speed. The club convergence process involves identifying converging subgroups and a diverging group within the panel. To determine these clubs and groups, we follow the ordering procedure proposed by Phillips and Sul (2007):

Step 1: Last Observation Ordering All institutions are sorted in descending order based on their last observation X_{it}.

Step 2: Forming the Core Group A certain number (k) of top institutions is selected from the dataset to form initial subgroups. The value of k ranges from 2 to 31. A log(t) test and convergence test t-statistics are conducted for each subset. The value of k is determined by maximizing the t-statistic over k, subject to its minimum t-statistic for k, which should be greater than -1.65 to achieve a 5 percent significance level rejection rate for the null hypothesis. If k is found to be equal to 31, it suggests overall convergence across institutions. If the first two institutions fail to meet the criteria ($k = 2$), the selection process is restarted with the remaining institutions. This process continues until a suitable group of institutions is identified for the core group. If all pairs of institutions

reject the null hypothesis, indicating no convergence clubs in the entire panel, it implies an overall divergence result.

Step 3: Screening Each Institutions for Club Membership Once the core group is formed in Step 2, the remaining institutions are individually assessed to determine their eligibility for joining the core club. The log(t) test is employed, and if the t-statistic exceeds a specific threshold (typically 0 for a sample size below 50, as recommended by Phillips and Sul (2007)), the institution is absorbed into the core club as a new member. This process continues until no additional institutions can be absorbed by the core club. At this point, the core group represents a convergence club.

Step 4: Recursion and Exit Conditions The above steps are recursively repeated to establish additional clubs using the same rules. If the remaining institutions can converge as a whole, a second convergence club is formed, and this process continues until no further convergence groups can be identified within the remaining panel. The institutions that do not belong to any convergence club are labeled as the divergence group.

Step 5: Club Merging Given the conservative clustering selection process, some institutions may meet the criteria for the upper group of convergence. Phillips and Sul (2007) propose a club merging procedure to combine these clubs. This step involves iteratively merging the convergence clubs based on the log(t) test results. The merging process starts with the club that exhibits the smallest log(t) test statistic. The club is then merged with the club that has the highest correlation in terms of the log(t) test statistic. The merging continues until no further clubs can be merged. The final result is a set of convergence clubs that capture the patterns of convergence and divergence among the institutions.

3 Results

Table 1 presents the results of the club convergence test. The test aims to identify convergence clubs based on the analysis of a total sample of 54 institutions between 2010 and 2022. The table is divided into three sections: Initial clubs, Club merging test, and Final clubs.

In the Initial clubs section, the table displays the identified initial clubs along with the estimated coefficient (b) and its corresponding t-statistic. The Total sample club, representing all observations, shows a significant negative coefficient (-0.78) with a highly negative t-statistic (-98.35), indicating the rejection of the null hypothesis of overall convergence. This finding implies that the wages in the 54 institutions do not move to a single equilibrium.

Next, we test the existence of several convergence clubs even in the absence of overall convergence. The formation of the different convergence clubs shows that there exist seven initial clubs. We further assess whether any evidence exists to support the merging of smaller clubs into larger clubs. The merging can be done between certain clubs based on the t-statistics of the estimated coefficients. The results indicate that Club 1 can be merged with Club 2, as their coefficients and t-statistics are the same (0.353 and 3.414). However, no merger is observed between Club 2 and Club 3, as their coefficients (-0.116 and 0.45) have different t-statistics (-1.872 and 4.584). A similar pattern is seen for Club 3 and Club 4, as well as Club 5 and Club 6, where no mergers occur due to differences in coefficients and t-statistics.

Taken together, the results show that wage in 54 institutions can be merged in 4 clubs. The Final Club 1 consists of 15 members with a coefficient of 0.353 and a t-statistic of 3.414. The same interpretation applies to the other Final clubs, indicating the formation of distinct convergence clubs within the dataset.

Table 1: Results of club convergence test

Initial clubs		Club merging test	Final clubs	
Club [members]	b[t-stat of b]	b[t-stat of b]	Club [members]	b[t-stat of b]
Total sample [54]	-0.78[-98.35]			
Club 1[9]	0.518[4.41]	Club 1 + Club 2 0.353[3.414] (Merger)	Club 1[15]	0.353[3.414]
Club 2[6]	0.103[1.021]	Club 2 + Club 3 -0.116[-1.872] (No merger)		
Club 3[12]	0.45[4.584]	Club 3 + Club 4 -0.088[-2.298] (No merger)	Club 2 [12]	0.45[4.584]
Club 4[17]	0.25[2.375]	Club 4 + Club 5 -0.439[-14.177] (No merger)	Club 3[17]	0.25[2.375]
Club 5[6]	0.432[10.026]	Club 5 + Club 6 0.408[5.945] (Merger)	Club 4[8]	0.408[5.945]
Club 6[2]	0.902[1.685]	Club 6 + Club 7 -1.699[-15.447] (No merger)		
Club 7[2]	-3.141[-114.977]		Club 5[2]	-3.141[-114.977]

Source : Authors' computations

It's important to note that the negative coefficients and highly negative t-statistics observed in Club 7 indicate a significant divergence from overall convergence, as the values are extremely low. This suggests that Club 7 represents a distinct group that does not exhibit convergence characteristics.

Table 3 presents the convergence clubs along with the average wage and convergence rate for each club. The clubs are denoted by numbers, and each club consists of specific sectors or ministries grouped together based on their convergence characteristics.

Functional Similarities: Club 1 consists of sectors such as Budget, Finance, Presidency, and Judicial power, which are closely related to the governance and administrative functions of the country. The average wage in this club is 1.11, indicating a relatively higher wage level compared to other clubs. The convergence rate for Club 1 is 0.18, suggesting that these sectors are converging at a moderate pace. The convergence of these sectors could be driven by their shared goals, coordination requirements, and interdependencies in terms of budgetary allocations, policy formulation, and decision-making processes.

Policy Cohesion: Club 2 comprises sectors like Communication and media, Health, Planning, and Social affairs, which are primarily responsible for implementing and coordinating specific policy areas. The average wage for Club 2 is 1.00, indicating a comparable wage level to the overall average. The convergence rate for this club is 0.22, indicating a slightly faster convergence rate than Club 1. The convergence in this club could be influenced by the need for collaboration and alignment in policy planning, implementation strategies, and resource allocation within these sectors.

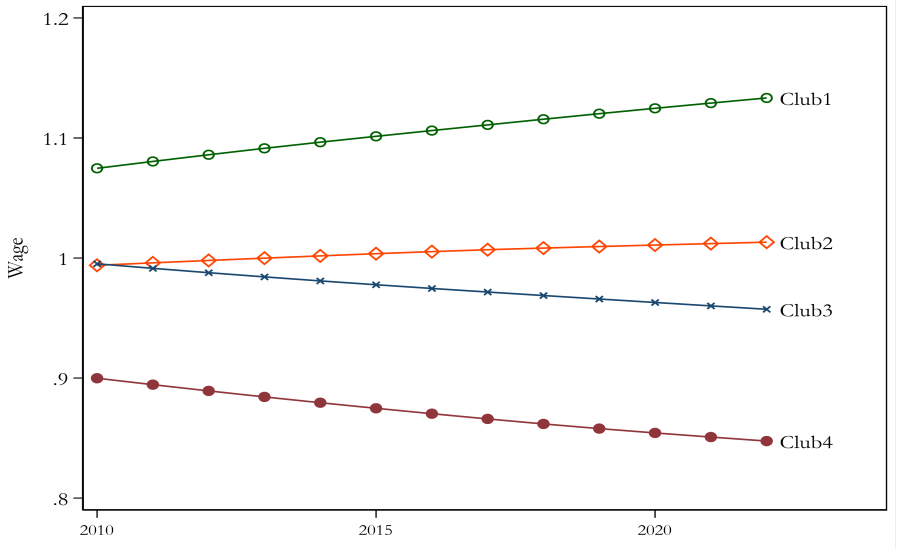
Sector Interdependencies: Club 3 includes sectors like Agriculture, Energy, Mining, Infrastructure, and Higher Education. These sectors are interconnected and mutually reliant in terms of resource allocation, infrastructure development, and human capital investment. The average wage in Club 3 is 0.98, slightly below the overall average wage. The convergence rate for this club is 0.12, suggesting a slower convergence rate compared to the previous clubs. The convergence within this club may be driven by the need for coordinated efforts to address common challenges, promote economic growth, and enhance sectoral synergies.

Security and Governance Focus: Club 4 encompasses sectors like Defense, Interior and security, Land affairs, and Public service. These sectors are primarily responsible for maintaining law and order, ensuring security, and providing essential public services. The average wage in Club 4 is 0.87, indicating a relatively lower wage level compared to other clubs. However, the convergence rate for this club is 0.20, suggesting a moderate pace of convergence. The convergence in this club could be influenced by the shared objectives of national security, stability, and effective governance.

It is important to note that these factors are indicative and require further analysis and context-specific understanding. The formation of convergence clubs could also be influenced by historical, political, and socio-economic factors unique to the DRC. Analyzing the underlying drivers and dynamics within each club can provide deeper insights into the convergence patterns and facilitate targeted policy interventions for effective institutional development and governance in the country.

The findings of this table reveal further interesting patterns. The highest wage club (Club 1) demonstrates a moderate convergence rate, while the lowest wage club (Club 4) exhibits a relatively slower convergence rate. However, the relationship between wage and convergence rate is not linear for the middle two clubs (Club 2 and Club 3). Club 2, with a higher wage, converges at a slower pace than Club 3, which has a lower average wage rate. Finally, Figure 1 plots the relative transition inside the convergence clubs. It shows large divergence, especially between Clubs 1 and 2 and between Clubs 3 and 4. These divergences seem to increase overtime.

Figure 1: Relative transition path of clubs



4 Conclusion

In this paper, we have examined the extent of inter-institutional wage inequalities in the Democratic Republic of Congo (DRC). Our analysis focused on the dynamics of wage disparities within congolese institutions and aimed to identify convergence patterns among them. To achieve this, we constructed a series of average salaries for each institutional entity in the DRC using data from the Ministry of Budget. This allowed us to analyze the evolution of wages within these institutions over the period 2010-2022. We employed the Phillips-Sul convergence test method, which involves identifying convergence clubs, to investigate the convergence of wages over time.

Our findings reveal that institutional wages in the DRC do not converge into a single common equilibrium. Instead, we identified four significant convergence clubs based on functional similarities, policy cohesion, sector interdependencies, and security and governance focus. These clubs represent groups of institutions that exhibit similar convergence patterns. Furthermore, the trend of the clubs' transition paths indicates a great divergence in institutional wages. Club 1 shows a clear and strong upward trend, while Club 2 exhibits a very slight upward trend. Club 3 displays a slight decline, and Club 4 shows a downward trend.

This study contributes to the literature by shedding light on the issue of inter-institutional wage inequalities, particularly within public institutions in developing countries like the DRC. Our analysis provides empirical evidence of the significant disparities in wages among congolese institutions and highlights the lack of overall convergence. These findings add to the understanding of the complexities of wage dynamics within the public sector, where factors such as corruption, rent-seeking behavior, and political power play a role in determining salary discrepancies.

In conclusion, our study emphasizes the need for further research and policy attention to address inter-institutional wage inequalities in the DRC. Understanding the factors driving these disparities and their implications for governance, development, and social cohesion is crucial for promoting fair and inclusive public institutions. By addressing these challenges, policymakers can work towards creating a more equitable and sustainable wage distribution system within the country's institutions.

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5 Appendix

Table 2: Summary statistics

	Mean	Std. Dev	Min	Max
ECN	1051.74	404.99	735.10	2180.62
PTNTIC	1962.07	2009.29	761.16	8319.43
Agriculture	1498.46	609.02	767.43	2766.02
Budget	16558.39	14213.44	5295.25	51311.70
Chancellery of national orders	3494.47	3562.88	963.41	14289.66
Communication and media	4049.46	1654.34	845.86	6761.50
Culture and arts	2007.92	1037.02	711.95	3930.89
Decentralization	2376.27	3820.88	100.00	11137.33
Defense	1062.84	270.66	749.98	1621.68
Employment and labor	2867.62	1801.18	446.11	7999.43
Energy	3210.36	3680.44	1022.99	13939.38
Finance	7438.11	11685.19	1230.51	37567.27
Foreign affairs	10593.45	5689.33	3043.57	25799.89
Foreign trade	1235.65	458.68	697.90	2070.05
Gender, family and children	3573.64	2698.28	1491.11	12344.09
Health	3726.40	1872.10	1369.09	7460.56
Higher Education and University	3451.73	874.36	2061.00	5805.17
Human rights	1859.76	1594.45	905.95	6790.92
Hydrocarbons	2176.72	2139.88	846.03	6736.81
INEC	37488.27	66521.62	48.16	194894.60
Industry	1272.16	660.46	675.49	2748.30
Infrastructure and public works	3224.76	2448.48	1144.89	10285.38
Institutional reforms	1663.98	1213.12	785.08	4779.08
Interior and security	1090.93	266.56	606.23	1532.65
International cooperation	3741.92	2542.27	669.80	10230.37
Judicial power	11478.33	4961.85	4892.04	21264.69
Justice	1636.15	1297.01	856.01	5725.85
Land affairs	1004.09	385.25	85.91	1707.51
Mining	1744.22	1281.60	545.98	5384.98
National assembly	18480.53	7452.56	9896.15	37575.57
National economy	1596.35	902.37	652.21	3017.00
National solidarity and humanitarian ac	4329.94	8981.32	303.26	32720.77
Planning	5788.36	1880.39	2917.71	8774.91
Portfolio	5800.39	2351.46	3096.07	10095.38
Presidency	12992.73	7863.20	4084.80	34497.18
Primary Education Secondary and Technic	1271.61	466.62	618.35	2485.62
Primature	19506.03	9822.09	6894.77	43351.24
Public service	7406.53	25700.32	157.94	92941.54
Reconstruction	1118.71	346.06	636.73	1991.20
Regional cooperation	3471.49	1173.99	1730.16	5328.77
Relations with the parliament	3428.21	1264.65	1555.81	6682.44
Rural development	1151.04	316.36	568.50	1757.33
SME	3588.62	1596.42	1182.31	8006.21
Scientific research	2294.60	642.03	1306.83	3437.64
Secretary general of the government	14069.44	4618.58	8108.76	21914.30
Senate	19780.59	8818.58	10122.22	42576.57
Social affairs	6508.73	19872.74	270.08	72612.42
Social security	4212.49	1481.58	1411.73	7999.43
Sports and recreation	6930.61	13441.94	600.56	48742.13
Tourism	1210.15	264.88	650.23	1621.47
Transport and communication	2201.76	1967.05	888.83	6933.90
Urban planning and housing	3453.67	8597.47	97.37	31966.45
Veterans affairs	2473.90	3606.90	65.42	11611.51
Youth	1001.45	390.61	20.53	1710.49

Table 3: Convergence clubs, wage and convergence rate

Club	Sectors	Average wage	Convergence rate
1	Budget, Decentralization, Finance, Foreign affairs, Hydrocarbons, INEC, International cooperation, Judicial power, National assembly, National solidarity and humanitarian actions, Presidency, Primature, Secretary general of the government, Senate, Veterans affairs	1.11	0.18
2	PTNTIC, Chancellery of national orders, Communication and media, Culture and arts, Gender, family and children, Health, National economy, Planning, Portfolio, SME, Social affairs, Transport and communication	1.00	0.22
3	Agriculture, Employment and labor, Energy, Foreign trade, Higher Education and University, Human rights, Industry, Infrastructure and public works, Institutional reforms, Justice, Mining, Regional cooperation, Relations with the parliament, Scientific research, Social security, Sports and recreation, Urban planning and housing	0.98	0.12
4	ECN, Defense, Interior and security, Land affairs, Public service, Reconstruction, Tourism, Youth	0.87	0.20

Figure 2: Static comparison (boxplot)

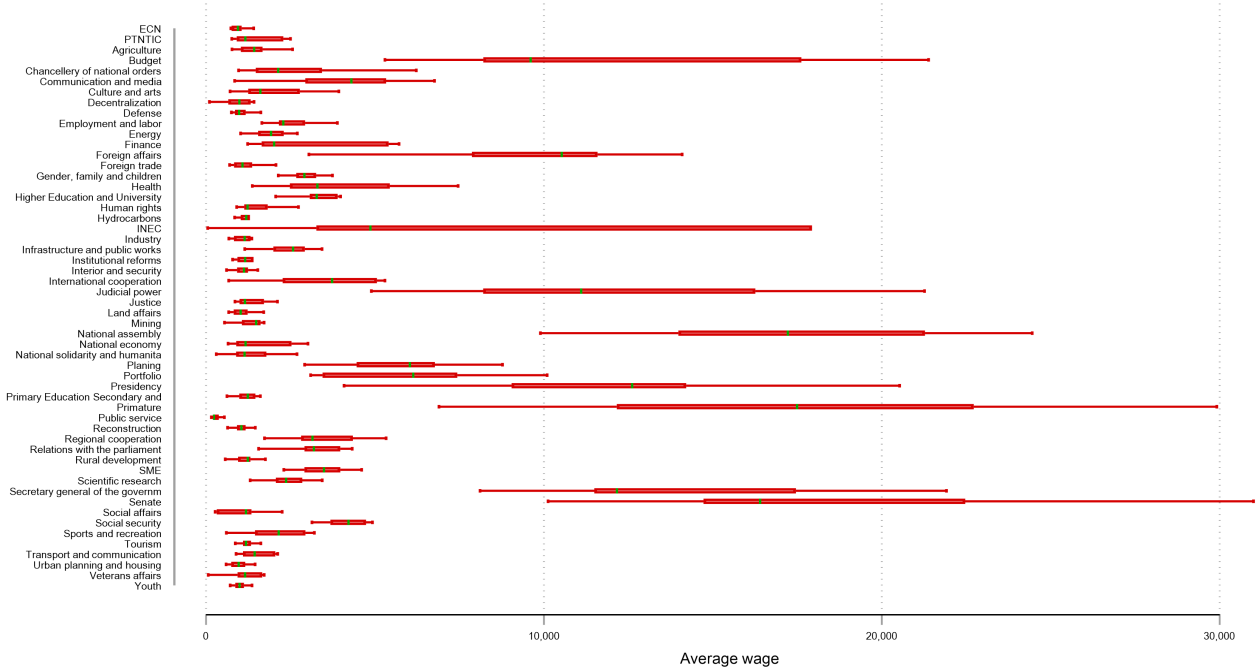

Figure 3: Distributional dynamics of wage (two-dimensional contour plot)

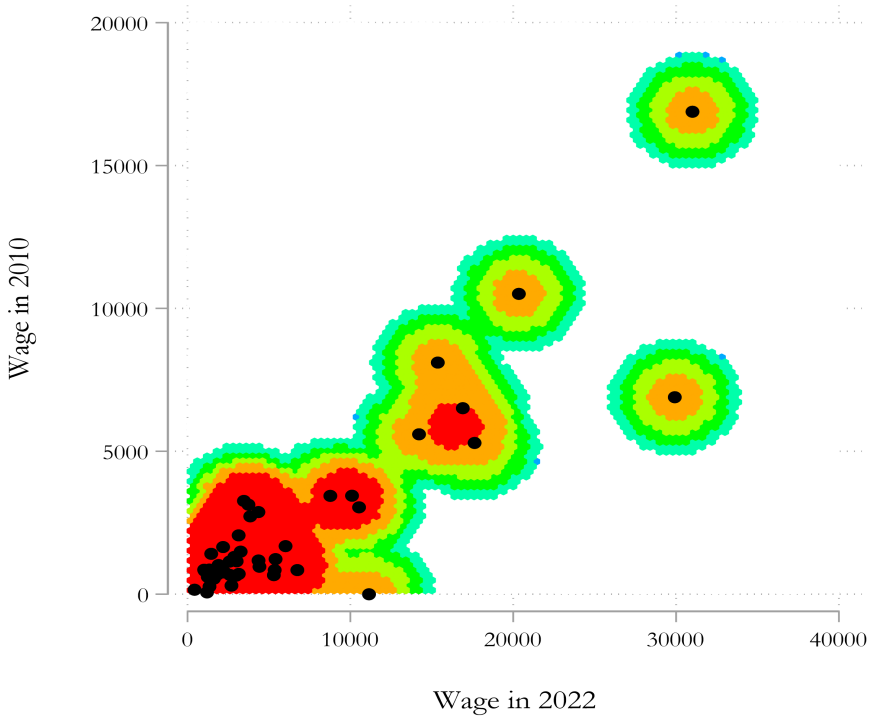

Figure 4: Distributional dynamics of wage (Three-dimensional surface of the stochastic kernel density)