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DIGITALNI AKADEMSKI ARHIVI I REPOZITORIJI

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THE CHARACTERISTICS OF THE TOP DECILE WAGE EARNERS IN CROATIA

ABSTRACT

International research on top incomes predominantly explores variations in income shares at the top, with a broad emphasis on cross-economy comparisons to highlight heterogeneity. In contrast, detailed analyses focusing on the specific attributes of top wage earners within individual countries are less common. Notably, Croatia has been overlooked in these discussions. This paper aims to address this gap by uncovering the distinctive characteristics of the highest decile of wage earners in Croatia, diverging from the more common approach of comparing across multiple economies to instead provide an in-depth look at a single country. Accordingly, the aim of the paper is to reveal the main characteristics of the top decile wage earners in Croatia. For this purpose, the paper uses the probit model and data from the EU-SILC 2020 survey. We analyse persons who received employment income and who worked all 12 months of the year. The results show that the top decile wage earners receive about a quarter of the total employment income. The probit analysis shows that gender, age, settlement size, education and economic activity of the main job have a significant impact on belonging to the top decile wage earners group. In other words, men, elderly persons, those living in densely populated areas, those with tertiary education and those working in financial intermediation are significantly more likely to be in the top decile wage earners group than others.

Key words: *top wage earners, probit model, Croatia.*

1. Introduction

The exploration of income inequality and the distribution of wealth has long been a critical area of study in economics, particularly given its implications for social policy, economic stability, and the overall health of a nation's economy (Acemoglu & Robinson 2012; Atkinson, 2015; Piketty 2014; Scheidel 2017; Stiglitz 2012). Among the various dimensions of this inquiry, the examination of top income earners holds a distinct place, offering insights into the mechanisms of wealth accumulation and the socio-economic characteristics that differentiate these individuals from the broader population. Despite the global relevance of such studies, the specific focus on the characteristics of top wage earners within individual countries, especially

those not typically highlighted in international research, is less common. Croatia, with its unique economic landscape and transition history, represents a compelling case for such a study.

This paper seeks to bridge the existing research gap by analysing the characteristics of the top decile of wage earners in Croatia. The focus on this particular group is driven by their disproportionate influence on economic indicators and policy outcomes. Leveraging data from the EU-SILC 2020 survey and employing a probit model for our analysis, this study aims to conduct a detailed examination of the factors associated with higher wage earnings in Croatia. This endeavour is timely and relevant, given the current debates on economic policy, labour market trends, and income distribution within the country.

The methodology of this study entails a comprehensive review of demographic, socio-economic, and geographical variables that could influence an individual's likelihood of being among the top wage earners. Concentrating on individuals who were consistently employed throughout 2019, our research offers insights into how stable employment conditions can lead to higher income levels. This methodological approach ensures that the findings of this study are pertinent for discussions on employment stability and labour market policies.

Our findings emphasize the critical importance of factors such as gender, age, educational attainment, urbanization, and the sector of employment in the achievement of high wages in Croatia. These results underscore the necessity for focused educational policies, urban development initiatives, and sector-specific economic measures to address income inequality and promote a more equitable distribution of wages. Furthermore, by providing empirical evidence from a country that has received limited attention in the global discourse on top income earners, this study contributes valuable insights to the broader body of literature.

To facilitate a comprehensive understanding of our findings, the paper is structured as follows: Section 2 offers an in-depth review of the relevant literature, setting the stage for our investigation. Section 3 outlines the methodology, detailing the data source, the analytical approach using the probit model, and the definition of variables. Section 4 presents the analysis results, diving into the characteristics of Croatia's top decile wage earners and the factors influencing their income levels. Finally, Section 5 integrates these findings with the wider research landscape and concludes the paper, summarizing the main insights and suggesting directions for further research.

2. Literature review

The investigation of income inequality, particularly at its highest levels, plays a pivotal role in understanding economic trends across different countries, shedding light on how socio-economic factors influence the distribution of wealth among the top earners. Global studies, such as Atkinson & Leigh (2007)'s examination of Australia's top income shares, show us how shifts in socio-economic conditions can significantly influence income distribution. These insights are directly relevant to Croatia, suggesting that exploring local socio-economic factors is essential for understanding the country's unique income distribution patterns.

Further research, like that of Brewer et al. (2007), highlights the role of external economic factors, such as market fluctuations, on the wealth of top earners in Great Britain. This analysis demonstrates the vulnerability of top income groups to wider economic patterns, offering a

comparative perspective to understand the factors driving income growth among Croatia's top earners. The link between global financial movements and individual income levels underscores the significance of external economic factors in our examination of Croatia's top decile of wage earners.

The topic of gender disparities within the highest tiers of income distribution has drawn considerable attention, with researchers like Atkinson et al. (2018) shedding light on the global issue of women's underrepresentation in these lucrative segments. This enduring gender gap, also observed in Sweden by Boschini et al. (2017), and the investigation of the glass ceiling in the United States by Guvenen et al. (2020), underscores pervasive inequalities that transcend national boundaries. These studies highlight the need for a detailed gender analysis in the Croatian context to fully grasp the scale and impact of gender disparities among top earners, echoing a wider demand for equality and representation at the highest income levels.

Furthermore, the influence of education and professional experience on securing top income positions has been underlined by Debowy et al. (2022), who demonstrate the significant, though diverse, role of formal education on income in Israel. This diversity suggests varying effects of educational attainment among different demographic groups, indicating a nuanced relationship between education, experience, and income levels. This discussion is expanded by Passaretta & Triventi (2023), who explore the gender earnings gap among Italy's educational elite, further highlighting the pivotal role of educational trajectories in shaping income disparities. These findings stress the need to examine the educational and professional backgrounds of Croatia's top earners to decode the elements driving their financial success.

Occupational and industry-specific factors are pivotal in determining income levels at the top, as highlighted by Denk (2015a) and Du Caju et al. (2010). Their investigations into the income of Europe's top earners and the differences in wages across industries shed light on the importance of sectoral and occupational dynamics in affecting income levels. These insights are particularly relevant for analysing Croatia's highest wage earners, suggesting that industry and occupation might be key factors in income differences.

Furthermore, the impact of demographic shifts is a crucial aspect of understanding the dynamics of income distribution. Research conducted by Srdelić & Dávila-Fernández (2022) explores the complex interplay between demographic changes, particularly aging populations, and economic growth in six European Union countries. Their findings reveal that demographic trends can have varied effects on economic growth in different EU states, with aging populations showing negative impacts on growth in some cases, while others may experience positive outcomes under certain conditions. This perspective on the influence of demographic trends on economic patterns adds depth to our examination of income inequality among top earners, highlighting how broader macroeconomic and demographic trends can shape income distribution.

Integrating these various strands of research, our literature review places the study of Croatia's top decile wage earners in the context of a wider academic dialogue on income inequality. This approach not only sheds light on the complex nature of income disparities but also enhances our understanding of the socio-economic factors that influence top-level income distribution. By doing so, it fills a significant gap in the existing literature and furthers the discussion on socio-economic fairness.

3. Data and methodology

The analysis uses data from the EU statistics on income and living conditions conducted for 2020 (EU-SILC 2020). EU-SILC is a mandatory survey that enables a comparative analysis of income statistics, indicators of poverty and social exclusion for all EU countries. The survey is conducted on an annual basis using a rotating panel sample of randomly selected private households. The data contains information on demographic, socio-economic and spatial characteristics for each member of the household. The collected sample is weighted in such a way that each person from the sample is assigned an appropriate weight, and in this way, the sample is projected onto the entire population. The reference period for income variables is the previous calendar year, so in this study all income variables refer to 2019.[1]

The paper analyses the characteristics of 10% of recipients with the highest employment income.[2] For this purpose, a binary indicator dependent variable is introduced, which with 1 indicates 10% of persons with the highest employment income, and with 0 other persons. Only persons who were employed for all 12 months of the year are taken into account. The explanatory variables used for the analysis of the determinants of the top decile wage earners are taken based on research Denk (2015a). The list and definitions of the used variables are given in Table 1.

Table 1: The list of variables used in the analysis (authors')

Variables	Definition	Values
Dependent variable:		
Top decile wage earner	A binary indicator variable indicating whether the observed person is among the 10% of persons with the highest employment income	1 = 10% of persons with the highest employment income; 0 = bottom 90%.
Explanatory variables:		
Gender	A binary indicator variable indicating the individual's gender.	0 = women; 1 = men.
Age	A categorical variable indicating the age group of the observed persons.	1 = 18 to 29 years; 2 = 30 to 39 years; 3 = 40 to 49 years; 4 = 50 to 59 years; 5 = 60 years and more.
Education status	A categorical variable for the education status of the observed persons.	1 = primary education; 2 = secondary education; 3 = tertiary education.
Area of living	A categorical variable which describes the degree of urbanization of the respondent's place of residence.	1 = thinly-populated area; 2 = intermediate area (at least 300 inhabitants per km2 and a minimum population of 5,000); 3 = densely populated area (at least 1 500 inhabitants per km2 and a minimum population of 50,000).
Economic activity of the main job	A categorical variable which describes the economic activity of the main job for respondents who are currently at work.	1 = Agriculture and Fishing; 2 = Mining, Manifact. And Utilities; 3 = Construction; 4 = Wholesale and retail; 5 = Hotels and restaurants;

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[1] The last available survey is EU-SILC 2022, which contains income variables from 2021. However, EU-SILC 2020 is the last survey that contains income variables unaffected by the COVID period. As such, EU-SILC 2020 is currently most appropriate for this research.

[2] In this paper, employment income includes gross employee cash or near cash income and gross non-cash employee income. Furthermore, instead of the term employment income, we also use the term wage.

Variables	Definition	Values
		6 = Transport and communication;
		7 = Financial intermediation;
		8 = Real estate and business
		9 = Public administ. And defence
		10 = Education;
		11 = Health and social work;
		12 = Other.

Source: Authors

There are certain shortcomings of the survey data used which also represent certain research limitations. Namely, it is a well-known fact that income data is underrepresented on the right tail of the distribution. One of the reasons is the lower willingness of persons with higher incomes to participate in the survey, as well as the reporting of lower incomes than they actually are. Using the example of Croatia, Ledić et al. (2022) showed certain methods of data correction that aim to improve the precision of data on the right tail of the distribution. They used EU-SILC 2018 data and found that capital income is the least represented in the survey data, while employment and pension income are the most represented. They illustrate that the EU-SILC data captured 93% of the aggregate employment income from the administrative source. As regards the number of recipients of employment income, the EU-SILC data captured 90% of the total number of recipients from the administrative source. In their paper, the data correction method improved the survey data on employment income amounts so that the corrected data captured 101% of the aggregate employment income from the administrative source, while the total number of recipients remained the same after data correction.

In our paper, we use the original survey data instead of the corrected survey data taking into account the following facts. This research is more oriented to the characteristics of the persons with the highest employment income than to precise amounts of employment income. Employment income is used only when constructing the dependent variable, that is when determining the persons who are among the 10% of persons with the highest amount of employment income. Therefore, even though the employment income data in the survey are underestimated at the very top of the income distribution, it is still of sufficient quality to successfully identify the top 10% of people with the highest employment income. Furthermore, the research by Ledić et al. (2022) showed that the data correction methods correct only the employment income amounts, but the number of recipients remains the same even after the correction data method. In addition, the correction methods would also correct the socio-economic characteristics of persons, which would consequently reduce the precision of the obtained results.

On the other hand, the advantage of survey data compared to administrative data is that it provides a wider set of available variables, e.g. administrative data does not contain a gender variable. Considering all the above facts, we conclude that it is best to use original survey data for this research purpose.

To assess the determinants of top decile wage earners, a probit regression model is conducted. For each person i, the estimated probability of the probit model is defined as follows:

$$P_i = Prob(y_i = 1) = Prob[x_i\beta + \varepsilon_i > 0] = Prob[\varepsilon_i > -x_i\beta] =$$
$$= F(x_i\beta),$$

where y is the dependent binary indicator variable, X_i is a vector of explanatory variables, β is the parameter vector, ε is the error term and $F(\cdot)$ is the cumulative distribution function of ε (Maddala, 2001). In the probit model, it is assumed that the error terms ε follow a standard normal distribution, so the function $F(\cdot)$ is defined as follows

$$F(x_i\beta) = \Phi(x_i\beta) = \int_{-\infty}^{x_i\beta} \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{t^2}{2}\right) dt \ .$$

The marginal effects of a unit change in the k - th explanatory variable are:

$$\frac{\partial P_i}{\partial x_{ik}} = \beta_k \phi(x_i\beta),$$

where $\phi(\cdot)$ denotes the standard normal density function.

4. Results

The results section begins with a descriptive analysis of the dependent variable. In Figure 1, persons who worked all 12 months in the year are divided into decile groups according to the amount of their employment income. The dependent variable is constructed in a way that with the value 1 are denoted persons who are in the tenth decile group, while persons from the first nine decile groups are denoted with 0. The results from Figure 1 show that persons placed in the tenth decile group (top decile wage earners) earn almost a quarter of the total employment income of all observed persons. The total amount of employment income falls as we descend towards the lower decile groups. Employed persons from the 9th decile group earn 13.9% of the total employment income, while those from the first decile group earn only 4.5%. The biggest jump in total employment income is between the ninth and tenth decile group; the total employment income earned in the tenth decile group is by 9 percentage points higher than in the ninth. On the other hand, the difference between the first and ninth decile groups is also the same, the total income earned in the ninth decile group is about 9 percentage points higher than in the first.

Figure 1: Distribution of the employment income according to decile groups (%)
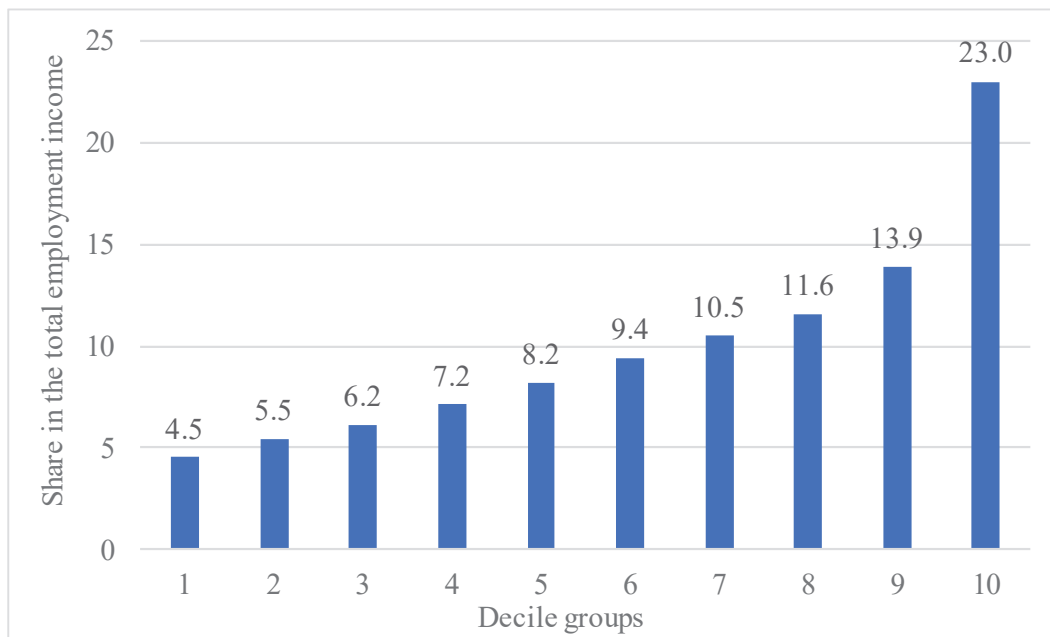
Source: Authors' work based on the EU-SILC 2020 survey

What are the main determinants of the top decile wage earners, who earn a quarter of the total employment income? In order to get an answer to that question, we first analyse the results of descriptive statistics that show the distribution of the dependent variable according to certain demographic, socio-economic and spatial determinants. Table 2 presents these descriptive results, which indicate that men are more frequently in the group of top decile wage earners than women (13.2% compared to 6.1%). Persons over the age of 65 are much more frequently to be in the top decile wage earners group than others; 16.2% of those aged over 65, about 11% of middle-aged persons (aged 30-59) and 4.2% of those aged 18-29 are in the top decile wage earners group. Those with tertiary education are much more often found in the top decile wage earners group than those with primary and secondary education (24.0% tertiary educated persons compared to 3.8% primary and 4.7% secondary educated persons are in the top decile wage earner group). Densely populated areas appear to have a much higher proportion of top decile wage earners than other areas. As for the economic activity of the main job, it turned out that the top decile wage earners most often work in the financial intermediation and in transport and communication.

Table 2: Distribution of the wage earners in Croatia, % of survey respondents

	Bottom 90%	Top 10%
Total	90.0	10.0
Gender		
Female	94.0	6.1
Male	86.8	13.2
Age in years		
18-29	95.8	4.2
30-39	89.1	10.9
40-49	89.0	11.0
50-59	89.8	10.2
65+	83.5	16.5
Education		
Primary	96.2	3.8
Secondary	95.3	4.7
Tertiary	76.0	24.0
Area of living		
Thinly populated area	93.6	6.4
Intermediate area	92.5	7.5
Densely populated area	83.4	16.6
Economic activity of the main job		
Agriculture and Fishing	96.5	3.5
Mining, Manifact. And Utilities	91.6	8.4
Construction	86.2	13.8
Wholesale and retail	93.0	7.0
Hotels and restaurants	92.5	7.5
Transport and communication	80.2	19.8
Financial intermediation	72.6	27.4
Real estate and business	89.4	10.6
Public administ. And defence	90.0	10.0
Education	94.6	5.4
Health and social work	91.2	8.8
Other	97.6	2.4

Source: Authors' work based on the EU-SILC 2020 survey

To evaluate whether there are the statistically significant determinants of the top decile wage earners, Table 3 shows the results of a probit regression analysis. Starting with the demographic variables, the results show that the probability of belonging to the top decile wage earners group is greater among men and older age groups. The marginal effect reveals that the probability of being a top decile wage earner is 8.7 percentage points higher for men than women. Relative to persons aged 30-39, those older than 65 are 4.4 percentage points more likely to be in the top decile wage earners group, while for those aged 18-29 this probability is lower by 4.2 percentage points. Place of living is also statistically significant with those living in density populated areas being more likely than others to be a top decile wage earner. Persons living in densely populated areas are 4.0 percentage points more likely to be a top decile wage earner than those living in thinly populated areas.

Research for other countries also found a gender wage gap, particularly at the top of the wage distribution. Blau & Kahn (2017) concluded, based on panel data for the United States from 1980 to 2010, that the gender wage gap decreased over the years.[3] This gap decreased significantly at the middle or bottom of the wage distribution, while it remained significant at

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[3] Similar results were obtained by Blau & Kahn (2000).

the top of the distribution. The same results were obtained by Atkinson et al. (2018), who conducted research on a sample of eight countries. They report that the presence of women at the top of the wage distribution increased over the years but grew more slowly as we moved to the very top. On a sample of 18 EU countries Denk (2015a) also concludes that men are more likely to be among the people with the highest wages. Regarding age, Denk (2015a) confirmed the same result, pointing out that older persons are more likely to be among the top earners. Similar results were obtained by Brewer et al. (2007) for the United Kingdom and Fortin et al. (2012) for Canada. They showed that in the UK those in their 40s are more likely to be among the top earners, while in Canada it is more likely for persons between 35 and 64 years old.

Regarding the socio-economic variables, the results show that the probability that a person is a top decile wage earner is higher for those with tertiary education and those working in financial intermediation, transport and communication, and construction. More precisely, persons with a tertiary level of education are 21.4 percentage points more likely to be top wage earners than those with secondary education. The probability of being a top decile wage earner is 11.8, 7.5 and 7.3 percentage points higher for persons working in financial intermediation, transport and communication, and construction (respectively) relative to those working in public administration and defence.

A study conducted for Israel also found that highly educated persons are more likely to belong to the top decile wage earners group (Debowy et al., 2022), and the same was shown for the group of 18 EU countries in the research conducted by Denk (2015a). Kaplan & Rauh (2010) showed that the top earners in the USA work in the financial sector, which was also found in the research for EU countries conducted by Denk (2015b). Similar results were obtained in another study conducted by Denk (2015a), in which it was determined that those who work in finance and insurance, information and communication, and professional services are more likely to belong to the group of top wage earners. Additionally, Astrov et al. (2019) in their research covering eight European countries (including Croatia) state that financial services are one of the highest-paid jobs in almost every country.

Table 3: Probit regression analysis of the top decile earners in Croatia

	Coefficient (Standard error)	Marginal effect
Gender (RC: Female)		
Male	0.622 (0.079)***	0.087
Age in years (RC: 30-39)		
18-29	-0.393 (0.149)***	-0.042
40-49	0.168 (0.098)*	0.024
50-59	0.148 (0.099)	0.021
65+	0.288 (0.135)**	0.044
Education (RC: Secondary)		
Primary	0.277 (0.524)	0.030
Tertiary	1.159 (0.077)***	0.215
Area of living (RC: Thinly populated area)		
Intermediate area	-0.004 (0.087)	-0.001
Densely populated area	0.273 (0.087)***	0.040
Economic activity of the main job (RC: Public administ. And defence)		
Agriculture and Fishing	-0.318 (0.255)	-0.032
Mining, Manifact. And Utilities	0.181 (0.125)	0.024
Construction	0.469 (0.153)***	0.073
Wholesale and retail	0.121 (0.153)	0.016
Hotels and restaurants	0.236 (0.234)	0.032
Transport and communication	0.479 (0.139)***	0.075
Financial intermediation	0.686 (0.233)***	0.118
Real estate and business	0.040 (0.180)	0.005
Education	-0.515 (0.174)***	-0.046
Health and social work	0.139 (0.156)	0.018
Other	-0.545 (0.251)**	-0.047
Constant	-2.475 (0.158)***	
Number of observations	4,965	
Prob > chi2	0.000	
R2	0.214	

Significance: *$p<0.05$, **$p<0.01$, ***$p<0.001$.

Source: Authors' work based on the EU-SILC 2020 survey

5. Conclusion

This paper is the first to analyse the characteristics of the persons with the top wages in Croatia. International studies have primarily focused on the distribution of income shares among top earners (e.g. Piketty, 2003; Joyce et al., 2019), leaving a distinct gap regarding the profiles of these individuals. Among the few, Denk's (2015a) investigation into the characteristics of top wage earners across 18 EU countries notably excluded Croatia, highlighting a significant gap in the literature. Additionally, while studies such as those by Brewer et al. (2007) in the UK, Godechot (2012) in France, and Fortin et al. (2012) in Canada have provided descriptive analyses of top earners, similar research focusing on Croatia has been absent. Our study seeks to bridge this void, contributing not only to the understanding of Croatia's economic landscape but also enriching the global dialogue on income distribution.

Employing data from the EU-SILC 2020 survey and utilising a probit model, this research estimates the defining characteristics of individuals within the top 10% of earners by employment income. Focusing on individuals with stable employment throughout the year, the study presents an in-depth descriptive analysis of the top decile wage earners' profiles.

Subsequently, the probit model discerns the attributes significantly associated with belonging to this high-earning group.

The findings reveal a higher likelihood of being among the top decile wage earners for men, older individuals, those with higher educational attainment, residents of densely populated areas, and employees within specific sectors such as financial intermediation, transport, communication, and construction. Notably, the gender disparity is pronounced, with men having an 8.7 percentage points higher chance than women to be in this group. Age also plays a critical role, with individuals aged 40-59 being approximately 2 percentage points more likely to be top earners compared to those aged 30-39. The advantages conferred by tertiary education and urban living are significant, enhancing the probability of high wage earning by 21.5 and 4.0 percentage points, respectively.

Given the contributions and findings of this study, several avenues for future research emerge. Firstly, further exploration into the underlying causes of the identified gender disparity among top wage earners in Croatia is warranted. Understanding the structural or societal barriers that contribute to this gap could inform policies aimed at promoting gender equity in the labour market. Secondly, an investigation into the longitudinal trends of income distribution among top earners could offer insights into the stability of these patterns and their evolution over time. Such analysis would be particularly relevant in the context of economic fluctuations and policy changes. Lastly, comparative studies involving Croatia and other countries with similar economic structures or transition histories could elucidate the unique or shared factors influencing top earners' profiles, enriching the global discourse on income inequality.

By addressing these gaps, future research can build upon the foundation of this study, broadening the understanding of income disparities and contributing to the formulation of strategies aimed at fostering socio-economic equity.

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