Has the digital economy improved income inequality for ethnic minorities? The case of China

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A B S T R A C T

This paper examines how China's ethnic minorities' income equality has changed due to the digital economy's development. The study focuses on the critical analysis of the legal system by juridical analysis combined with doctrinal and textual analysis. Furthermore, the article makes the argument convictive by developing econometric models and heterogeneity analysis. Through a dialectical discussion, this paper shows a shared understanding of what the term "digital economy" means in Chinese society, and that income equality for ethnic minorities in the digital economy has both positive and negative effects. On the one hand, the digital economy is conducive to raising income levels and reducing the income gap between Han Chinese and ethnic minorities; however, on the other hand, the digital economy exacerbates the income gap between Han Chinese and ethnic minorities among low-income groups. As a result, disputes over income equality for ethnic minorities in the digital economy are more pronounced among low-income groups. The institutional causes of these problems include the inadequacy of China's digital economy policies for ethnic minorities and the shortcomings of China's legal system for labor protection. The Chinese government should renew the Chinese Constitution, labor law, and employment protection policies to improve the present situation. Based on China's experience, other countries should have pragmatic attitudes to revise the laws and regulations and explore some target measures, such as the digital services tax, to help ethnic minorities.

1. Introduction

1.1. Research background

Since the 20th century, an international consensus has existed to develop the digital economy. According to a United Nations (UN) report, in 2021, China and the United States were the two leading nations in the digital economy were China and the United States [1]. In bilateral relations on the digital economy, China and Chile signed a free trade agreement as early as 2005.[2] In 2015, China and the EU signed a cooperation agreement on 5G after the EU released its Digital Single Market Strategy (DSMS) [2]. In 2017, China held the

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[2] See Free Trade Agreement Between the Government of the People's Republic of China and the Government of the Republic of Chile, article 111.

fourth World Internet Conference, where digital economy cooperation became essential to China's Belt and Road strategy [3]. In 2019, China and France also committed to strengthening their dialogue and cooperation on the same topic.[3]

In China, the government announced the 14th Five-Year Plan in 2021 to grow the digital economy over the following 15 years, and it is thought to be the most important economic form today.[4] Furthermore, all Chinese provinces have started to develop administrative programs on the digital economy. Indeed, seven[5] provinces have already developed a unified digital economy development program in China, but ethnic minority provinces have not yet taken relevant legal or administrative measures. Therefore, it is a critical concern both internationally and within China.

Moreover, people have begun to pay attention to whether the rights of different groups are adequately protected, among which the income equality of ethnic minorities in the digital economy has long since been one of the core issues. In 2003, the UN and the International Telecommunication Union drafted the World Summit on the Information Society. Furthermore, it explicitly mentions the equal protection of the rights of minorities and indigenous peoples in the digital economy [4]. In 2021, the development of language and voice technologies was encouraged to reduce the digital divide in the digital economy for ethnic minorities.[6] Moreover, income equality for ethnic minorities in the digital economy has also entered the research landscape for the digital economy [5].

1.2. Research significance

This research rethinks the relationship between the digital economy and the income equality of ethnic minorities in China, which can help to critically examine the attitudes of different social groups regarding the digital era. The economy's evolution is evolving is currently receiving widespread attention in international and Chinese societies, and policymakers are actively promoting the achievement of associated economic and social goals.

By analyzing income equality, this paper is also dedicated to providing a lens through which to rethink the realization of constitutional rights for China's ethnic minorities. The constitutional rights in the economic market are controversial and worth studying [6]. Equal rights protection for ethnic minorities has been developed based on the Chinese Constitution.[7] However, due to factors like the economic level and the complexity of language in minority regions, equal rights protection for ethnic minorities is constantly being reformed in real society. This paper aims to fill the research gap in this field.

Furthermore, this paper echoes the eighth UN Sustainable Development Goal: to ensure that all people can have decent work based on sustainable development [7]. The UN is committed to advancing these goals by 2030, requiring the concerted efforts of all countries and regions. By analyzing China's experience, this paper hopes to provide experiences and lessons for other countries on mechanisms to achieve income equality for ethnic minorities and indigenous peoples.

1.3. Research structure

This paper follows an analytical path to argue the impact on the income equality of ethnic minorities in China due to the digital economy. First, the paper constructs a foundational theoretical framework by analyzing past and present research to explain several significant concepts and relationships. Second, the study examines how the digital economy affects the income equality of ethnic minorities from an economic standpoint. Third, the paper discusses income inequality in the results of its economic analysis. Fourth, this paper presents several concluding remarks about the contribution of the Chinese experience to the same topics in other countries.

2. Theoretical framework

2.1. Digital economy

A unified view must be established to define the digital economy. According to scholars, the digital economy comprises the Internet, IT services, hardware, and software [8]; however, from the perspective of international organizations, there is no unified definition of the digital economy. According to a 2018 International Monetary Fund (IMF) study, the same applies to industries, products, and digital transactions. Although the digital economy would be narrowly defined as a platform economy in some cases, the IMF questions this because any activity in the modern economy that uses digitized data to drive economic development can be called a digital economy. It can also involve all economic activities [9]. At the G20 summit in 2016, it was described as a series of economic activities that use digital knowledge and information as key factors of production, modern information networks as important carriers, and the effective use of information and communication technologies as an important driver of efficiency improvement and economic structural optimization.[8] However, the IMF does not accept the G20's definition.

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[3] See Joint Statement of the People's Republic of China and the French Republic on Jointly Upholding Multilateralism and Improving Global Governance, article 16.

[4] See the 14th Five-year Plan for the Development of Digital Economy ("十四五"数字经济发展规划).

[5] As of January 17, 2023, seven of China's 34 provinces have formulated digital economy promotion regulations: Beijing, Shanxi, Zhejiang, Guangdong, Jiangsu, Hebei, and Henan.

[6] See Action Plan to Enhance Digital Literacy and Skills for All (提升全民数字素养与技能行动纲要).

[7] See the Constitution of the People's Republic of China (Amended in 2018), article 4.

[8] See G20 Digital Economy Development and Cooperation Initiative (G20 数字经济发展与合作倡议).

In China, the definition of digital economy follows the G20 summit. For example, in response to the Chinese government's long-term strategic plan for 2035,[9] provinces have formulated local administrative regulations to promote digital development. In 2021, the Guangdong Province of China promulgated a regulation to develop the digital economy. Economic activity features include data resources as the key production factor. Furthermore, contemporary information networks are essential carriers, and the effective use of information and communication technology is vital for efficiency improvement and economic structure optimization.[10] Furthermore, in Hebei Province, the definition is fundamentally in line with that of G20 countries; however, it differs slightly in the formulation compared to the definition of Guangdong Province.[11] Other provinces face similar situations; thus, the definition presents some basic features of China's legal system. First, the digital economy is developed based on data resources. Second, the digital economy needs to be realized through information network carriers. Although the digital economy has no agreed-upon definition globally, the Chinese definition has been more unanimously accepted among the academic community in China [10]. Consequently, data resources, and information network carriers are vital for quantifying the digital economy. By quantifying the digital economy, scholars have found that it has reduced industrial wastewater emissions and significantly improved China's urban industrial structure [11]. At the same time, haze control benefits significantly from the digital economy [12]. Furthermore, the digital economy positively impacts the industrial structure, research investment, and financial and Internet development [13], and it can support the modernization and transformation of industrial structures [14].

2.2. Income equality of ethnic minorities

2.2.1. Definition

Income equality is an inherent part of civil rights; however, considering the long-standing gap between *de lege lata* (how the law is) and *de lege ferenda* (how the law should be) [15], it is necessary to conduct systematic judicial analyses and sorting of the issue of income equality regarding ethnic minorities. Income equality is the proper interpretation of equal rights for citizens in the Chinese Constitution; however, there is no direct expression of income equality for ethnic minorities in the Chinese Constitution, which instead comprises a basic interpretation of civil rights. Current research by Chinese scholars considers income equality as a concrete translation of article4[12] of the Chinese Constitution. Specifically, income equality requires equal pay for equal work [16]. Moreover, income equality is an inherent right of Chinese citizens' labor rights[13]; however, equality is not absolute, and the right to equality under the Chinese Constitution is divided into formal and substantive equality [17]. "Equal pay for equal work" refers to the principle that employers should pay equal incomes to employees who perform the same work, put in the same amount of labor, and achieve the same labor success.[14] The principle is also recognized in China Labor Law[15]; however, "equal pay for equal work" is sometimes considered a manifestation of equal employment opportunity. For example, in the 1951 Equal Remuneration Convention[16] (No. 100) of the International Labor Organization, "equal pay for equal work" is a reference for equal employment opportunity [18].

The legal theory of the right to equality can be divided into formal equality and substantive equality, which the EU anti-discrimination law can explain [19]. According to the principle of substantive equality, the right to equality recognizes reasonable differences and requires differential treatment based on these differences [20]. Accordingly, the basis for assessing whether the income equality of different groups is realized lies in evaluating whether the differences between different groups are reasonable. Although the Chinese legal system recognizes reasonable differences, there is no explanation of the basis for judging what differences are reasonable. Therefore, as for the concept of "equal pay for equal work", controversy surrounds whether to use the same amount or the same pay standard for incomes.

In an ideal situation, if the work of two different employees is the same, their labor efforts are equal, and the fruits of their labor are the same; thus, the labor remuneration they receive should also be identical. Consequently, in the specific judicial discretion, the legislator recognizes the reasonable value judgment of the adjudicator, as well as the reasonable differences in employment rights. The institutional arrangement considers the different attributes and characteristics of income equality, following the formal and substantive equality principles advocated by Chinese law in general.

The Chinese Constitution has the highest rank among the hierarchy of norms in Chinese law. The Chinese Constitution does not directly define income equality, but China Labor Law confirms it [21]. Moreover, income equality in labor law necessitates a more nuanced interpretation. According to the Chinese Constitution's provisions, its broad interpretation of income equality encompasses

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[9] See Outline of the 14th Five-Year Plan (2021–2025) for National Economic and Social Development and Long-Range Objectives for 2035 (中华人民共和国国民经济和社会发展第十四个五年规划和2035年远景目标纲要).

[10] See Regulations of Guangdong Province on Promoting Digital Economy (广东省数字经济促进条例), Article 2.

[11] See Regulations of Hebei Province on Promoting Digital Economy (河北省数字经济促进条例), article 2. The definition of the digital economy is that it takes data resources as its critical element, modern information networks as its primary carrier, the integrated application of ICT, and an all-factor digital transformation as its vital driving force.

[12] It shows that all ethnic groups in the People's Republic of China are equal.

[13] According to article 42 of the Constitution of the People's Republic of China (Amended in 2018), citizens of the People's Republic of China have the right and duty to work.

[14] See Notice of the General Office of the Ministry of Labor on Promulgation of the Interpretation on Some Articles of the Labor Law (劳动部关于《中华人民共和国劳动法》若干条文的说明), article 46.

[15] See Labour Law of the People's Republic of China (Amended in 2018), article 46.

[16] See Equal Remuneration for Work of Equal Value and Prohibition of Discrimination in Respect of Employment and Occupation.

ethnicity, race, occupation, gender, family origin, property status, religious beliefs, educational level, and length of residence.[17] In contrast, China Labor Law gives a different interpretation, and employees' rights to nondiscrimination are limited to four areas: ethnicity, race, gender, and religious beliefs.[18] This division requires further reflection. In the case law, employees can be discriminated against because of their family origin and education status,[19] which is unreasonable under the Chinese Constitution, and Chinese scholars have subsequently criticized this situation [22]. Moreover, when institutional discrimination conflicts with the principle of equality, the principle of equality should receive preferential status.[20]

2.2.2. Current status

There is little information on the income equality of ethnic minorities in China, and this paper hopes to contribute some valuable perspectives. Some scholars argue that the income equality of ethnic minorities can be transformed into corrective actions to improve their disadvantageous position in employment due to language, culture, and customs [23]. The income equality of ethnic minorities thus inherently includes skewed protection for ethnic minorities. The view has a certain degree of reasonableness. From the current situation, the income level of ethnic minorities still lags behind that of Han Chinese. Indeed, scholars warned put out warnings about this problem many years ago and called to improve the situation [24], but income gaps continue to exist and have for many years. Uncertainty continues to surround the issue, and there remain significant challenges.

In terms of the relationship between the digital economy and legal development, the digital economy has driven changes in law, such as the emergence of computational jurisprudence, which is a typical example; meanwhile, the digital economy has posed challenges to traditional legal theory and practice, such as algorithmic discrimination and the protection of the digital rights of ethnic minorities. In Chinese ethnic minorities, these can be reflected in inadequate policies and legislation. On the one hand, these are due to the shortcomings of China's current digital policies for ethnic minorities. On the other hand, the shortcomings are also a long-standing institutional problem in China's labor protection system.

2.2.2.1. Deficiencies in digital economy policies for ethnic minorities. Chinese digital economy policies for ethnic minorities still lack detailed guidance and actionable programs. Specifically, the Chinese government pushed to improve of employees' digital skills in 2018 through executive directives and encouraged employment increases.[21] In 2021, the Chinese government advocated supporting the development and application of speech technology for minority languages.[22] However, from public sources indicate that among the five autonomous ethnic minority regions in China,[23] by 2022 only the Inner Mongolia Autonomous Region had proposed a training program for professional and technical talents selecting professionals in the field of the digital economy for exchange and study in universities and research institutions in other regions.[24] No targeted digital economy support policies for ethnic minorities exist in other provinces. Their digitalization policies are usually targeted at all local populations and do not consider the characteristics of ethnic minorities; thus s, this is not adequate way to achieve income equality for ethnic minorities in the digital economy.

Furthermore, the income equality of ethnic minorities, especially in low-income groups, is not well realized because the digital economy is still being developed, mainly in international or domestic language patterns. For example, in the computer field, English is the primary programming language, and in China's digital economy, Chinese is the primary language tool. In contrast, ethnic minorities lack a fruitful and universal education on the dominant languages in the digital economy due to their relatively backward economic and technological conditions. For example, according to data published by the Chinese government in 2019, toward towards the end of 2017, the ethnic minority population in Yunnan province was 16,115,300, of which more than 11 million people (approximately 68.26 %) still used the local dialect [25]. Thus, in Yunnan province, most ethnic minorities do not use Chinese. The same situation exists in other ethnic minority regions in China; thus, the language proficiency barrier hinders technology development and leads to backward development.

2.2.2.2. Inadequacies of the legal system for labor protection. In addition to the deficiencies of digital economy policies, another critical reason ethnic minorities cannot achieve income equality in the digital economy is the institutional deficiencies in the protection of Chinese labor. The development of the digital economy has brought employment opportunities, but there are risks to the stability of labor relations [26]. The International Labor Organization believes that the labor legal system must respond to digital labor relations based on traditional labor relations to ensure employees' legitimate rights [27].

In the digital economy, Chinese ethnic minority employees are often limited to jobs with lower technology skill levels and income levels; thus, the difficulty they face in judicial practice is determining the existence of labor relations. In May 2023, the Ministry of Human Resources and Social Security and the Supreme People's Court in China issued some typical court judgments and labor

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[17] See the Constitution of the People's Republic of China (Amended in 2018), article 34.

[18] See Labour Law of the People's Republic of China (Amended in 2018), article 12.

[19] See case law: Zhou Gang v. Sercon Technology (Shenzhen) Co., LTD (广东省深圳市宝安区人民法院民事判决书，（2016）粤0306民初24833号).

[20] Ibid.

[21] See Guideline on Stabilizing and Expanding Employment in the Digital Economy (关于发展数字经济稳定并扩大就业的指导意见).

[22] See Action Plan to Enhance Digital Literacy and Skills for All (提升全民数字素养与技能行动纲要), chapter 3.

[23] These are the Inner Mongolia Autonomous Region, Guangxi Zhuang Autonomous Region, Tibet Autonomous Region, Xinjiang Uygur Autonomous Region, and Ningxia Hui Autonomous Region.

[24] See Notice of the Inner Mongolia Human Resources and Social Security Department on Continuing Education of Professional and Technical Personnel in 2023 (内蒙古自治区人力资源和社会保障厅关于做好2023年全区专业技术人员继续教育有关工作的通知).

arbitration decisions on labor relations disputes concerning the digital economy, including the employment situation involved in network broadcasting, food delivery platforms, and logistics enterprises [28]. These case laws are significant for identifying ethnic minority labor relations in the digital economy. For example, in 2021, a court judgment in Changshu showed that although the agreement between the network broadcast platform and the broadcast personnel combined labor relations and service relation, the platform should compensate the employees following the agreement.[25] Nevertheless, these are only individual cases and lack unified legal norms and regulations, especially for ethnic minorities.

Labor and service relations are two different legal concepts. China Labor Law protects the labor relationship, and the rights and obligations are mainly established by the contract signed between the natural person and the employing unit. The employing unit should manage the employee; however, the service relationship is established based on the Civil Code, and its rights and obligations are determined by mutual agreement. There is no management of activities between the two parties [29]. China Labor Contract Law protects the right of dispatched workers in labor dispatching relationships to a limited extent[26]; however, the courts rarely support the plaintiff's claim in disputes over equal pay for equal work in the service relation in judicial practice. In contrast, although China's Labor Contract Law confirms (to a certain extent) equal pay for equal work in labor relations, the provisions lack judicial interpretation, the provisions lack judicial interpretation. Instead, they are considered more of a principal provision, although they face many disputes in judicial practices.

In Chinese society, legal dispute cases arising from labor relations are mainly concentrated in migrant labor markets [30]; therefore, it is an institutional problem that Chinese society has long since needed to solve. Indeed, the economic level of minority regions is relatively backward, and employees mainly engage in low-skilled jobs such as the takeaway industry and online dating [31]. Employers are more inclined to sign service agreements in these jobs than labor contracts [32]. Consequently, the boundary of labor relations is increasingly blurred, and the regulation of service relations cannot ensure that ethnic minority employees realize income equality.

2.3. The relationship between the digital economy and income equality

2.3.1. Positive relationships

From the literature review perspective, few studies specifically research the link between the digital economy and income equality for ethnic minorities; however, some studies suggest that the digital economy has led to some new jobs, such as the gig economy [33]. The digital economy has also increased employment opportunities for many disadvantaged groups, including women; thus, it also brings more employment opportunities for ethnic minorities and improves their employment situation. Because ethnic minorities are considered vulnerable in the Chinese legal context, they should receive favorable protection. For example, in the Chinese Western Development Strategy, the Chinese central government continuously increased fiscal transfers to ethnic minorities to support their economic development [34]. Therefore, the digital economy has narrowed the income gap between ethnic minorities and Han Chinese and promoted income equality for ethnic minorities.

Furthermore, ethnic minorities are also actively promoting the development of national and regional digital economies. According to the IMF's definition of the digital economy, the future digital economy will involve all forms of the economy [9], which will naturally include all regions. Then, as an essential part of a country and its society, the future digital economy model mentioned by the IMF cannot be realized without the active participation of ethnic minorities. Additionally, provincial governments must include the growth of the digital economy in their economic and social development plans, following China's Data Security Law, which went into effect in 2021.[27] In this context, China's administrative planning contains five autonomous regions for ethnic minorities,[28] meaning that in the future these provinces should also respond to the central government's policies and legal requirements by promoting the digital economy. For example, local governments should actively formulate policies for the digital development of ethnic minorities, and revise measures for the regulation of labor contracts in the context of the digital economy, to help ethnic minorities embrace the development of the digital economy more quickly. As a result, ethnic minorities must experience income equality as the digital economy develops.

2.3.2. Negative relationships

A dialectical relationship exists between the income equality of ethnic minorities and the digital economy. In addition to their positive interrelationship, the two sometimes encounter certain antagonistic relationships.

On one side, digital development may not effectively improve the income equality of ethnic minorities in the current situation. According to the extant literature, ethnic minority employees are limited by their literacy, language ability, and technology skill level; thus, in the digital economy, ethnic minority employees can only work in occupations that do not require high technology skills [31]. As such, ethnic minorities' limited occupational choices constrain the possibility of improving their income levels. Although ethnic minorities can participate in digital development, their employment opportunities and incomes are often affected by their literacy, language ability, and skill levels. Furthermore, as the digital economy relies heavily on intangible assets and data and extensively uses

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[25] Cao v. Hou [Link].
[26] See Labour Contract Law of the People's Republic of China, article 63.
[27] Data Security Law of the People's Republic of China, article 14.
[28] These are the Inner Mongolia Autonomous Region, Guangxi Zhuang Autonomous Region, Tibet Autonomous Region, Xinjiang Uygur Autonomous Region, and Ningxia Hui Autonomous Region.

multifaceted business models, it is difficult to identify jurisdictions where value is created increasing increases the challenge of taxation due to Base Erosion and Profit Shifting (BEPS) [35]. If a digital services tax is introduced, it will increase the tax burden on ethnic minority regions, leading to fiscal shortfalls and a lack of sufficient funds to help ethnic minority people access adequate digital facilities and services. Therefore, many obstacles arise to realizing income equality between ethnic minorities and Han Chinese.

The dilemma of realizing income equality for ethnic minorities can also hinder digital development. The central government of China is pressuring local administrations to advance digital development. Furthermore, although China's autonomous minority regions have yet to implement targeted digital economy development programs for all people, local economic development should rely on the efforts of residents [36]. For example, entrepreneurs from ethnic minorities can actively explore entrepreneurial opportunities in the digital economy, where competition in related fields is not yet fierce and many opportunities exist. This approach could also inspire more people to grow in the development of the digital economy. As a result, the digital development of ethnic minorities must actively promote the participation of ethnic minorities; however, the digital development is demanding in terms of language and technology [37], which does not match the reality of ethnic minority employees. Therefore, the government should conduct information technology poverty alleviation to avoid increasing the poverty of ethnic minorities [37]. The local digital development would be severely hampered if the government cannot achieve income equality in the digital economy.

3. Analysis results based on economic data

This paper discussed the system and judicial practice of "equal pay for equal work" and identified theoretical and practical difficulties. However, income equality for ethnic minorities is a persistent topic to explore. The World Bank shows that Latin American countries (such as Costa Rica) and Roma in Europe have suffered discrimination regarding economic equality and digital access due to gender, region, age and other factors [38]. Furthermore, regarding the relationship between the digital economy and income equality, factors such as education, race, occupation, and age contribute to the digital divide between different castes in India, leading to income inequality [39]. In the Chinese case, the following empirical analysis will be conducted from the economic perspective in conjunction with relevant Chinese databases. Existing studies focus on the digital inclusive finance index, which is limited by the availability of data on relevant dimensions. Few data are constructed from the digital economy input and output dimensions. This paper introduces a novel approach by developing city-level digital economy indicators and integrating them with individual data to investigate whether income equality has been attained among ethnic minorities. On the one hand, this approach enables critical contemplation of how the digital economy has affected society. On the other hand, it facilitates the quantitative explanation of whether China's ethnic minorities' income equality is guaranteed.

3.1. Econometric method

The following regression models are used in this paper to explore how digital development has affected the income equality of racial and ethnic minorities.

$$\log(\text{income}_{ijt}) = \beta_0 + \beta_1 \text{dig}_{jt} + \beta_2 \text{nationality}_{ijt} + \varphi X_{ijt} + \lambda_j + \eta_t + \varepsilon_{ijt} \tag{1}$$

where i indicates an individual, j indicates a province and t indicates the period. In Eq. (1), *income* is the after-tax wage income from all jobs (primary + general) in the past 12 months. After-tax wage income is presented logarithmically to avoid extreme values and other factors. Moreover, *dig* is the digital economy. The ethnicity of respondents is denoted by *nationality*, with *Han* = 1 and *ethnic minority* = 0. Furthermore, λ indicates province-fixed effects; η indicates time-fixed effects; and ε indicates a random disturbance term. The X represents a set of individual control variables, including age (*age*), the age-squared term (*age2*), years of education (*schooling*), marital status (*marital*), health status (*health*), and gender (*gender*). Years of schooling are expressed as schooling, which translates into 0 years for illiterate or semi-literate people, 22 years for doctors, 19 years for masters, 16 years for bachelors, 15 years for specialists, 12 years for senior high school, 9 years for junior high school, and 6 years for elementary school [40]. Marital status is expressed by *marital*; the four states of unmarried, cohabiting, divorced, and widowed are regarded as nonmarital (*nonmarital* = 0 and *marital* = 1). Furthermore, health status is expressed by *health*. Very healthy and healthy statuses are regarded as healthy, i.e., *health* = 1, while average and unhealthy are regarded as non-healthy, i.e., *non-healthy* = 0. Gender is expressed by gender (*male* = 1 and *female* = 0).

Relative to group regressions, including the interaction term allows the direct observation of whether the differences are statistically significant. Therefore, the interaction term between *nationality* and *dig* is introduced to the baseline regression model to examine the income disparity on that gap (see the following regression model).

$$\log(\text{income}_{ijt}) = \beta_0 + \beta_1 \text{dig}_{jt} + \beta_2 \text{nationality}_{ijt} + \beta_3 \text{dig}_{jt} \cdot \text{nationality}_{ijt}$$
$$\varphi X_{ijt} + \lambda_j + \eta_t + \varepsilon_{ijt} \tag{2}$$

In Eq. (2), if the interaction term β_3 coefficient is a key factor, a significant income difference exists between Han Chinese and ethnic minorities, the partial effect of the digital economy on income is d *income/* d *dig* = β_1 + β_3 nationality. Here, β_3 is the moderating effect of the digital economy on the income gap between Han Chinese and ethnic minorities. If $\beta_1 > 0$ and $\beta_3 > 0$, it indicates that the digital development will widen the income gap between Han Chinese and ethnic minorities. If $\beta_1 > 0$ and $\beta_3 < 0$, the wealth difference between Han Chinese and ethnic minorities will narrow as the digital economy develops [41].

4. 2 variable descriptions and data sources

The data utilized in this paper are from publicly accessible sources. , including uses micro-individual-level data from the China Family Panel Studies (CFPS) database, which covers 25 provinces in China from 2010 to 2020 (released every two years). Specifically, CFPS is a household-based tracking survey of the labor force [42]. This paper employed Stata 17 to analyze and remove invalid data, such as missing values in personal data. Subsequently, we longitudinally combined yearly data to obtain a panel dataset with a total sample size of 80,308. The number of Han Chinese in the sample was 74,858, and the number of ethnic minorities was 5450; we excluded individuals who did not give their ethnic status in the studies. Individual control variables were obtained from the CFPS database.

This paper selected five sub-indicators from the input and output dimensions (see the China Statistical Yearbook and provincial statistical yearbooks) to measure the combined level of the digital development, based on the methodologies developed by Yang [43], Jiang [44], and Duan [45]. These sub-indicators include the Internet broadband penetration rate (*Internet*), the telephone penetration rate (*tel*), the length of long-distance fiber optic cable lines (fiber), the Internet broadband access ports (*Inter_access*), and the number of Internet domain names (*N_internet*). This paper used the principal component analysis to calculate the digital economy (*dig*).

This paper utilized principal component analysis to replace indicator groups with specific correlations (e.g., five digital economy indicators) by recombining them into a new set of mutually uncorrelated composite indicators. The most traditional method is to represent the variance of *F1*, the first linear combination chosen, or the first composite indicator; the more information *F1* contains, the bigger the *var (F1)*. The first principle component (*F1*) is referred to as such because it should have the most significant variation across all linear combinations. The information already in F1 need not appear in *F2*, i.e., if *cov(F1, F2)* = 0, then call *F2* the second principal component, and so on, to construct the third, fourth, ……, nth principal component. If the first principal component is insufficient to represent the information of the original n indicators, then the *F2* should be considered, i.e., choosing the second linear combination. This paper used *F2* to construct the digital indicators.

The statistical analysis of the variables is displayed in Table 1. The income from the observed sample shows a large income gap and a small mean value, and digital development varies by region. Table 2 uses the Pearson correlation coefficient to measure the degree of correlation between the variables. Indeed, the digital economy positively correlates with income. Similarly, nationality is also positively correlated with income.

4.1. Regression results

The influence of digital growth on the income equality of Han Chinese and ethnic minorities is investigated in this work using a fixed effects model (FE). Table 3 presents the linear estimation of the digital development on wage income. With year-province FE and no other individual variables controlled, the estimated coefficient of the digital economy (*dig*) is significantly positive in the model (1). Moreover, the coefficient of *nationality* implies that, when holding other factors fixed, Han Chinese earn wages 12.98 % higher than ethnic minorities. The following calculations are performed by calculating the exact percentage difference in expected wages. Holding all other factors fixed, the percentage difference in incomes between Han Chinese and ethnic minorities is

$$(\widehat{income}_{han} - \widehat{income}_{ethnic}) / \widehat{income}_{ethnic}$$

What we have from model (1) is

$$\log(\widehat{income}_{han}) - \log(\widehat{income}_{ethnic}) = 0.1298$$

Table 1
Descriptive statistics of variables.

Variable	Obs	Mean	Std. dev.	Min	Max
income	80,308	24609.490	50762.350	5	10300000
dig	80,308	−0.048	0.774	−1.067	2.723
nationality	80,308	0.932	0.252	0	1
schooling	80,308	6.090	4.309	1	19
age	80,308	44.847	15.369	16	110
marital	80,308	0.807	0.395	0	1
health	80,308	0.476	0.499	0	1
gender	80,308	0.566	0.496	0	1
year	80,308	2013.689	3.435	2010	2020
province	80,308	37.493	14.563	11	65
Internet	80,308	0.1776	0.0911	0.0524	0.4543
tel	80,308	112.4546	31.9579	67.1400	228.0900
fiber	80,308	32006.1500	14780.7900	914.9600	125048.3000
Inter_access	80,308	2069.3940	1785.2140	107.1500	8653.2300
N_internet	80,308	89.2460	119.8635	1.0500	736.3700

Table 2
Pearson correlation analysis.

	income	dig	nationality	schooling	age	age2	marital
income	1						
dig	0.1879*	1					
nationality	0.0297*	0.0797*	1				
schooling	0.2422*	0.1359*	0.0641*	1			
age	−0.1573*	−0.1046*	0.0332*	−0.3333*	1		
age2	−0.1648*	−0.1131*	0.0306*	−0.3176*	0.9840*	1	
marital	−0.0201*	−0.0313*	0.0158*	−0.1437*	0.1953*	0.1130*	1
health	−0.0408*	−0.1969*	−0.0286*	−0.0373*	−0.1883*	−0.1821*	−0.0326*
gender	0.1042*	0.0097*	0.0031	0.0121*	0.0166*	0.0098*	0.0138*
	health	gender					
health	1						
gender	0.0448*	1					

Standard errors are in parentheses; * = p < 0.01.
Correlation coefficient 0.8–1.0 stands for very strong correlation; 0.6–0.8 stands for strong correlation; 0.4–0.6 stands for moderate correlation; 0.2–0.4 stands for weak correlation; 0.0–0.2 stands for very weak correlation or no correlation.

Table 3
Estimates of the impact of the digital economy on income.

Dependent	(1)	(1)	(2)	(2)
Variables	lincome	lincome	lincome	lincome
dig	0.0650***	0.0946***	0.1858***	0.1808***
	(0.0200)	(0.0174)	(0.0353)	(0.0323)
nationality	0.1298***	0.1732***	0.1076***	0.1573***
	(0.0315)	(0.0257)	(0.0303)	(0.0252)
nationality#dig			−0.1247***	−00.0890***
			(0.0298)	(0.0277)
age		0.0628***		0.0628***
		(0.0026)		(0.0026)
age2		−0.0010***		−0.0010***
		(0.0000)		(0.0000)
schooling		0.0747***		0.0747***
		(0.0015)		(0.0015)
marital		0.1970***		0.1979***
		(0.0152)		(0.0152)
health		0.1617***		0.1614***
		(0.0110)		(0.0110)
gender		0.6445***		0.6445***
		(0.0106)		(0.0106)
Constant	8.6059***	7.1207***	8.6307***	7.1383***
	(0.0326)	(0.0613)	(0.0315)	(0.0613)
year fixed effects	yes	yes	yes	yes
province fixed effects	yes	yes	yes	yes
Observations	80,308	80,308	80,308	80,308
R-squared	0.264	0.479	0.264	0.479

Robust standard errors are in parentheses; *** = p < 0.01, ** = p < 0.05, and * = p < 0.1.

Exponentiating and subtracting 1 gives

$$(inc\widehat{o}me_{han} - inc\widehat{o}me_{ethnic}) / inc\widehat{o}me_{ethnic} = \exp(0.1298) - 1 \approx 0.1386 \tag{3}$$

In Eq. (3), the more accurate estimate implies that the income of a Han Chinese is approximately 13.86 % higher than that of an ethnic minority [46]. A log-linear model of income development provides a precise assessment of the income's contribution. The coefficients estimated by the formula alone may include the impact of other factors on income, thus potentially overestimating the impact of the digital economy. Therefore, the model is extended by adding a series of control variables to obtain "unbiased" and "consistent" estimates. In the model (1), with the addition of individual control variables, the digital economy (*dig*) is projected to have a positive coefficient. The development of the digital economy still has a significant positive impact on the income increase, increasing income by 9.46 %. A Han Chinese worker's income is approximately 18.91 % higher than that of an ethnic minority. Incomes and age have an inverted U-shaped connection. When holding all other factors fixed, the incomes reach their highest value at age 31 and gradually decline.

The interaction term in model (2), which has controls for year-province FE but no other individual control variables; its coefficient is considerably negative The bias effect of the digital economy on income is d *income/*d *dig* $= \beta_1 + \beta_3$ *nationality*$=0.0695$, which agrees with model (1)'s conclusion that digital growth may significantly increase income. Here, the Han Chinese majority has an income 11.36 % higher than ethnic minorities.

The expansion of the digital economy narrows the income gap, as shown by the coefficient of the interaction term in model (2). The biased effect of the digital economy on income is d *income/* d *dig* $= \beta_1 + \beta_3$ *nationality*$= 0.0979$. Furthermore, the digital development can increase the wage income. The coefficient of *nationality* is then 0.1573, and the income of Han Chinese is 17.03 % higher than that of ethnic minorities, which is lower than the value of 18.91 % in model (1). Consequently, digital development helps to promote the reduction of the income gap and the realization of income equality for ethnic minorities. When all other factors are fixed, income achieves its highest value at age 31 before gradually declining.

The estimated coefficients of the individual control variables in models (1) and (2)indicate that individual control variables, including years of schooling, marital status, and health status, significantly affect income.

4.2. Heterogeneity analysis results

4.2.1. Male and female

The sample data is divided into males and females for grouped regressions (Table 4). In the male group, the digital economy significantly increases income; however, the interaction term between ethnicity and the digital economy is negative but insignificant, indicating that the digital moderating effect is also insignificant. Male Han Chinese earn 15.87 % more than ethnic minorities, 17.03 % lower than the overall sample. In the female group, the digital economy can significantly increase income. Indeed, the coefficient of the interaction term between *nationality* and *dig* is significantly negative, suggesting that the income difference between female Han Chinese and ethnic minorities narrows. This finding is consistent with Vyas. [33], who stated that the digital economy brings more employment opportunities for females, thus reducing the income gap among females. If all other factors are fixed, female Han Chinese earn 18.91 % more than ethnic minorities, which is higher than the overall sample level. Thus, a noticeable disparity exists in income between female Han Chinese and ethnic minorities.

4.2.2. Income level

For grouped regressions, the data are separated into low-, middle-, and high-income groups (Table 5). The interaction term coefficient is significantly positive in the low-income group but negative in the digital economy, suggesting digital economy development will adversely affect income growth, widening the economic gap. In the middle-income group, the coefficient of the interaction term is negative, but the coefficient of the digital economy is significantly positive. Therefore, developing the digital economy helps increase income while reducing the income gap. In the high-income group, the moderating effect is insignificant, and no significant income gap exists.

4.2.3. Education

The sample data are regressed by education (Table 6). The coefficient of the interaction term is significantly negative only for individuals with a senior high school education or less. Han Chinese and ethnic minorities differ significantly under the same conditions. Han Chinese have an income 15.22 % higher than ethnic minorities; therefore, digital development can reduce the income gap. In the undergraduate and graduate groups, the coefficient of nationality is insignificant, and no significant income gap is found. Accordingly, the income difference is particularly noticeable in the low-education category.

5. Discussion of the impact of income equality in the results of the analysis

This paper examines the impacts of the digital economy on the income equality of ethnic minorities using the CFPS database and the China Statistical Yearbook for 2010–2020 using an FE model. Due to data limitations, this paper does not analyze the types of jobs the population holds. Regarding indicators, this paper only uses one measure for the digital economy; therefore, a more comprehensive digital economy level indicator could be constructed based on other data. At the same time, a deeper analysis could be conducted by matching individual-level data of different occupations. After a comprehensive empirical analysis, this paper finds comprehensive aspects of the digital economy on the income equality of ethnic minorities.

5.1. Dual impacts

Regarding its positive impacts, this paper's baseline regression uses an FE model and controls for year-province FE and other control variables. The study finds that digital development is conducive to a higher income. This finding aligns with Ye, Chen and Li [47], who indicated that the fintech index's development has effectively reduced poverty in the provinces of China. Nevertheless, we also conclude that individual control variables significantly affect this income, including education, marital status, and health. For example, minorities who get a better education would also have higher income levels than those who do not, all other variables being equal. Second, after further introducing the interaction term of digital economy and ethnicity, developing the digital economy can reduce the income gap [48]. Therefore, whether ethnic minorities or not, individuals can benefit from the development of the digital economy, suggesting that the digital economy positively impacts the first two of three variables: gender, education, and income. Again, through a heterogeneity analysis, this paper finds that the digital economy's development helps narrow the income gap among women

Table 4
FE Empirical results-gender.

Dependent	male	female
Variables	lincome	lincome
dig	0.1415***	0.2445***
	(0.0410)	(0.0521)
nationality	0.1473***	0.1732***
	(0.0333)	(0.0383)
nationality# dig	−0.0312	−0.1790***
	(0.0353)	(0.0447)
Constant	7.6082***	7.3914***
	(0.0806)	(0.0940)
individual control variables	yes	yes
year fixed effects	yes	yes
province fixed effects	yes	yes
Observations	45,424	34,884
R-squared	0.445	0.482

Robust standard errors are in parentheses; *** = p < 0.01, ** = p < 0.05, and * = p < 0.1.

Table 5
FE Empirical results-income level.

Dependent	Low-income	Middle-income	High-income
Variables	lincome	lincome	lincome
dig	−0.3392***	0.0517**	−0.0290
	(0.1026)	(0.0212)	(0.0222)
nationality	0.3080***	0.0172	0.0019
	(0.0545)	(0.0129)	(0.0159)
nationality#dig	0.1965**	−0.0284*	0.0122
	(0.0859)	(0.0171)	(0.0190)
Constant	6.8448***	9.0214***	10.0127***
	(0.1038)	(0.0297)	(0.0383)
individual control variables	yes	yes	yes
year fixed effects	yes	yes	yes
province fixed effects	yes	yes	yes
Observations	19,877	32,105	28,326
R-squared	0.298	0.128	0.212

Robust standard errors are in parentheses; *** = p < 0.01, ** = p < 0.05, and * = p < 0.1.

Table 6
FE Empirical results-education.

Dependent	senior high school and below	undergraduate school	graduate school
Variables	lincome	lincome	lincome
dig	0.1603***	0.0938	−0.2789
	(0.0326)	(0.1147)	(0.5433)
nationality	0.1417***	−0.0236	−0.0565
	(0.0253)	(0.0680)	(0.2301)
nationality#dig	−0.1084***	0.0522	0.2981
	(0.0275)	(0.1084)	(0.4572)
Constant	6.9289***	7.1771***	10.4492***
	(0.0611)	(0.1872)	(2.3518)
individual control variables	yes	yes	
year fixed effects	yes	yes	yes
province fixed effects	yes	yes	yes
Observations	73,714	4973	1621
R-squared	0.459	0.352	0.739

Robust standard errors in parentheses; *** = p < 0.01, ** = p < 0.05, and * = p < 0.1.

and individuals with low-education levels. Therefore, the empirical analysis shows that digital development helps to increase the income level overall and narrow the income gap for vulnerable communities among ethnic minorities. Digital development is thus essential to realize the income equality of ethnic minorities.

Regarding its adverse effects, the baseline regression finds that although the digital economy can increase employees' income, a significant income gap remains [49,50]. Furthermore, the heterogeneity analysis finds that the digital economy exacerbates in low-income groups. Uneven development in the digital financial market remains apparent, as various population segments lack access to equivalent digital services [49]. It means that the digital economy positively affects income; thus, if an individual in a low-income group of minorities can quickly integrate into the digital economy, then the income growth will be significant. Conversely, if an individual is in a middle-income or high-income group, the income growth from the digital economy is relatively insignificant compared to a low-income group. The analysis results are theoretically plausible since control variables are as comprehensive as possible in the economic model analysis and include year-province FE. Then, going back to the concept of "equal pay for equal work," the government should adopt a consistent pay standard. For example, the pay amount should remain when employees have the same technical skills and labor proficiency and are under the same workload and work results. Moreover, in the economic model analysis, the pay difference in the low-income group widens if other factors are fixed. As a result, the income equality of low-income groups needs to be better realized in the digital economy.

5.2. Policy suggestions

5.2.1. Language improvement measures and tax incentives

The Chinese government advocates digital technology to improve the development and application of speech technology for minority languages; however, the results show that no universally applicable intelligent tools for ethnic minority languages have emerged in Chinese society. Therefore, the Chinese government should implement skewed protection policies to achieve income equality for ethnic minorities in the digital economy.

Specifically, the Chinese government can carry out a specific support program for digital language tools for ethnic minorities and provide tax incentives concerning such a program. The Chinese government,[29] however, has failed to mention tax incentives regarding to the digital development of ethnic minorities. Indeed, ethnic minorities can also benefit from such policies; however, the policy does not consider the characteristics of ethnic minority employees and entrepreneurs, nor does it effectively protect the concept of equal employment rights for ethnic minorities. Therefore, China's digital economy policies for ethnic minorities must continuously improve to guarantee income equality. Such improvements include special programs and tax incentives for language training and technology development and implementing the principle of substantive equality therein. In terms of procedure, given the complexity of the normative hierarchy in Chinese law and the speedy implementation of the measures, tax incentives can first be used by local governments to explore innovative tax policies within the existing legal framework; then, at the appropriate time, the legislature can be asked to improve the taxation legal system.

Furthermore, while developing the digital economy, Chinese tax incentives for language improvement for ethnic minorities must be explored based on the tax complexity in China, which can be analyzed from two perspectives. First, from the perspective of the traditional tax system, the Chinese tax complexity lies in the fact that there are as many as 18 types of taxes and some inconsistencies in the tax system in different local provinces [51]. Furthermore, On September 1, 2022, China started implementing the BEPS Convention [52]. Currently, China is significantly adjusting its tax system to meet the requirements related to BEPS. Uncertainty remains concerning the impact of these tax adjustments on Chinese tax incentives for ethnic minorities; therefore, the Chinese government can explore tax rebate policies for the digital economy of ethnic minorities within the framework of existing tax incentives. Second, in terms of the development of the digital economy, Chinese society is in the midst of a massive controversy over the taxation of digital services, which increases the complexity of Chinese digital taxation policy [53]. However, in the long run, the development of the Chinese digital economy has become a national strategy, and the introduction of digital service tax is very likely to happen. Considering the challenges faced by ethnic minorities in digital services, China could take the lead and start exploring preferential and rebate policies for digital services tax in ethnic minority areas. This approach can help cope with the complexity of digital services tax in the future.

5.2.2. Revisions of the Labor Contract Law, judicial interpretation and the constitution

The Labor Contract Law's amendment in 2012 added limited protection for employees' right to "equal pay for equal work" in service relations. Although it is still a principal provision, its application has many difficulties in judicial practices. Indeed, China's labor protection legal system is still progressing in realizing equal employment rights. Moreover, 10 years have passed since this legal revision, in which the Internet economy has profoundly affected human society in China and other countries worldwide. Digital development has brought about many new employment and labor relations (e.g., E-hailing and webcasting). In contrast, the current Chinese Labor Contract Law has yet to respond promptly to the changes in the everyday life of society. Therefore, in terms of procedure, Chinese lawmakers must promptly revise the Labor Contract Law to better respond to workers' income equality in the digital economy; then, lawmakers would need to develop detailed judicial interpretations to remedy ambiguities in the application of the law.

In this dimension, China may be able to learn dialectically from the EU's DSMS. The EU is a typical multi-market integrator among

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[29] See Guidelines on Tax and Fee Preference Policies for Digital Economy (数字经济税费优惠政策指引).

the major global players in the digital economy. Despite significant differences in language, legal culture, etc. among its 28 Member States, the EU is committed to removing virtual borders in the EU digital economy market through the DSMS. This situation shares the similar issues and goals that China's Han Chinese and 55 ethnic minorities face developing its digital economy. The EU protects all citizens of the EU with non-discriminatory access to digital services and a fair, competitive market environment through the Digital Services Act and Digital Markets Act [54]. Since China currently lacks unified digital legislation, the Chinese lawmakers can try first to amend the Chinese Labor Contract Law to reflect the relevant elements of the digital economy, as well as to formulate a unified regulation on building the digital economy to ensure access to a wide range of digital rights for ethnic minorities on a broader scale. After that, China can provide a more operational judicial interpretation of the equal employment rights of ethnic minorities in the digital economy to realize the concept of equal pay for equal work.

Chinese lawmakers can also make plans to gradually revise the Chinese Constitution to confirm the digital rights of employees in the digital economy. The Constitution is relatively stable and is not frequently amended [55]; therefore, when the rights protection of employees from ethnic minorities in the digital economy has presented a clear legal relationship, the amendment of the Constitution can become possible. Thus, the Chinese government must also dialectically examine the EU's measures. The EU's legislation is aimed at different Member States, while the Chinese legislation should focus on the internal regional governance of a unified country, which is a fundamental difference. Therefore, the hope remains that China will be able to more efficiently promote the rights and protection of ethnic minorities in the digital economy at the constitutional level.

6. Concluding remarks

This paper combines economic and juridical analysis with doctrinal and textual analysis to examine the income equality of ethnic minorities in China. The results indicate that even though the digital economy has been widely recognized by countries worldwide, including China, the income equality of ethnic minorities has not been adequately guaranteed despite current economic developments. This failure is due to the specificity of ethnic minorities in the economic, linguistic, and technological fields and the state's and society's institutional inadequacies in labor protection. Legislators and policymakers should objectively view the positive and negative aspects of the digital economy based on the principle of substantive equality. They should address problems that currently exist (or could potentially exist) in the digital economy labor market for ethnic minorities by adopting more equitable measures so that ethnic minority workers can participate equally in digital development. The UN's sustainability goals can only be achieved if China and other countries work together to guarantee the equal participation and employment rights of ethnic minorities or indigenous peoples.

This paper also serves as a reference for the income equality of indigenous and ethnic minorities in digital growth by providing a Chinese perspective. Accordingly, China and other countries should dialectically view the digital economy and consider more supportive measures for ethnic minorities' protection based on substantive equality.

6.1. Dialectical view of the digital economy on ethnic minorities

A dialectical view of the digital economy on ethnic minorities is fundamental to achieving sustainable economic and social development. Chinese society and other countries are aggressively developing and investing in the digital industries. Inequalities between developed and developing countries will become increasingly severe in this context. Even within the same society, the digital divide also leads to inequalities between different groups. Although the digital economy brings new employment opportunities, it is questionable whether different social groups can enjoy equal social benefits from the digital economy. In the case of Chinese ethnic minorities, the problem of "equal pay for equal work" has not been solved in the digital economy due to differences in ethnic minorities' language abilities and technology skill levels. Conversely, the problem may become increasingly severe. For low-income groups in particular, such disparities may become more pronounced. The Chinese government has long since advocated for "common prosperity,"[30] a policy for all groups in Chinese society, including ethnic minorities. Therefore, this goal should also be pursued in the digital economy. It can be advised that China can learn dialectically from the EU's DSMS to improve the fair digital economic competitive environment for ethnic minorities and provide non-discriminatory digital labor rights protection; however, blind development will only lead to more severe problems of social equality. Therefore, the international community should remain rational about developing the digital economy.

When determining what attitudes minorities or indigenous populations in other countries should adopt when facing the digital economy, it should be remembered that actions speak louder than words. Although Chinese society also faces the problem of income inequality of ethnic minorities, the participation of ethnic minorities should be supported by financial support and more targeted measures. The Chinese government's long-standing "Western Development Strategy," regional autonomy for ethnic minorities, and infrastructure development, including the Qinghai–Tibet Railway, prove its substantial economic investment in developing ethnic minorities. In Chinese society and other countries, ethnic minorities face problems with language and technological competence in economic development, and their backwardness has slowed their technological development to the dominant language model of the digital economy; however, the situation largely depends on technological advances in the digital economy. For example, Google Translator and Youdao Translator are tools for developing complex language systems in the technological age; however, no widely used system of ethnic minorities' language tools exists in China. The same situation also exists in other countries. For example, there

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[30] See Resolution of the Fifth Session of the 13th National People's Congress on the Report on the Work of the Government (第十三届全国人民代表大会第五次会议关于政府工作报告的决议).

are 26 languages in Pakistan, but the government neglects the minority and indigenous languages, and no tools exist to resolve the issue [56]. The importance of this issue lies in the fact that only when ethnic minorities are familiar with the mainstream language of the digital economy can they genuinely participate in the employment system. Therefore, other countries should have pragmatic attitudes.to tackle the institutional obstacles that prevent hiring ethnic minorities and the connection between economic growth and income equality as they work for digital development.

6.2. Measures to realize income equality for ethnic minorities

Other countries should focus on achieving income equality for ethnic minorities when expanding the digital economy, according to China's experience. Legislators and policymakers should create pertinent measures to safeguard the income equality of ethnic minorities in the two elements discussed in China and other nations as the digital economy develops.

First, countries should balance efficiency and equity when formulating digital economy policies. This paper explained that all countries and areas should be rational; however, countries should also take more specific policies concerning the digital economy. For example, the government can provide tax incentives to ethnic minorities for employment and entrepreneurship to ensure that ethnic minorities have equal opportunities to participate in digital development. In particular, local governments can explore the implementation mechanisms of digital services tax to increase the revenue of minority or indigenous groups to help them obtain more resources to improve their digital skills, language skills, etc. Furthermore, the government can also provide targeted digital technology skills training in minority regions and bring in professionals to provide academic support.

Second, the current system of equal employment rights protection for employees should be improved. As the situation in China shows, the labor and service relationship reflects the complex and diversified employment structures in the labor market. This issue is essential in every country or region when attempting to guarantee workers' right to "equal pay for equal work" in different employment structures. Furthermore, legislators and policymakers should update their legal systems for labor protection in response to the digital market and the emerging types of occupations to avoid policies and laws lagging behind the development of the times. Legal reforms can help minorities avoid institutional discrimination in the face of the digital economy and thus gain economic equality. If so, appeals from some international organizations like the International Labor Organization can be answered in the development of the digital economy.

Ethics declarations

This study did not need an ethics committee's review and/or approval because permission was acquired to gather the raw data.

CRediT authorship contribution statement

Kailiang Ma: Writing - review & editing, Writing - original draft, Validation, Methodology, Formal analysis, Conceptualization. **He Zhang:** Writing - review & editing, Writing - original draft, Validation, Software, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors disclosed no relevant relationships.

The study's data has not yet been deposited into a publicly available repository. However, the data supporting the findings are accessible upon reasonable request from the corresponding author.

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