Article

Calculation and Cause Analysis of Hidden Unemployment—A Case Study of the Northeast State-Owned Forest Areas in China

Chen Wang [1], Juanjuan Cao [2,3,*] and Jing Wen [4,*]

1   School of Economics and Resource Management, Beijing Normal University, Beijing 100875, China
2   Commercial College, Shanghai DianJi University, Shanghai 201306, China
3   Beijing Key Laboratory of Study on Sci-Tech Strategy for Urban Green Development, School of Economics and Resource Management, Beijing Normal University, Beijing 100875, China
4   School of Applied Economics, Renmin University of China, Beijing 100872, China
*   Correspondence: lillia04.c@outlook.com (J.C.); 2018000394@ruc.edu.cn (J.W.)

Abstract: The Northeast State-owned Forest Areas comprise the largest region of resources in China. The transformation of the Northeast State-owned Forest Areas is due to various stimuli, such as policies, systems, and markets. In the context of ecological construction and the reform of the state-owned forest system in Northeast China, these have undergone a transformation in terms of economy, society, and ecology. However, a mismatch persists between employment and industrial structures, leading to hidden unemployment. This study employs the framework of hidden unemployment theory, utilizing the Cobb–Douglas production function to quantify the hidden unemployment rate, revealing the relationship between transformation and hidden unemployment. Through this analysis, the underlying causes of hidden unemployment in Northeast China's state-owned forest regions are scrutinized. There is a bidirectional causal relationship between ecological transformation and hidden unemployment, while there is a unidirectional causal relationship between economic transformation and hidden unemployment. Variance decomposition analysis highlights the substantial contribution of social transformation, followed by economic transformation, with ecological transformation playing a comparatively smaller role. Based on the above research, this article proposes expediting the reforms within the forest industry groups, facilitating the separation of governmental and corporate interests. Additionally, it advocates for strategic forestry development planning to effectively absorb surplus labor, and proposes three policy directives aimed at supporting forest area employees, including provisions for job transfers and reemployment opportunities.

Keywords: Northeast State-owned Forest Areas; forestry groups; hidden unemployment; production functions; transformation

1. Introduction

The Northeast State-owned Forest Areas, comprising China's largest forest ecological functional zone, are essential for ecological preservation and sustainable economic development [1,2]. This region has suffered economic, social, and ecological catastrophes as a result of the extended and intensive exploitation of forest resources [3,4]. The government has thus implemented the Natural Forest Resources Protection Project, which involves the protection of ecological functional areas [5]; a complete ban on commercial logging of natural forests; and the "Reform Plan of State-owned Forest Farm" and "Guiding Opinions on Reform of State-owned Forest Region" [6–8]. These initiatives aim to facilitate the transformation of the forest region [9]. Ecological policies mainly affect the environmental and economic features of the Northeast State-owned Forest Areas, while the literature on forest system reform mostly discuss changes at the forest system level [2,10]. Therefore, the Northeast State-owned Forest Areas have undergone economic, social, and ecological shifts [11]. However, in this transition, a discrepancy arose between the employment structure and industrial structure [12,13]. Additionally, the nature of the employment system in

the Northeast State-owned Forest Areas generates a surplus of laborers [12,14], giving rise to "hidden unemployment".

Forest industry groups form against the background of a traditional planned economy system. Their special management system ensures that forest workers can be fully employed without unemployment, disproving the theory that labor is a commodity. Consequently, there exists no labor market or unemployment insurance system within these groups. However, with economic, social, and ecological reforms, the efficiency of labor from both internal and external sources has prompted us to reconsider the issue of unemployment among forestry workers. Forest industry groups gradually divest government functions through institutional reform and transform into enterprises, aiming to solve the internal surplus labor and redistribution problems through market mechanisms. However, this process has become challenging due to the imperfect labor market and incomplete unemployment insurance system. Moreover, the dearth of research on hidden unemployment in the Northeast State-owned Forest Areas exacerbates this issue. Thus, it has become imperative to quantify the extent of hidden unemployment in these regions to facilitate a deeper analysis of its causes and ramifications. Therefore, enhancing the unemployment insurance system has emerged as a vital strategy to mitigate hidden unemployment in the Northeast State-owned Forest Areas. Such measures would provide a safety net for transitioning individuals affected by hidden unemployment, fostering a more sustainable workforce within these regions.

Labor demand and hidden unemployment in the Northeast State-owned Forest Areas are vital indicators of future workforce reallocation. Investigating the root causes and repercussions of hidden unemployment in these regions would lay the groundwork for targeted development strategies in subsequent phases of forest area advancement. This study utilizes forestry statistics, primarily sourced from the China Forestry and Grassland Statistical Yearbook, alongside data from the "Northeast State-owned Forest Region Reform Monitoring" project, to calculate and analyze hidden unemployment in the Northeast State-owned Forest Areas. Incorporating labor heterogeneity components enhances the accuracy of these estimates. By examining the causal relationships between economic, social, and ecological changes and analyzing the factors contributing to hidden unemployment, this study predicts the impact of economic, social, and ecological transformations on hidden unemployment. Such insights offer valuable guidance for addressing hidden unemployment challenges in these areas during later development.

This paper makes several potential contributions. (1) Integration of supply–demand theory and dual-economy structure: Hidden unemployment in the Northeast State-owned Forest Areas is examined using supply–demand theory and a dual-economy structure. This statement highlights that, amid the increasing intensity of natural forest protection measures, the primary causes and mechanisms of hidden unemployment are rooted in the mismatch between the current industrial and employment structures, as well as the nature of the employment mechanism. (2) Analysis of labor force heterogeneity: This research examines labor force heterogeneity using data from the China Forestry and Grassland Statistical Yearbook and the "Northeast State-owned Forest Region Reform Monitoring" project launched collaboratively by the State Forestry and Grassland Bureau and the Northeast Forestry University. Heterogeneity analysis enhances the precision of measuring the hidden unemployment rate and offers a greater understanding of the current state of hidden unemployment in the Northeast State-owned Forest Areas (3) Exploration of transformation impact: This research explores the underlying factors of hidden unemployment and estimates the factors that might lead to later transformation in the Northeast State-owned Forest Areas, which contributes to our understanding of how economic, social, and ecological transformation factors impact hidden unemployment and reassign the surplus labor in the Northeast State-owned Forest Areas. The Northeast State-owned Forest Areas are typical resource areas, and their development thus depends on the resources they offer. Furthermore, the hidden unemployment in these areas is stimulated by ecological policies (projects) and institutional reforms, which will not only affect the social stability of forest

areas and hinder their economic development but also indirectly affect the protection and development of forest resources. The study of hidden unemployment in the Northeast State-owned Forest Areas is not only conducive to improving social stability and people's livelihoods in forest areas but also provides a basis for the protection of forest resources in the Northeast State-owned Forest Areas. Although this study was carried out in the context of China's forest reform, it can provide a broader understanding of and impact on the economics of population, resources, and the environment. Insights gleaned from this study can inform global efforts to address hidden unemployment, particularly in regions undergoing ecological and resource transitions, such as those in Africa and South America. These areas face similar challenges of resource depletion and livelihood insecurity, making the findings and lessons learned herein valuable for devising solutions to hidden unemployment worldwide.

2. Literature Review

In 1936, the British economist Robinson defined hidden unemployment as skilled professionals taking on nontechnical tasks to make a living during the Great Depression. Here, marginal productivity is lower than potential productivity [15]. Subsequently, the American economist Lewis extended this concept to describe a labor force with zero (negative) marginal productivity in the traditional agricultural sector of developing countries [16]. The research scope of hidden unemployment has evolved from agriculture [17,18] to industry [19–21] as economic changes altered the industrial and labor market structures, being influenced by shifting consumer preferences and technological innovation [22,23], resulting in the emergence of "surplus" labor [19]. Research suggests that there is a direct relationship between the amount of economic growth and the development of the labor market, specifically in terms of labor demand. Regions or nations with higher levels of economic development tend to have lower rates of hidden unemployment. Early studies on hidden unemployment mostly focused on determining how it happens and measuring it.

Agriculture is the first sector to be impacted and undergo economic transformation with economic development. Changes in the industrial structure alter the position of farmers in the labor market [17]. However, the released labor force often fails to secure alternative nonagricultural jobs that match its skill set [24,25], giving rise to hidden unemployment [26]. Hidden unemployment in agriculture can be categorized into five groups [15]: (1) Low nutritional and health levels: this category describes unrealized potential output per worker due to the low nutritional and health levels of the labor force [17,27,28]. (2) Insufficient motivation of cultivators: in this category, there is a low level of output per labor input due to the insufficient motivation of cultivators to maximize productivity [29]. (3) Low willingness to prioritize material income: this category highlights situations where a low willingness to prioritize material income over leisure results in a much lower labor supply than the full employment potential [29,30]. (4) Underutilization of factors: in cases of relatively fixed factor ratios, the supply of some factors exceeds demand, leading to their underutilization and subsequent unemployment [18,28,31,32]. (5) Highly seasonal agricultural patterns: this category involves highly seasonal agricultural patterns, leading to periods of labor being unused for months [17,33].

Presently, the research on hidden unemployment predominantly concentrates on traditional agriculture, with limited attention given to the forestry sector, particularly in the case of the Northeast State-owned Forest Areas. Building upon this gap, in this study, we aimed to analyze hidden unemployment in the Northeast State-owned Forest Areas, emphasizing labor productivity. The approach employed utilizes the Cobb–Douglas production function method for accurate calculations. Given that the transformation of the Northeast State-owned Forest Areas is an enduring and evolving process with changing focal points, a comprehensive exploration of its causes and contributions to transformation offers a theoretical foundation [34,35]. This foundation is essential for addressing hidden unemployment during different phases of transformation, with a focus on the later stages of development in the Northeast State-owned Forest Areas

## 3. Theoretical Analysis Framework and Research Strategy

3.1. Theoretical Analysis Framework

The administrative entities overseeing the Northeast State-owned Forest Areas in China consist of five forest industry groups: the Inner Mongolia Forest Industry Group, the Jilin Forest Industry Group, the Changbai Mountain Forest Industry Group, the Longjiang Forest Industry Group, and the Greater Khingan Mountains Forest Industry Group. These groups possess characteristics intrinsic to both government and enterprise entities. Functioning as "protectors of national forest resources", "managers of state-owned enterprises", and "administrative overseers for local government" [1], forest industry groups bear both social and enterprise responsibilities [3,6–8,10,36,37]. In their role as "the manager of state-owned enterprises", forest industry groups optimally utilize existing capital investments and labor inputs to maximize enterprise utility. Simultaneously, as enterprises, they consider labor costs. The economic development of a forest industry group, as an enterprise unit, hinges on forestry resources. Therefore, the introduction of a series of ecological protection policies aims at promoting the Northeast State-owned Forest Areas transformation, and unveiling the mechanism behind the formation of hidden unemployment during the transitional period.

As an enterprise unit, a forest industry group relies on forestry resources for economic development. Therefore, when a series of ecological protection policies are introduced, it promotes its transformation, causing the gradual decline of the resource industry. This has significantly impacted the production and life of forest workers and generated a large number of "surplus" personnel. These "surplus" personnel are partly due to the asset restructuring and downsizing of the forest industry group and to the closure of related enterprises due to the shrinkage of the forest industry group, which is consistent with the emergence of surplus personnel in the first category of enterprises. However, due to the nature of the work of the forest industry group, personnel adjustments cannot be made according to market demand, resulting in surplus labor force. This article combines the research of domestic and foreign scholars on hidden unemployment (mainly referring to Felices, 2003), the study of "surplus" personnel in enterprises, and the special situation of the research object, the forest industry group. Hidden unemployment is defined in this article as follows: The forest industry group has undergone transformation in the face of policy implementation and institutional changes but fails to fully utilize the labor force it employed during the transformation process. A phenomenon where the actual demand for labor is smaller than the number of hired workers has emerged, and hidden unemployment is understood as a phased product caused by the institutional changes and transitional development of the Northeast State-owned Forest Areas.

Based on the definition of hidden unemployment and the evolution of the forestry industry in the Northeast State-owned Forest Areas, we established the theoretical framework depicted in Figure 1. The forestry industry structure and forestry employment structure of the Northeast State-owned Forest Areas have undergone changes with the implementation of ecological policies (projects) such as comprehensive logging cessation, and hidden unemployment is seen as a result of the collision and uncoordinated development of these two subsystems. The sustainable development of forest economy must be based on the coordinated development of the forestry industry structure and forestry employment structure. In the process of forest transformation, the forestry industry structure changes first, and the forestry employment structure will then change according to the adjustment of the forestry industry structure, resulting in some surplus personnel. Under the dual effects of forest area transformation and the implementation of forestry ecological protection policies, the forestry industry structure of the forest industry group undergoes changes, which are then transmitted to the three forestry industries. This is reflected, to a certain extent, in the development of the primary forestry industry, which will absorb a small amount of labor force [34,35]. The primary forestry industry is mainly focused on forestry planting and nurturing. The implementation of ecological policies, including comprehensive logging cessation projects, spurs the growth of the primary forestry industry and heightens labor

demand, albeit imposing a greater burden on the sector. However, the primary forestry industry is not a labor-intensive industry; so, the absorption of labor is limited. The development of the secondary forestry industry is suppressed, which, in turn, leads to the release of a significant portion of the labor force. The secondary forestry industry mainly focuses on forest logging and related manufacturing and processing, and it is a labor-intensive industry with a large number of laborers; the implementation of the comprehensive logging cessation policy has greatly curbed the development of the secondary forestry industry, thus releasing a large amount of the labor force. The tertiary forestry industry has developed rapidly due to an increasing emphasis on the ecological environment, especially on forest tourism, forest health, and understory planting. Correspondingly, as the leading industry, the tertiary forestry industry will absorb a large amount of labor. During this process, the structure of the forestry industry undergoes rapid changes, while the employment structure of the forestry industry does not. In the secondary forestry industry, manufacturing, as the leading industry in the forest industry group, generates a large number of "surplus" personnel, i.e., hidden unemployment. As forest reforms expand and the forestry industry transforms, hidden unemployment is expected to initially rise and then decline [38]. The specific process is shown in Figure 1.
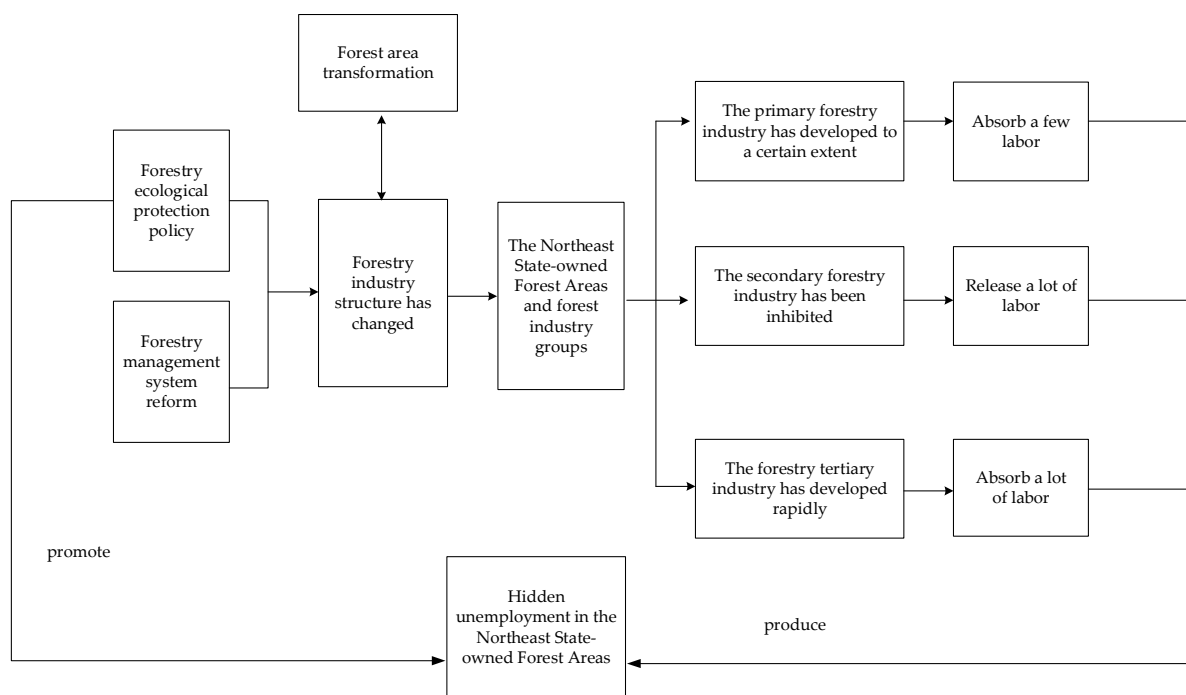
Figure 1. Formation mechanism of hidden unemployment in the Northeast State-owned Forest Areas.

3.2. Research Methods

This article explores the repercussions of ecological policies, engineering initiatives, and institutional reforms on the forest industry groups of the Northeast State-owned Forest Areas. Through the assessment of hidden unemployment, we formulate rational employment strategies for forest workers with the aim of fostering sustainable development in the region. On the basis of existing theoretical research, in this study, we initially scrutinize the impact mechanism of ecological policies on forest industry group employment, proposing relevant research hypotheses. Subsequently, employing the Cobb–Douglas production function method with available data, we calculate the number of hidden unemployed individuals and the hidden unemployment rate. Moreover, recognizing the multifaceted stimuli driving the transformation of the Northeast State-owned Forest Areas—including policies, systems, and market dynamics—we explore the relationship between this transformation and hidden unemployment through causal analysis and variance decomposition.

3.2.1. Estimation Method for the Hidden Unemployment Population

In this paper, the Cobb–Douglas production function is used to calculate the hidden unemployment level in the Northeast State-owned Forest Areas [39–42], the specific formula for which is as follows:

$$Q_t = A K_t^\alpha L_t^\beta \tag{1}$$

In Equation (1), Q represents the social output of the whole forest area; A indicates the technical level; K represents the physical capital stock; L denotes the amount of labor employed; t denotes time; and α and β denote the elasticity of capital and labor output, respectively. It is assumed that w_t is the wage of forest employees, P is the comparable price, and the real wage of the labor force is w_t/P. Under the condition of maximizing profit, when the effective labor supply in the forest area is $\frac{dQ_t}{dL_t} = \frac{w_t}{P}$, the amount of labor needed is L^*, and the hidden unemployment rate is $\frac{L_t - L_t^*}{L_t}$ when the enterprise added value is Q. Further considering the human capital factor of the labor force [39–42], the production function can be expressed as follows:

$$Q_t = (A_0 h_t) K_t^{\alpha_t} (L_t h_t)^{\beta_t} \tag{2}$$

In Equation (2), A_0 represents the technical level and is a fixed value; h_t represents the average human capital level of the labor force. The effective labor supply and the corresponding hidden unemployment rate can be calculated.

3.2.2. Analysis of Labor Force Heterogeneity

It is assumed that the individual efficiency and wage of the labor force in the employed population are given according to the proportion of their individual qualities, and the individual qualities x of the labor force obey the normal distribution of N (u, 1) (u represents the average quality level of the labor force, which should be large enough to ensure that almost all the individual qualities of the labor force are greater than zero). Assuming that the number of labor employment in t year is L_t and the effective employment rate is η_t under the condition that there is no difference in labor quality, the corresponding hidden unemployment rate, or the total labor quality needed by the whole society, is $1 - \eta_t$ (in fact, the total quality is equivalent to the amount of labor). When the quality of the labor force is heterogeneous and the high-quality labor force prioritizes the distribution of work, only the labor force with a quality greater than a receives work task arrangement, and the total quality, $\eta_t \mu L_t$, provided by this part of the labor force should be equal to the total quality needed under the condition that there is no difference in the quality of the labor force, as follows:

$$\int_a^\infty x L_t \frac{1}{\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2}} dx = \eta_t \mu L_t \tag{3}$$

Furthermore, the following formula can be obtained: $\frac{1}{\mu\sqrt{2\pi}} e^{-\frac{(a-\mu)^2}{2}} + \int_a^\infty \frac{1}{\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2}} dx = \eta_t$. In this way, when η'_t and u are known, the value of a can be obtained. Additionally, we can obtain the effective employment proportion $\eta'_t = \int_a^\infty \frac{1}{\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2}} dx$, which corresponds to the hidden unemployment $1 - \eta'_t$ and the hidden unemployed population $L_t(1 - \eta'_t)$.

3.2.3. Transformation Evaluation—Entropy Weight Method

The min–max standardization method is used to eliminate the influence of different units between index data, as follows [43–45]:

$$Y_{li} = \frac{X_{li} - min(X_i)}{max(X_i) - min(X_i)} \tag{4}$$

In Equation (4), the k indices $x_1, x_2..., x_k$ are given, where $X_i = \{x_1, x_2..., x_k\}$. It is assumed that the standardized values of each index dataset are $Y_1, Y_2, ...Y_k$. Y_{li} is the standardized datum of the i-th index in year l, and the weight of each evaluation index is calculated by the entropy weight law [43–45]. If the entropy of the i-th index is E_j in the model, the calculation formula of E_j is as follows:

$$E_j = -ln(n)^{-1} \sum_{i=1}^{n} p_{li} ln p_{li} \tag{5}$$

In Formula (5), $P_{li} = Y_{li} / \sum_{j=1}^{n} Y_{li}$; if $P_{li} = 0$, then $\lim_{P_{li} \to o} P_{li} ln P_{li} = 0$. After calculating the information entropy of each index, the weight of each index is calculated. The specific formula is as follows:

$$W_i = \frac{1 - E_j}{k - \sum_{j=1}^{k} E_j} \ (i = 1,\ 2,\ 3..., k) \tag{6}$$

According to Formula (6), the scoring formula of the economic transformation ability of the Northeast State-owned Forest Areas can be derived as follows:

$$Z_l = \sum_{i=1}^{n} Y_{li} W_i \ (i = 1, 2, ..., n) \tag{7}$$

In Equation (7), Z_l is the final score of the transformation ability evaluation in year l for the Northeast State-owned Forest Areas; Y_{li} is the standardized datum of year i in year l; and W_i is the entropy weight of the i-th index.

3.2.4. Panel Vector Autoregression Model

In this paper, the panel vector autoregression model is used to analyze the transformation impact of the Northeast State-owned Forest Areas on hidden unemployment [46–48]. The specific formula is as follows:

$$Y_{it} = a_0 + \sum_{j=1}^{n} a_j Y_{i,t-j} + \beta_i + y_i + \varepsilon_{it} \tag{8}$$

Here, Y_{it} is an endogenous variable that includes economic transformation, social transformation, economic transformation, and hidden unemployment in the Northeast State-owned Forest Areas; t is the year; i represents different regions; a_0 is the intercept; j is the lag order; a_j is the parameter matrix of j lag order; β_i is an individual fixed effect; y_i is an individual point-in-time effect; and ε_{it} is a random perturbation term.

3.3. Data Sources and Descriptive Statistics

A vital aspect of calculating hidden unemployment in the Northeast State-owned Forest Areas lies in the meticulous handling of pertinent data. Consequently, after establishing the calculation and cause analysis methods for hidden unemployment, specific indices are selected. A descriptive analysis and rigorous treatment of these chosen indices are conducted to furnish the fundamental data for computing the hidden unemployment rate in the Northeast State-owned Forest Areas.

3.3.1. Data Sources

This paper categorizes the data sources for hidden unemployment in forest industry groups into two segments. (1) Elasticity coefficient estimation (2000–2010): In the initial part, the elasticity coefficients of labor output and human capital output are estimated using forest industry group data from 2000 to 2010. This period was chosen for two reasons: In 2000–2010, forest industry groups experienced stable economic, social, and ecological development, with high-quality forest resources. This stability aligns well with the Cobb–Douglas production function, rendering the elasticity coefficients of labor output and human capital output more accurate. Since 2010, the robust implementation of ecological protection policies and forest management reforms has impacted the economic develop-

ment of forest areas. Substantial changes in forestry industrial and employment structures occurred during this period, marking a crucial timeframe for the emergence of hidden unemployment in forest industry groups. Thus, the elasticity coefficients estimated from 2000 to 2010 provide more accurate insights. (2) Hidden unemployment rate estimation (2011–2020): The second part utilizes forest industry group data from 2011 to 2020 to estimate the hidden unemployment rate [17,19,20,38,49,50]. This timeframe encapsulates a significant period during which forest industry groups underwent hidden unemployment production. The definition of variables of hidden unemployment is showed as Table 1.

Table 1. Definition of variables.

Variables	Time	Goal
Total output value of the enterprise Number of employees on duty Human capital stock Capital stock	2000–2010	Calculate the elasticity coefficient value of labor output Calculate capital stock Calculate the elasticity coefficient value of human capital output
Total output value of the enterprise Number of employees on duty at the end of the year Total salary at the end of the year	2011–2020	Calculate the size of the hidden unemployment rate of the forest industry group

Note: the basic data of the indicators in the table were derived from the China Forestry and Grassland Statistical Yearbook (formerly the China Forestry Yearbook, which was renamed in 2019).

3.3.2. Descriptive Statistics

The basic data of the elasticity coefficient of labor output of the Northeast State-owned Forest Areas from 2000 to 2010 are shown in Table 2.

Table 2. Sample data for the elasticity coefficient estimation of labor output of the Northeast State-owned Forest Areas.

Indicator	Value	The Northeast State-Owned Forest Areas	The Inner Mongolia Forest Industry Group	The Jilin Forest Industry Group	The Changbai Mountain Forest Industry Group	The Longjiang Forest Industry Group	The Greater Khingan Mountains Forest Industry Group
Total output value of the enterprise (unit: CNY 100 million)	Max	5098.232	412.116	368.361	348.564	3214.950	561.840
	Min	844.660	129.551	128.931	168.056	525.860	146.996
	Average	2807.205	255.398	200.162	254.088	1661.497	318.837
Number of employees on duty (unit: person)	Max	702,759	91,370	67,451	74,780	302,779	96,299
	Min	426,066	55,642	20,839	29,583	217,529	51,682
	Average	541,143	74,811	40,957	48,619	258,875	65,092
Capital stock (unit: CNY 100 million)	Max	3605.629	364.053	322.563	287.418	1253.978	432.526
	Min	799.557	103.393	83.104	75.184	264.564	121.811
	Average	1637.502	183.354	165.148	143.275	521.354	222.038
Human capital stock (unit: CNY 10,000)	Max	1092.850	42.200	28.720	45.830	645.430	36.830
	Min	94.240	13.720	3.020	8.380	113.640	12.440
	Average	465.750	23.210	13.490	26.100	324.700	19.960
Average salary (unit: CNY 10,000)	Max	57,832.470	9554.250	5130.490	4500.02	22,956.720	7841.670
	Min	27,382.780	4122.570	2102.120	2950.04	8821.080	3762.490
	Average	35,706.710	610.874	3391.889	3514.77	12,774.679	5178.934

Note: 1. The capital stock is calculated using perpetual inventory. 2. The Forestry Bureau under the Changbai Mountain Forest Industry Group was under the management of the Jilin Forest Industry Group before 2013. For the convenience of this research, this article separates these Forestry Bureau data from data taken for 2010.

According to Table 2, from 1999 to 2010, the Longjiang Forest Industry Group exhibited the highest added value among the enterprises, at CNY 321.495 billion, while the Jilin Forest Industry Group recorded the lowest, at CNY 12.8931 billion. The Longjiang Forest Industry Group had the highest year-end employee count, with 302,779 people, whereas the Jilin

Forest Industry Group had the lowest, with 20,839 people. The Longjiang Forest Industry Group's capital stock reached its pinnacle at CNY 125.3978 billion, while the Changbai Mountain Forest Industry Group reported the lowest capital stock at CNY 7.5184 billion. The human capital stock varied, with the highest observed for the Longjiang Forest Industry Group at CNY 6,454,300 and the lowest observed for the Jilin Forest Industry Group at CNY 30,200. In terms of the average wage, the Longjiang Forest Industry Group ranked highest at CNY 229.5672 million, while the Jilin Forest Industry Group had the lowest at CNY 21.0212 million.

Table 3 shows that between 2011 and 2020, the Longjiang Forest Industry Group recorded CNY 607.290 billion in enterprise added value, while the Changbai Mountain Forest Industry Group reported only CNY 34.8564 billion. With 240,035 employees at the year's end, the Longjiang Forest Industry Group had the largest workforce, while the Jilin Forest Industry Group had the smallest, with 16,826 employees. The Longjiang Forest Industry Group had the greatest average wage of CNY 533,540, while the Jilin Forest Industry Group had the lowest at CNY 54,460.

Table 3. Sample data for hidden unemployment estimation of the Northeast State-owned Forest Areas from 2011 to 2020.

Indicator	Value	The Northeast State-Owned Forest Areas	The Inner Mongolia Forest Industry Group	The Jilin Forest Industry Group	The Changbai Mountain Forest Industry Group	The Longjiang Forest Industry Group	The Greater Khingan Mountains Forest Industry Group
Total output value of the enterprise (unit: CNY 100 million)	Max	8180.626	786.303	820.775	423.683	6072.900	965.948
	Min	5755.432	412.116	368.361	348.564	3214.950	646.434
	Average	7277.448	572.789	579.789	382.184	4672.111	790.904
Number of employees on duty (unit: person)	Max	437,629	53,504	34,763	31,130	240,035	49,802
	Min	279,550	38,825	16,826	21,735	157,239	44,216
	Average	358,691	45,906	25,628	25,836	211,318	46,448
Average salary (unit: CNY 10,000)	Max	110.080	20.515	12.171	10.553	53.349	18.861
	Min	69.754	12.412	5.446	5.531	26.024	11.078
	Average	99.772	17.138	8.822	8.253	44.584	14.245

We selected indicators that are relevant to the transformation of the Northeast State-owned Forest Areas based on scientific rigor, practicality, comprehensiveness, representativeness, operability, and data availability. The indicators selected originate from well-established frameworks, including the modern forestry development index system [51–56], economic transformation index system [57–59], resource-based city transformation ability index system [60–62], and transformation index system of state-owned forest areas [3,6–8,10,36,37,63], as suggested by several scholars. The indicators are organized based on three characteristics that reflect the capacity of state-owned forestlands to undergo change. In addition, this article utilizes entropy weight methodology to determine the weights of economic transformation, social transformation, and ecological transformation indicators for the Northeast State-owned Forest Areas. The analysis covers the period from 2011 to 2020, and the specific findings are reported in Table 4.

Table 4. Sample data of cause analysis of hidden unemployment in the Northeast State-owned Forest Areas from 2011 to 2020.

Indicator Layer	Variables	Min	Max	Average	Weight
Economic transformation	Total output value of the enterprise (CNY 100 million)	5755.432	8180.626	7277.448	0.224
	Self-raised funds (CNY 10,000)	11.365	37.526	19.253	0.182
	Capital stock (CNY 10,000)	6616.001	149,817.002	69,118.671	0.269
	Location entropy	93.706	122.029	108.588	0.073
	The proportion of the tertiary industry in the total forestry output value	0.495	3.008	1.743	0.232
Society transformation	Average salary of employees (CNY 10,000)	69.754	110.080	99.772	0.200
	Number of people participating in pension insurance at the end of the year (number of people)	541,157	879,192	696,858	0.234
	Number of employees engaged in forestry technology exchange and promotion services (number of people)	0	4149	1655	0.158
	Enterprise employment index (%)	61.104	68.032	65.218	0.235
	Forestry education CNY (10,000)	0.000	21,953.000	8977.909	0.173
Ecological transformation	Land renewal area (1000 hectares)	301.000	424.000	348.610	0.212
	Actual area of closed mountains (sand) for afforestation at the end of the year (10,000 hectares)	681,969.000	1,012,566.000	814,497.364	0.212
	Actual forest management and protection area at the end of the year (10,000 hectares)	33,584,546.000	38,528,237.000	36,402,666.182	0.213
	Forest park area (10,000 hectares)	115,340.270	129,972.000	127,311.685	0.175
	Wildlife and plant protection and nature reserves (CNY 10,000)	86.000	9060.000	2711.364	0.187
	Hidden unemployment	24.712	47.376	37.356	

4. Empirical Results

The preceding theoretical analysis, model configuration, and data compilation are used to estimate the elasticity coefficient of labor output for the Northeast State-owned Forest Areas. Subsequently, the hidden unemployment number and hidden unemployment rate of the Northeast State-owned Forest Areas from 2011 to 2020 are computed. Expanding on this, this study incorporates the heterogeneity of the entire labor force, calculating the rate of hidden unemployment within the context of labor force heterogeneity. Finally, this research delves into the analysis of the causes of hidden unemployment and evaluates the contribution of transformation measures at different levels.

4.1. Hidden Unemployment Calculation Results

4.1.1. Labor Heterogeneity

Utilizing microscopic data from reform monitoring of the Northeast State-owned Forest Areas, this study employs comprehensive indicators based on the age, years of education, and physical health of forestry employees' families. These indicators are treated as normal distribution functions, and their μ (mean) value is determined. The results are shown in Table 5:

Table 5. Test of normal distribution results.

		Labor Quality
N		2964
Normal parameter [a,b]	Average	15.251
	Standard error	3.483
The most extreme difference	Absolute value	0.097
	Positive	0.092
	Negative	−0.097
Kolmogorov–Smirnov Z		5.284
Asymptotic significance (bilateral)		0.000

Notes: a. the test distribution is normally distributed; b. data source: livelihood monitoring data in the Northeast State-owned Forest Areas.

4.1.2. Hidden Unemployment Outcomes

Employing panel data from the *China Forestry and Grassland Statistical Yearbook* spanning from 2000 to 2010, this study separately estimates the output elasticity of the labor force and human capital for the Northeast State-owned Forest Areas. The regression results are presented in Table 6.

Table 6. Logarithmic regression results of the two production functions.

Variables	Model 1	Model 2
Constant	7.950 (0.069)	9.641 (0.074)
Physical Capital	0.790 (0.000)	0.644 (0.000)
Labor Force	0.302 (0.000)	
Human Capital		0.396 (0.000)
R-squared	0.777	0.949
F	234.646 (0.000)	229.524 (0.000)

By integrating the above formula and regression results, we derive the hidden unemployment rate under four distinct scenarios: considering the labor force and labor force homogeneity, considering the labor force and labor force heterogeneity, considering human capital and labor force homogeneity, and considering human capital and labor force heterogeneity.

Table 7 reveals that under these four conditions, the hidden unemployment rate of the Northeast State-owned Forest Areas exhibits a similar change trend. However, the values of the hidden unemployment rate differ, highlighting two key observations. First, when employing the production function calculation, the hidden unemployment rate calculated considering only the labor force is greater than that calculated considering human capital. Second, under the condition of a homogeneous labor force, the hidden unemployment rate of the Northeast State-owned Forest Areas is lower than that under the condition of a heterogeneous labor force. The former discrepancy arises from the fact that the elasticity coefficient of human capital output is greater than that of labor output when human capital is considered. The latter disparity occurs because under the condition of labor force heterogeneity, a high-quality labor force can secure work tasks first, reducing the demand for the labor force in terms of quantity. In reality, differences in labor quality and human capital have an objective influence. Consequently, the hidden unemployment rate calculated under the fourth case (considering human capital and the heterogeneous labor force) is deemed more reasonable [20,36–38,40–42].

Table 7. Comparison of the hidden unemployment rate results for four different scenarios in the Northeast State-owned Forest Areas.

Location	Year	Considering Labor and Labor Homogeneous	Considering Labor and Labor Heterogeneity	Considering Human Capital and Labor Homogeneous	Considering Human Capital and Labor Heterogeneity	Average Value
The Northeast State-owned Forest Areas	2011	35.245	24.712	37.427	26.894	31.070
	2012	41.458	32.865	43.641	35.048	38.253
	2013	36.681	26.596	38.863	28.779	31.905
	2014	41.110	32.408	43.293	34.591	36.658
	2015	47.376	40.631	49.559	42.813	43.309
	2016	42.381	34.076	44.564	36.258	38.785
	2017	40.407	31.485	42.589	33.668	36.837
	2018	40.186	31.196	42.369	33.379	37.067
	2019	41.295	32.650	43.477	34.833	38.064
	2020	40.365	31.023	41.331	33.123	36.461
The Inner Mongolia Forest Industry Group	2011	24.798	11.003	26.980	13.186	18.992
	2012	25.528	11.962	27.711	14.144	19.836
	2013	31.253	19.473	33.435	21.656	28.735
	2014	30.115	17.980	32.297	20.162	27.794
	2015	20.649	15.559	22.831	17.741	23.663
	2016	41.284	32.637	43.467	34.819	38.402
	2017	47.695	41.049	49.877	43.231	44.739
	2018	41.555	32.992	43.738	35.175	38.274
	2019	46.309	39.230	48.491	41.412	43.861
	2020	43.112	37.239	45.321	37.865	40.884
The Jilin Forest Industry Group	2011	17.027	10.806	19.209	12.989	15.008
	2012	18.411	12.623	20.594	14.806	16.608
	2013	24.061	10.036	26.243	12.218	19.976
	2014	27.845	15.002	30.028	17.185	27.630
	2015	24.115	20.108	26.298	22.290	25.979
	2016	31.270	29.496	33.452	31.678	32.470
	2017	31.010	19.155	33.192	21.337	29.701
	2018	40.977	32.233	43.159	34.416	38.450
	2019	24.871	11.100	27.054	13.282	19.077
	2020	25.334	20.331	27.568	26.129	24.841
The Chang-baiMountain Forest Industry Group	2011	16.065	13.457	18.247	15.639	15.852
	2012	18.380	12.582	20.563	14.765	16.572
	2013	20.368	15.190	22.550	17.373	18.870
	2014	32.882	21.611	35.064	23.793	28.338
	2015	34.782	24.104	36.964	26.287	30.534
	2016	25.099	21.399	27.282	23.582	27.416
	2017	35.382	24.891	37.564	27.074	33.301
	2018	44.102	36.334	46.284	38.516	40.473
	2019	44.571	36.950	46.754	39.132	41.852
	2020	43.112	38.230	40.234	37.369	39.736

Table 7. *Cont.*

Location	Year	Considering Labor and Labor Homogeneous	Considering Labor and Labor Heterogeneity	Considering Human Capital and Labor Homogeneous	Considering Human Capital and Labor Heterogeneity	Average Value
The Longjiang Forest Industry Group	2011	31.788	20.176	33.971	22.359	27.073
	2012	46.711	39.757	48.893	41.940	44.325
	2013	33.471	22.384	35.654	24.567	28.234
	2014	39.255	29.974	41.438	32.156	36.135
	2015	46.431	39.391	48.614	41.573	41.484
	2016	43.681	35.782	45.864	37.964	39.346
	2017	37.389	27.525	39.571	29.707	35.153
	2018	35.969	25.662	38.151	27.844	32.984
	2019	34.156	33.283	36.339	35.466	34.811
	2020	34.097	32.278	31.465	36.227	33.517
The Greater Khingan Mountains Forest Industry Group	2011	24.776	20.975	26.959	23.158	23.967
	2012	29.913	17.716	32.096	19.898	24.906
	2013	29.402	17.045	31.584	19.227	25.506
	2014	18.059	12.161	20.241	14.343	21.902
	2015	39.698	30.555	41.881	32.738	36.070
	2016	43.179	35.123	45.362	37.306	40.233
	2017	44.696	37.114	46.879	39.296	41.331
	2018	46.791	39.862	48.973	42.045	42.706
	2019	43.698	35.803	45.880	37.986	40.842
	2020	42.327	36.112	43.221	37.264	39.731

The four estimates of hidden unemployment in forest areas align closely. From 2011 to 2020, the hidden unemployment rates in the Northeast State-owned Forest Areas remained consistent between 30% and 45%. The lowest hidden unemployment rate was recorded in 2011 at 24.712% (considering the labor force and heterogeneous labor force), while the highest rate occurred in 2015, reaching 49.559% (considering human capital and the homogeneous labor force). Among the specific forest industry groups, the Inner Mongolia Forest Industry Group exhibited hidden unemployment rates ranging from 30% to 50%, with the lowest rate occurring in 2011, at 11.003% (considering the labor force and heterogeneous labor force), and the highest occurring in 2017, at 49.877% (considering human capital and the homogeneous labor force).

The hidden unemployment rates of the Jilin Forest Industry Group fell between 33% and 45%, reaching their lowest point in 2013, at 10.036% (considering the labor force and heterogeneous labor force), and their highest in 2018, at 43.159% (considering human capital and homogeneous labor force), averaging 23.322%. The Changbai Mountain Forest Industry Group's hidden unemployment rates were generally between 30% and 45%, with the lowest recorded in 2012 at 12.582% (considering the labor force and heterogeneous labor force) and the highest in 2019 at 46.754% (considering human capital and homogeneous labor force), averaging 27.655%.

The Longjiang Forest Industry Group exhibited hidden unemployment rates ranging from 20% to 60%, with the lowest rate recorded in 2011, at 20.176% (considering the labor force and heterogeneous labor force), and the highest in 2012, at 48.893% (considering human capital and the homogeneous labor force). The hidden unemployment rates of the Greater Khingan Mountains Forest Industry Group hovered between 30% and 50%, with the lowest rate observed in 2014, at 12.161% (considering the labor force and heterogeneous labor force), and the highest, at 48.973% (considering human capital and homogeneous labor force), in 2018. Overall, the hidden unemployment rates of the Northeast State-owned Forest Areas have shown an upward trend.

The hidden unemployment rate of the five forest industry groups was generally on the rise, especially after 2015. Ecological functional zones in the Xing'an Mountains and Xiaox-

ing'an Mountains implemented by the government in 2010 made the ecological protection of the Northeast State-owned Forest Areas a priority, suppressing the development of logging-related mining and processing industries, and hidden unemployment gradually increased. The comprehensive logging cessation policy implemented in 2015 further stunted the leading industry of the forest industry group, hindering the effective utilization of labor previously engaged in logging-related activities. At present, forest industry groups are in their nascent stages of transformation, struggling to adapt their workforce to the evolving industry landscape, leading to a surge in hidden unemployment. Among these groups, the Jilin Forest Industry Group boasts the lowest hidden unemployment rate due to its distinct operational model. It operates as an enterprise rather than a government entity, undergoing early restructuring and long-term market adaptation. Thus, the Changbai Mountain Forest Industry Group, which separated from the Jilin Forest Industry Group in 2013, faced challenges in swiftly adjusting to market and policy changes, resulting in significant hidden unemployment. Similarly, the Inner Mongolia Forest Industry Group, the Longjiang Forest Industry Group, and the Greater Khingan Mountains Forest Industry Group, all government run, have encountered greater challenges in the context of institutional reforms and forestry transformation compared to the Jilin Forestry Industry Group.

4.2. The Causes of Hidden Unemployment Analysis

This article explored the relationship between implicit unemployment and transformation in state-owned forest areas in Northeast China, and the data used have passed the test. Then, this paper delved into the relationship between the transformation and hidden unemployment of the Northeast State-owned Forest Areas through a Granger causality test. The specific results are presented in Table 8.

Table 8. Results of the Granger causality test.

Dependent Variables	Independent Variables	Statistics	p Value
Hidden unemployment	Economic transformation	3.371	0.338
	Social transformation	1.257	0.739
	Ecological transformation	23.396	0.000 ***
Economic transformation		7.485	0.058 *
Social transformation	Hidden unemployment	2.185	0.535
Ecological transformation		10.718	0.013 **

Note: ***, **, and * are significant at the 1%, 5%, and 10% levels, respectively.

Analyzing the outcomes from Table 8, it is evident that when the explanatory variables include hidden unemployment and when the explained variables include economic transformation, social transformation, and ecological transformation in the Northeast State-owned Forest Areas, the ecological transformation exacerbates hidden unemployment. This contradicts the initial hypothesis that ecological transformation is not a cause of hidden unemployment. Conversely, when the explanatory variables are economic transformation, social transformation, and ecological transformation, and the explained variable is hidden unemployment, hidden unemployment promotes economic transformation and ecological transformation in the Northeast State-owned Forest Areas. This goes against the notion that hidden unemployment is not a cause of economic transformation or ecological transformation.

In summary, there is a bidirectional causal relationship between ecological transformation and hidden unemployment in the Northeast State-owned Forest Areas. Simultaneously, there is a unidirectional cause-and-effect relationship between hidden unemployment and economic transformation in the Northeast State-owned Forest Areas. This phenomenon arises because climate change and the deterioration of forestry resources necessitate transformation in the Northeast State-owned Forest Areas. This transformation leads to changes in the forestry industrial structure, but the alteration in the employment structure occurs gradually, and the unique employment system contributes to the emergence of hidden

unemployment in the Northeast State-owned Forest Areas. The emergence of hidden unemployment promotes economic transformation and labor diversion in the Northeast State-owned Forest Areas. Throughout this process, the focus is on ecological construction shifts, influencing the transformation of the ecological employment structure in the Northeast State-owned Forest Areas.

By analyzing the impact of variables at various transformation levels on the degree of hidden unemployment in the Northeast State-owned Forest Areas, deeper insights into the variations in the degree of contribution of hidden unemployment at different levels can be gained. This understanding can assist in formulating policies to address the issue of hidden unemployment in the Northeast State-owned Forest Areas in the future. The specific results of the predicted variance decomposition are shown in Table 9.

Table 9. Predictive variance decomposition results for hidden unemployment in the Northeast State-owned Forest Areas during the transformations.

Forecast Period	Economic Transformation	Social Transformation	Ecological Transformation
1	5.602	1.462	11.344
2	33.014	5.637	7.684
3	22.603	36.468	5.147
4	27.099	34.155	5.367
5	24.185	43.107	13.151
6	25.233	46.199	11.856
7	18.811	57.267	11.174
8	5.705	87.060	3.380
9	5.246	88.016	3.102
10	1.157	96.819	1.266
Average	16.866	49.619	7.347

Table 9 shows that in the last ten forecasted periods, economic transformation, social transformation, and ecological transformation impacted hidden unemployment in the Northeast State-owned Forest Areas. However, the degree of this impact varied over time. Notably, the impact of economic and ecological transformations on hidden unemployment initially increased and then declined, while the impact of social transformation gradually rose. Furthermore, social transformation in the Northeast State-owned Forest Areas had the largest contribution to hidden unemployment, averaging 49.619. This was followed by economic transformation, with an average contribution rate of 16.866, and ecological transformation, with an average contribution of 7.347.

As the ecological transformation of the Northeast State-owned Forest Areas gradually stabilizes, the future employment structure may not undergo significant changes. However, the region still needs to develop further, necessitating a shift in its economic structure. With economic transformation, the employment structure will also change, requiring the redirection of hidden unemployment. Simultaneously, challenges such as the placement of a surplus labor force and social security need to be addressed. Therefore, the most substantial contribution to hidden unemployment in the later period comes from the social transformation of the Northeast State-owned Forest Areas.

5. Conclusions and Implications

During the Northeast State-owned Forest Areas' transformation and institutional reform, there has been a phenomenon wherein the labor force employed during the transformation process is not fully utilized, resulting in the actual demand for labor being lower than the number of employed workers. The implementation of the current comprehensive logging ban policy led to significant changes in the management mode of the forest industry groups, further exacerbating the hidden unemployment level within the group. Forest industry groups are not only legal entities of economic organizations but also exercise forest resource supervision and management functions on behalf of the country. They

also have management functions when it comes to social and administrative affairs in forest areas under their jurisdiction [6–8]. The unique corporate structure and management system of the Northeast State-owned Forest Areas pose challenges in adapting the labor force to market shifts, leading to hidden unemployment. This, in turn, diminishes the production efficiency of forest industry groups and drives up costs. Studying hidden unemployment in these areas can expedite reform within forest industry groups and enhance their ability to respond to market changes, fostering a fairer and more competitive labor market environment.

This study began by estimating the output elasticity of hidden unemployment labor force and human capital using panel data from the China Forestry and Grassland Statistical Yearbook spanning from 2000 to 2010. Leveraging microscopic data from reform monitoring in the Northeast State-owned Forest Areas and considering labor force heterogeneity, four hidden unemployment rates for the region were estimated from 2011 to 2020. The hidden unemployment rate was found to initially rise and then decline over time. To analyze the causes of hidden unemployment in the Northeast State-owned Forest Areas, a Granger causality test was employed to examine the causal relationships between economic transformation, social transformation, ecological transformation, and hidden unemployment in the region. The findings reveal a two-way cause-and-effect relationship between ecological transformation and hidden unemployment and a one-way cause-and-effect relationship between economic transformation and hidden unemployment in the Northeast State-owned Forest Areas. In the variance decomposition analysis, social transformation emerged as the most influential factor predicting hidden unemployment, followed by economic transformation, with ecological transformation exerting the smallest impact.

The Northeast State-owned Forest Areas have undergone extensive reforms and industrial transformations. However, this has resulted in a mismatch between the forestry industry and employment patterns, leading to hidden unemployment and impeding sustainable progress in the region. This study investigated the current status, underlying causes, and extent of hidden unemployment in the Northeast State-owned Forest Areas. It also explored the intricate relationship between transformation efforts and hidden unemployment, as well as the varied impacts of different levels of change on hidden unemployment in subsequent stages. These findings offer insights into how hidden unemployment can be addressed and how vital reform measures can be implemented for different phases of development in the Northeast State-owned Forest Areas. However, it is important to note that this paper's analysis of the origins of hidden unemployment was limited to broad changes, without delving into specific influencing factors. Additionally, a more comprehensive analysis of the subsequent reform trajectory, including decisions regarding industrial and employment structure transformation, is necessary.

This article provides policy insights by examining the evolving impacts of economic, ecological, and social transformations on hidden unemployment in the Northeast State-owned Forest Areas. The emergence of hidden unemployment has altered the outcomes of economic, ecological, and social changes. Currently, social and economic changes have significant effects and make substantial contributions, warranting focused attention on these areas. Strategic planning is crucial for the economic development of the forestry industry. This involves establishing comprehensive strategies, developing specific forest-related industries, optimizing forest product utilization, creating integrated industrial clusters to expand the tertiary forestry sector, and forming new clusters within the tertiary industry to absorb excess labor.

Addressing surplus labor on a societal level can be achieved by providing vocational training to young individuals and facilitating their transition to reemployment through investment in new sectors, legislative support, and skill development. Prioritizing social security reform for the aging surplus labor force through forest system reforms, government activity divestiture, and successful reintegration of aged surplus laborers into society is essential. Implementing social security reforms in forest areas should entail adjusting contribution ratios, expanding coverage, and ensuring the sustainability of forest areas.

Moreover, revising forestry laws from an ecological standpoint is necessary, focusing on forestry tending, management, conservation, and projecting future resources. Providing technical training to surplus laborers can enhance labor security in future forest resource management efforts.

References

1. Su, H.; Zheng, H.; Giessen, L. Policy forum: Challenges and ways forward in implementing "a guide on sustainable overseas forest management and utilization by Chinese enterprises". *For. Policy Econ.* **2019**, *102*, 114–118. [CrossRef]
2. Zhang, Q.; Cheng, B.; Diao, G.; Tao, C.; Wang, C. Does China's natural forest logging ban affect the stability of the timber import trade network? *For. Policy Econ.* **2023**, *152*, 102974. [CrossRef]
3. Yang, H.; Yuan, T.; Zhang, X.; Li, S. A Decade Trend of Total Factor Productivity of Key State-Owned Forestry Enterprises in China. *Forests* **2016**, *7*, 5–97. [CrossRef]
4. Zhao, J.; Liu, J.; Giessen, L. How China adopted eco-friendly forest development: Lens of the dual-track mechanism. *For. Policy Econ.* **2023**, *149*, 102931. [CrossRef]
5. Zhang, P.; Zhao, J.; Krott, M. Strictest nature conservation: China's national park policy underpinned by power shift and turf dynamic. *For. Policy Econ.* **2023**, *54*, 103033. [CrossRef]
6. Wu, Z. Study on the Countermeasures of Rebuilding the Relationship between Government and Enterprises in State-owned Forest Industry Enterprises. *World For. Res.* **2004**, *6*, 60–64. (In Chinese)
7. Wei, Y.; Jiang, M. Exploration on the management system reform of key state-owned forest areas in Northeast China and Inner Mongolia. *J. For. Sci.* **2005**, *41*, 163–168. (In Chinese)
8. Geng, Y.; Wu, Z.; Wei, L. Research on the reform progress and policy of state-owned forest areas-taking Longjiang Forest Industry Group and Daxinganling Forestry Group as examples. *J. For. Econ.* **2017**, *39*, 3–11. (In Chinese)
9. Aguilar, F.X.; Wen, Y. Socio-economic and ecological impacts of China's forest sector policies. *For. Policy Econ.* **2021**, *127*, 102454. [CrossRef]
10. Jiang, Y.; Su, H. The Status, Trend, and Global Position of China's Forestry Industry: An Anatomy Based on the Global Value Chain Paradigm. *Forests* **2023**, *14*, 102040. [CrossRef]
11. Long, H.; de Jong, W.; Yiwen, Z.; Liu, J. Institutional choices between private management and user group management during forest devolution: A case study of forest allocation in China. *For. Policy Econ.* **2021**, *132*, 102586. [CrossRef]
12. Zhang, Y.; Zhang, T.; Zeng, Y.; Cheng, B.; Li, H. Designating National Forest Cities in China: Does the policy improve the urban living environment? *For. Policy Econ.* **2021**, *125*, 102400. [CrossRef]
13. Ma, B.; Zhang, Y.; Huang, Y.; Wen, Y. Socioeconomic and ecological direct and spillover effects of China's giant panda nature reserves. *For. Policy Econ.* **2020**, *121*, 102313. [CrossRef]
14. He, W.; Cheng, Y.; Lin, Y.; Zhang, H. Microeconomic effects of designating National Forest Cities: Evidence from China's publicly traded manufacturing companies. *For. Policy Econ.* **2022**, *136*, 102669. [CrossRef]
15. Rosenstein-Rodan, P.N. Europe Versus America: Implications of the "New Order". *Int. Aff. Rev. Suppl.* **1942**, *19*, 555–556. [CrossRef]
16. Lewis, W.A. Economic Development with Unlimited Supplies of Labor. *Manch. Sch. Econ. Soc. Stud.* **1954**, *22*, 139–191. [CrossRef]
17. Farmer, B.H.; Yong, S.C. *'Disguised Unemployment' in Underdeveloped Areas with Special Reference to South Korean Agriculture*; University of California Press: Berkeley, CA, USA; Los Angeles, CA, USA, 1963; pp. 6–163.
18. Mathur, A. The anatomy of disguised unemployment. *Oxf. Econ. Pap.* **1964**, *16*, 161–193. [CrossRef]
19. Fei, J.H.; Ranis, G. Development of the Labor Surplus Economy: Theory and Policy. *Econ. J.* **1967**, *77*, 480–482.

20. Feld, L.P.; Kirchgässner, G. Official and hidden unemployment and the popularity of the government: An econometric analysis for the Kohl government. *Elect. Stud.* **2000**, *19*, 333–347. [CrossRef]

21. Simonova, M.; Lyachenkov, Y.; Kostikova, E. *Regional Labor Market: Supply and Demand in the Context of Digitalization*; Springer: Cham, Switzerland; New York, NY, USA, 2021.

22. Pastuszka, S.; Skrzypek, J. Convergence or Divergence of Italian Regions? *Gospod. Nar.* **2017**, *288*, 101–130. [CrossRef]

23. Berveno, O.V.; Yurchenko, L.S. The Main Directions of the Employment Promotion Policy in the Conditions of Economy Digitalization. *Probl. Econ.* **2020**, *4*, 351–356. [CrossRef]

24. Tsaurkubule, Z.L.; Mahmudova, J.A. Socio-economic problems and disparities of the Latvian labor market. *Sotsiologicheskie Issled.* **2017**, *10*, 133–140.

25. Koodziejczak, W. An Attempt to Assess the Scale of Hidden Unemployment in Polish Agriculture in 2017. *J. Agric. Rural Dev.* **2018**, *50*, 395–401. [CrossRef]

26. Koodziejczak, W. Hidden Unemployment in Polish Agriculture in 2005–2018—A Simulation of the Scale of the Problem. *Rocz. Nauk. Stowarzyszenia Ekon. Rol. I Agrobiznesu* **2020**, *XXII*, 170–180. [CrossRef]

27. Leibenstein, H. The Theory of Underemployment in Backward, Economies. *J. Political Econ.* **1957**, *65*, 91–103. [CrossRef]

28. Mazumdar, D. The Marginal Productivity Theory of Wages and Disguised Unemployment. *Rev. Econ. Stud.* **1959**, *26*, 190–197. [CrossRef]

29. Jasny, N.; Moore, W.E. Economic demography of eastern and southern Europe. *J. Farm Econ.* **1946**, *28*, 871–892. [CrossRef]

30. Rottenberg, S. Income and Leisure in an Underdeveloped Economy. *J. Political Econ.* **1952**, *60*, 95–101. [CrossRef]

31. Eckaus, R.S. The Factor Proportions Problem in Underdeveloped Areas. *Am. Econ. Rev.* **1945**, *45*, 539–565.

32. Foster, A.D.; Rosenzweig, M.R. *Is There Surplus Labor in Rural India?* Working Papers; Yale University, Department of Economics: New Haven, CT, USA, 2010; p. 85.

33. Himes, N.E. The population problem in Egypt. A study of population trends and conditions in modern Egypt. *Eugen. Rev.* **1938**, *30*, 66.

34. Li, Z.; Xiao, J.; Lu, G.; Sun, W.; Ma, C.; Jin, Y. Productivity and profitability of Larix principis-rupprechtii and Pinus tabuliformis plantation forests in Northeast China. *For. Policy Econ.* **2020**, *121*, 102314. [CrossRef]

35. Nathan, I.; Chen, J.; Hansen, C.P.; Xu, B.; Li, Y. Facing the complexities of the global timber trade regime: How do Chinese wood enterprises respond to international legality verification requirements, and what are the implications for regime effectiveness? *For. Policy Econ.* **2018**, *92*, 169–180. [CrossRef]

36. Cao, J.; Wang, Y.; Cao, B.; Li, J. Calculation of hidden unemployment in Jilin Forest Industry Group and analysis of its influencing factors-based on the perspective of production function. *For. Econ.* **2022**, *44*, 17–33.

37. Cao, J.; Wang, Y.; Chen, H. Causes and impacts of hidden unemployment in key state-owned forest areas in China. *World For. Res.* **2020**, *35*, 124–129. (In Chinese)

38. Yuan, Z.; Lu, M. *Hidden Unemployment Theory*; Lixin Accounting Publishing House: Shanghai, China, 1998. (In Chinese)

39. Zhao, K.; Wu, Y.; Kuang, Z. Dynamic evolution and impact mechanism of human capital mismatch in strategic emerging industries: Evidence from the Yangtze River Delta region of China. *Heliyon* **2023**, *9*, e21684. [CrossRef]

40. Liu, H.; Liao, Z. Study on the influence mechanism of learning-application matching of graduates from private institutions: Based on human capital and family capital perspectives. *Heliyon* **2023**, *9*, e22077. [CrossRef]

41. Zhang, Y.; Li, S.; Wang, X.; Wu, W. Research on human capital and energy development caused by decarbonization. *Renew. Sustain. Energy Rev.* **2023**, *187*, 113720. [CrossRef]

42. Bosi, S.; Camacho, C.; Ha-Huy, T. Balanced growth and degrowth with human capital. *Econ. Lett.* **2023**, *232*, 111348. [CrossRef]

43. Zhai, S.; Li, G.; Wu, G.; Hou, M.; Jia, Q. Cooperative task allocation for multi heterogeneous aerial vehicles using particle swarm optimization algorithm and entropy weight method. *Appl. Soft Comput.* **2023**, *148*, 110918. [CrossRef]

44. Han, G.; Feng, G.; Chen, C.; Pan, C.; Zhou, W. Evaluation of the ventilation mode in an ISO class 6 electronic cleanroom by the AHP-entropy weight method. *Energy* **2023**, *284*, 128586. [CrossRef]

45. Yang, B.; Wu, X.; Hao, J.; Xu, D.; Liu, T.; Xie, Q. Estimation of wood failure percentage under shear stress in bamboo-wood composite bonded by adhesive using a deep learning and entropy weight method. *Ind. Crops Prod.* **2023**, *197*, 116617. [CrossRef]

46. Poh, S.C.; Siong, H.L.; Irwan, T.; Jamal, W.; Sylviana, M.D.; Bruno, S.S. Dynamic linkages among transparency, income inequality and economic growth in developing countries: Evidence from panel vector autoregressive (PVAR) model. *Res. Int. Bus. Financ.* **2022**, *69*, 101599.

47. Wang, M.; Zhang, H.; Zhang, M. Industrial Structure Servitization, Financial Structure Marketization and Economic Growth—Based on PVAR Model. *Procedia Comput. Sci.* **2023**, *221*, 1432–1439. [CrossRef]

48. Emad, K.; José, A.F.; Matheus, K.; Mohammad, T.A.I. Relationship between the share of renewable electricity consumption, economic complexity, financial development, and oil prices: A two-step club convergence and PVAR model approach. *Int. Econ.* **2023**, *173*, 260–275.

49. Errington, A. Disguised unemployment in British agriculture. *J. Rural Stud.* **1988**, *4*, 1–7. [CrossRef]

50. Cao, J.; Wang, Y.; Chen, H. Evaluation and difference analysis of transformation ability of forest industry groups in the key state-owned forest areas. *J. Agric. For. Econ. Manag.* **2020**, *19*, 77–86. (In Chinese)

51. Šálka, J.; Longauer, R.; Lacko, M. The effects of property transformation on forestry entrepreneurship and innovation in the context of Slovakia. *For. Policy Econ.* **2006**, *8*, 716–724. [CrossRef]

52. Arne, P. Transformation to continuous cover forestry in a changing environment. *For. Ecol. Manag.* **2006**, *224*, 227–228. [CrossRef]
53. Jin, M.; Chen, N.; Wang, S.; Cao, F. Does forestry industry integration promote total factor productivity of forestry industry? Evidence from China. *J. Clean. Prod.* **2023**, *415*, 137767. [CrossRef]
54. Lippe, R.S.; Luna, T.O.; Katajamäki, W.; Jörg, S. Labor informality in forestry: A longitudinal (2009–2020) cross-country analysis of determinants in 70 developing countries. *For. Policy Econ.* **2023**, *156*, 103056. [CrossRef]
55. Bishnu, H.P.; Dil, B.K.; Dinesh, P.; Kristina, M.; Sanjaya, K. Examining Forest transition and collective action in Nepal's community forestry. *Land Use Policy* **2023**, *134*, 106872.
56. Kristina, J.; Maria, J.; Elias, A. All talk and no action? Making change and negotiating gender equality in Swedish forestry. *For. Policy Econ.* **2023**, *154*, 103013.
57. Zhang, Y.; Zhao, F.; Zhang, J.; Wang, Z. Fluctuation in the transformation of economic development and the coupling mechanism with the environmental quality of resource-based cities—A case study of Northeast China. *Resour. Policy* **2021**, *72*, 102128. [CrossRef]
58. Samin, A.M.; Ali, B.; Ali, R.M.B. Reducing vulnerability to the climate change—Reversibility and transformation adopting in a hydro-economic model. *Environ. Dev.* **2023**, *47*, 100893.
59. Weronika, D.; Aleksandra, Z. The spatial dimension of coal phase-out: Exploring economic transformation and city pathways in Poland. *Energy Res. Soc. Sci.* **2023**, *99*, 103058.
60. Zhou, J.; Zhang, Z.; Xu, X.; Chang, D. Does the transformation of resource-dependent cities promote the realization of the carbon-peaking goal? An analysis based on typical resource-dependent city clusters in China. *J. Clean. Prod.* **2022**, *365*, 132731. [CrossRef]
61. He, T.; Song, H.; Chen, W. Recognizing the transformation characteristics of resource-based cities using night-time light remote sensing data: Evidence from 126 cities in China. *Resour. Policy* **2023**, *85 Pt A*, 104013. [CrossRef]
62. Wang, Z.; Fu, H.; Zhou, L. Multiple urban resilience evaluation of resource-based cities' sustainable transformation effect Resources. *Conserv. Recycl.* **2023**, *191*, 106912. [CrossRef]
63. Chen, Y.; Ji, X. The evaluation of the synergetic degree of ecology economy society system of China forestry during the last decade. *J. Sustain. For.* **2017**, *36*, 2822–2828. [CrossRef]