SCHOOL OF ECONOMICS AND MANAGEMENT

Bachelor of Science in Development Studies

Navigating Technological Tides

A Comparative Study of Technological Advancements in the Chinese Labor Market

Contextualizing Socioeconomic Implications and Complementarity

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Abstract

Technological development has empirically demonstrated significant social impact across diverse global contexts. The uncertainty of the effects necessitates continuously updated research and historical revision to foster sustainable processes and address research gaps. Traditional economic optimism tends to overlook multidimensional compositions of effects, beyond financial gains. This paper examines the evolution of economic thinking regarding the relationship between technological development and employment patterns while reflecting on socioeconomic implications. Through a historically comparative approach, the paper investigates the direct alternation of technology on employment and its indirect impact on related variables in the high-tech regions of Guangdong and Sichuan, China. Aligned with the theoretical framework of Skill-biased Technological Change indicating that technological development favors certain worker subgroups based on skill levels, context, and industry, the paper reflects upon the distinct paradigms. Utilizing unobtrusive data through a sequential explanatory design, the paper identifies trends of labor substitution, skill premiums, and shifts in technological complementarity, particularly in the earlier stages of technological adoption. The findings conclude the importance of acknowledging the nature of the technical advancements, the context capacity, and internal and external dynamics in assessing socioeconomic impact and complementarity. Finally, the research highlights the destabilizing effects of rapid technological development on socioeconomic conditions, stressing the need for adaptive measures and further research to address the accelerating nature of the contemporary phenomenon.

Keywords*: Technological Development, Labor Markets, Complementarity Measures, Skill Biases, Artificial Intelligence*

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List of Abbreviations:

HEI: Higher Education Institutions

UER: Unemployment Rate

NUP: Number of Unemployed Persons

PRC: People's Republic of China

AI: Artificial Intelligence

IMF: International Monetary Fund

SEZ: Special Economic Zones

PRD: Pearl River Delta

FDI: Foreign Direct Investment

GDP: Gross Domestic Product

MPD: Most Prosperous Districts

LPD: Least Prosperous Districts

HTZ: High-Tech Zones

FTZ: Free Trade Zones

ICT: Information and Communication Technologies

RMB: Renminbi

PI: Primary Industries

SI: Secondary Industries

TI: Tertiary Industries

AIOE: Artificial Intelligence Exposure Index

C-AIOE: Complementarity - Artificial Intelligence Exposure Index

AE: Advanced Economies

EM: Emerging Economies

SBTC: Skill-Biased Technological Change

TFP: Total Factor Productivity

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1. Introduction

In a world of constant transformation, where the increasing pulse of progress is integrating society, the phenomenon of technology plays a pivotal role. Throughout history, technology has modified, influenced, and reshaped global systems and structures, positioning itself at the heart of human progress. From historical industrialization to the contemporary digital age, each epoch has witnessed advancement and its outcomes (Worldbank, 2008). However, the profound uncertainty of both historical and contemporary advancement brings consequential results. Economists and researchers have long expressed concerns about the labor prospects associated with technological integration. The interplay between prevailing capitalism and the financial gains of technological development exacerbates the challenge of maintaining socioeconomic harmony (Dachs, 2018).

Additionally, the observed correlations between increasing disparities and technological integration have prompted extensive research (Goldin and Katz, 1998). However, the difficulties of persistent conclusions are aggravated by the exponential and unavoidable development of technology accompanied by the substantial number of variables involved in the transformations (Dahlin, 2021: Autor et al., 2022, pp. 1-2). These variables, encompassing social and individual capacities, abilities, and possibilities determine the complementarity and, therefore, the sustainability of technological advancements. The paper acknowledges the importance of recognizing the inevitable phenomenon of transformation, as encapsulated by philosopher Heraclitus:

"The Only Constant in Life is Change." - Heraclitus (Marjanovic, n.d.).

Embarking on the uncertainty of development, this paper emphasizes the value of analysis, insight, and enlightenment for sustainable progress. By doing so, it investigates the relationship between technological development and employment patterns through historical comparative measures in China. The thesis aims to reflect upon the complementarity of technology including socioeconomic implications, in varying contexts, through statistical observations and qualitative explanations.

1.1. Presentation of Problem

The profound uncertainty of adaptation to technology is visual in both contemporary and historical contexts. Interpretation of effects is vital, not only in explaining the past but also in

adaptation processes in future technological development. Investigations, analyses, and examinations of these advancements are imperative due to the profound ramifications they entail for socioeconomic structures and labor dynamics (Dachs, 2018, p. 4-5; Ito, 2019). Contemporary technological advancements fuel the fear of job displacements and labor transformation in disfavor of the individual. However, the inevitable nature of technological transformations increases the importance of monitoring structural outcomes (Garcia-Murillo, 2018, pp.1-2).

The rapid rise of contemporary technologies, particularly artificial intelligence, has impacted society through exponential illustrations. The OECD (2023) clarifies the certainty of significant labor market impact thus the ambiguity of the phenomenon. Additionally, the characteristics of contemporary technology illustrate distinct differences compared to other historical technological developments. The main differences presented by the OECD (2023) are:

> *"i) it significantly expands the range of tasks that can be automated beyond just routine, non-cognitive tasks;*
> *ii) AI is a general-purpose technology, meaning that nearly every sector and occupation will be affected;*
> *iii) the speed of development is unprecedented." (OECD, 2023)*

The recognition of these observations stresses the importance of conducting historical comparative analyses of the trajectory of technological advancement and its impacts on the labor market. In other words, a central cluster emerges from the necessity to discern parallels, disjunctions, and implications across these districts' temporal and socioeconomic contexts. By scrutinizing the ramifications of the major increase of technological integration in the late twentieth century in the People's Republic of China (PRC) alongside the unfolding of contemporary technological transformations in the present labor landscape, the thesis confronts the complexities inherent in technological integration, encompassing shifts in employment patterns, skill requirements biases, and socioeconomic disparities.

1.2. Aim of the Thesis

Following the premise that technological development has an impact on the structure of the labor market, this paper aims to identify patterns and compare potential structural transformations in the regions containing contemporary high-tech concentration but with

variations in economic structures and technological background in China. To be able to achieve this aim, the study will navigate the design to answer the research questions:

RQ1: Have transformative technological shifts reshaped the structure, dynamics, and socioeconomic implications of the labor market in Guangdong and Sichuan?
RQ1.1. How can potential transformation be identified and explained in economic structures and socioeconomic implications?

RQ2: What are the multifaceted parallels and disparities between the historical adoption of technology in the late twentieth century and the contemporary technological adoption in Guangdong and Sichuan?
RQ2.1. What differences and similarities can be identified in the findings in the comparative analysis of the regions?
RQ2.2. How can potential differences and parallels be explained?

The first research question is of a more descriptive nature and will operate to provide information about the technological transformations and their impact on the labor market on a general level for both regions during the time scope of the research. The quantitative findings will be generally and separately reflected upon using qualitative resources within the theoretical framework. The purpose of the question is to gather data in favor of the second research question which is more of an explanatory comparative nature. This question will provide more in-depth explanations depending on the context (region and period) to provide analytical explanations of the key findings. Additionally, the study aims to support or disprove the hypotheses based on the theoretical framework (see section 4.2.).

1.3. Relevance, Contribution, and Scope of the Study

1.3.1. Relevance and Contribution

The relevance and justification of the study are backed by the urgency of researching the societal effects of technological integration in the labor market. Furthermore, the constantly accelerating technological transformation demands for updated monitoring of the effects. As a result of the rapidity and prioritization, the research on the socioeconomic implications is not equated with the analysis of technological and financial outcomes. Moreover, the financial-gain from technological development has a tendency of overshooting social

consequences. Additionally, the considerable size of the social field accompanied with substantial variation of structures, aggravates the examination of technological adaption generating a constant research gap (Dahlin, 2021 pp. 1-2). This paper advocates for the urgency, and will contribute to minimize the current research gap and to further analyze the historical adaptation of technologies. By focusing on historical adaption, the research seeks to mitigate risk in contemporary technological development, enhance understanding of socioeconomic outcomes, and assist in the broader field of development.

1.3.2. Scope of the Study

The scope of this thesis, of a historical-comparative approach, focuses on examining the trajectorical adoption of technological advancement in China from 1990 to the contemporary technological development, particularly in the realm of AI, to 2022. The chosen research context encompasses the regions of Guangdong and Sichuan. The rationale for selecting these regions, as elaborated in section 1.3.1., is justified as follows.

1. China stands as a pivotal nation in the field of contemporary technological advancement (ex. AI) while also boasting historically significant technological development appropriate for this research. This selection is further justified by the necessity to discern potential shifts in the labor market (Ritcher, 2023). Additionally, the comparative potential of the context within the same nations yet with discernible differences in technological trajectories and economic structures enhances the research's analytical depth.
2. The regions of Guangdong and Sichuan are selected based on their distinct differences and similarities (elucidated information in section 2.4.). Guangdong's historical and contemporary reliance on secondary and tertiary industries contrasts with Sichuan's diverse economy, with an emphasis of primary sectors alongside more contemporary technological integration. The regions demonstrate variating technological adaption though with similar contemporary patterns and governmental incentives. Furthermore, similarities between initial population distributions (Appendix B, Fig. 8) and contemporary technological integration highlight the comparative abilities.
3. The year this research is examining is 1990 - 2022. As presented in points 1., and 1.3.1., the technological trajectory of China over the years is justified in definite relevance of the study. Furthermore, the availability of relevant data such as the

Statistical Yearbooks accessible online through the National Statistics of China spans from 1998 - 2022 with some indications reaching back to 1990.

4. Finally, in previous research made by the IMF on the complementarity rate of artificial intelligence among nations, China is not included even though being one of the leading roles within the technology. Moreover, this paper highlights the examination of China in the AI spectrum.

1.4. Delimitations

The thesis acknowledges the following delimitations to be considered when analyzing the research. First, the study is limited towards external validity which is further aggravating casualty in the comparative approach of the research. In other words, the findings of the study are related to the contexts of choice (see section 1.3.2.) and are not argued to be applicable to other contexts. However, as previously mentioned, the regions selected are argued to be of a comparative nature which increases the external validity including a variating set of economic structures that expand possibilities of indicativity to a larger set of contexts. Thuś the paper recognizes the specific political landscape of China which aggravates external validity as well as source reliability and accessibility.

Additionally, the sample size accompanied by the contexts and selection of indicators (see section 5.3.1.), does advocate for statistical generalizability whereas the findings of the research refer to a general applicability outside of the contexts. However, as mentioned by Robson and McCartan (2016) due to the nature of data and the dominant focus on quantitative data together with the aims of the study, generalizability is argued as not of major concern (Robson & McCartan, 2016, pp. 20, 78) Also, the paper acknowledges the lack of robust data highlight the possibility and potential in the conclusions.

Moreover, with external validity, causality, and generalizability in mind, the paper highlights the aim of identifying patterns and themes among the findings through correlations of cause and effect among the contexts.

1.5. Structure of the Thesis

The structure of the thesis is delineated as follows: Initially, the paper will introduce the contexts selected for the research and incorporate relevant information aligned with the aim of the thesis. This will be followed by literature on complementarity measures employed in both contemporary and historically oriented studies applicable to the analysis of research

outcomes. Furthermore, the theoretical framework from which perspective the analysis will be viewed is introduced accompanied with hypotheses based on the theory related to the research questions. Subsequently, the method of the research is explicated encompassing the research design, analytical framework, and limitations. Finally, the results are presented followed by the analyses and discussion, culminating in concluding remarks.

2. Context

This section will now introduce the contexts of the research and elucidate the historical trajectory, political incentives relevant to the thesis, and identified outcomes of technological development. The section will later compile identified parallels and disparities among the regions relevant to the explanatory measures of the analysis.

2.1. National Trajectory of Technological Transformation

China has been at the forefront of technical incentives since the economic rise and reforms in 1978. Together with marketization, digitalization and technologicalization were emphasized to increase productivity and efficiency. The strategic incentives and high focus on the developing aspects triggered rapid economic growth which simplified further development development agendas. Some examples of development campaigns aiming at technological advancements include “Made in China 2025”, “Internet Plus Action Plan", and “New Generation Artificial Intelligence Development Plan”, all to increase core technologies through industrial investments (Ito, 2019, pp. 50-52). The current race of contemporary technological advancements (such as Artificial Intelligence) has been a current dispute between China and the US. Furthermore, in the aspect of exascale computing and commercial drones, demonstrating two of the nine advanced technological factors, China is the leading nation. The country emphasizes the aspiration to obtain the global first place in the race of technological development which can be identified in the promotion of national AI policies (Ito, 2019, p. 51: U.S.-China Economic and Security Review Commission, 2019, pp. 7-9).

However, the increase in technologies is accompanied by resistance to socioeconomic implications. Increasing technologies parallelly risk disharmony in the labor market. Moreover, there can be a larger impact on less-skilled workers through for example job replacement due to automation (Ito, 2019, p. 68). Additionally, accompanied by urbanization driven by industrial changes, national disparities are becoming more tangible. Income inequalities incline depending on the level of skill and geographical position and are further

exponentially demonstrated due to the synchronized technological emphasis (Dollar, 2007, pp. 1-2: 6). Finally, Ito (2019) states that the impact of the technological advancements in China and its impact on the labor market are in need for further examination to conclude outcomes (Ito, 2019, p. 68).

2.2. Guangdong Province of China

Development Trajectory

The Guangdong region is recognized as the national financial powerhouse. Distinguished by its home to five of the seven Special Economic Zones of China (SEZs) and its inclusion of the Pearl River Delta (PRD) which has been designated “coastal open cities", the region is strategically positioned to catalyze economic development. The economic reforms in the late 70s initiated national advanced international technology and access to the open market in the external world. The geographical advantage of Guangdong (part of PRD and close to Hong Kong) provided for its role as the national forefront and pioneer of market-oriented reforms and national economic growth (Cheng, 2018, p. 1-2). The SEZs indicated a dominant influx of FDIs. Being a part of the PRD, where resources, technology, information, and capital were concentrated, Guangdong demonstrated remarkable growth. National GDP presented 10,9% annual growth and GDP per capita from 313 yuan in 1978 (less than 80 USD) to 63 469 yuan in 2014 (over 10 000 USD). Notably these numbers demonstrated exponential growth (Ibid, pp. 1-3).

Parallelly with the reforms, the transformations initiated shifts in the labor market. The combination of flexible market mechanisms and advanced institutional innovations accompanied by cheap land and labor fueled the rapid growth of the manufacturing sector. Labor-intensive industries further advocated export-oriented enterprises mainly dependent on the international market. The development model of the PRD is argued by scholars to be a construction of various models. However, the trajectory of enterprises of external organizational characteristics to engage with internal transformations and therefore international cooperation (FDIs) which resulted in import-substitution industries, technological encouragement, and national consumption power was a common denominator (Ibid, pp. 4-5: Laurence & Chusheng, 1993, pp. 598-590).

Industrial and Technical Clusters

In the 2000s the regions experienced the phenomenon of comparative advantage and the accompanying pressure on the PRD economies. The result of the rapid growth caught up with the region demonstrating increasing prices of productivity exceeding those in the producer prices indices. One main argument for this was the difficulties of authorities in synchronizing the pace of policy implementation with rapid economic growth. (Cheng, 2018, pp. 7-8: 18) The high liability and relationships with FDIs were volatile in the growth of national regions, decreasing the technological inflow and competencies which were of high importance to the industries of Guangdong. In terms of the economic structure of the sectors (primary, secondary, and tertiary industries) there were major transformations from the agricultural sector to the manufacturing and service industries. Though substantial growth has been presented, the foundations of the industries have received major criticism. The primary industries had a volatile structure, the large secondary industries were weak and not internally developed and the tertiary industries were argued to be structured somewhat backward (Ibid, 2018, pp. 7-10: Wuttke, 2011, pp. 365-366).

Policy Implementation and Development Strategies

The task force of the Chinese Academy of Social Sciences introduced an examination of the implemented reform measures by regional governments due to the financial downward spiral in the early 2000s and identified several indicators explaining the outcome (Zhuang et al., 2012). First, the economic development during the recent decades has been initiated from the bottom through intensive labor and too heavy international reliance and therefore caused irregular growth. Second, The Provincial Development and Reform Commission demonstrated how the growth rates were synchronized with the major investments in technological and information industries which fell 10.5% and high-tech fell 22.8% in 2009, generating a downfall in domestic production as a proportion of the regional GDP from 57.4% in 1978 to 38% in 2009. Third, the growing competitive market combined with little investments in research and technology consequently indicated the loss of Guangdong as the pioneer for national economic growth (Cheng, 2018, p. 2).

To recover a reconstruction of primary bodies was initiated aligned with the Hu Jintao administration. The new major development object leaned towards a knowledge-oriented economy, technological innovations, and skill-intensive learning including high-tech districts (Shaw & Ning, 2012, pp. 2-3: Cheng, 2018, 18; Wuttke, 2011, pp. 366). Development strategies were implemented, such as “Decision on the Acceleration of the Promotion of a Modern Industrial Structure” in 2008 and “Overall Planning of Guangdong Modern

Industrial Structure" in 2010 aiming to focus on scientific development. Facilitation of industrial upgrading and labor re-location accompanied by high-tech emphasis through a comprehensive top-level design generated autonomous technological developments and introduced momentum for economic growth (Cheng, 2018, p 19-21).

Further, the region transitioned from an intensive catch-up economic structure towards a sustainable knowledge-oriented economy which represented strategies of integration between the economy and the society as a whole, not separate spectrums (Wuttke, 2011, p. 371).

Disparities in Guangdong

Moreover, the issues of comparative advantage and environmental degradation were not the only consequences of the rapid growth. The increasing regional disparities have been prominent since the first reforms and further extracted due to the deepening reforms in the mid-90s. The emergence of enterprises, the concentration of FDIs in more developed areas (PRD (south) rather than rural areas (north)), globalization, and marketization generated increasing income inequalities which are demonstrating contemporary exponential growth.

Indicator	***1978***	***2013***
GDP per Capita	MPD = 570 yuan LPD = 253 yuan	MPD = 89,262 yuan LPD = 65,795 yuan
Gini-index	0.19	0.36
Economic Structure (primary, secondary, and, tertiary industries)	MPD = 33:41:26	MPD = 2.1: 46.2: 51.7
Urbanization rate	19%	83.84%

Table 1: Guangdong Comparative Disparities. MPD= Most Prosperous Districts
LPD = Least Prosperous Districts Data source: Cheng, 2018, p. 14: Guangdong Statistical Yearbook, 2012)

Due to the disparities and changes presented in Table 1, various poverty alleviations were implemented starting from 1992 to the present day. The strategies included political mobilization, fiscal measurements, and re-structuring with the dominant goals of including the rural part of the region in accessibility in both geographical measures and relocation of industries. Even though extensive measures for battling growing disparities have been

implemented and proven efficient, Cheng (2018) indicates how the challenges and trends will most likely remain dependent on geographical opportunities (Ibid, 2018, pp. 13-15: 17).

However, the cities in the PRD specialized in industrial clusters focused on manufacturing and electrical machinery. Through its dependency on external enterprises, the international market, and focus on main economic development in the absence of strategic internal sustainable development, the region has experienced a variety of hindrances.

2.3. Sichuan Province of China

Background

The region of Sichuan is referred to as the ´province of abundance´, and holds significant economic importance within China's regional landscape. Situated in the southwestern part of the country, Sichuan stands out as the largest province in the western region, both in terms of population size and economic output. The location serves as a pivotal junction connecting the rural hinterlands of the southwest to the southern coastal regions and extending further to central Asia. The size of the region (similar to Spain) contributes to a diverse array of environments and landscapes (MoFA, 2017, p. 3). The diversification is notably evident in the contrasting characteristics of its eastern and western lands. The eastern region is known for its fertile lands, abundant water resources, and flourishing agriculture, also referred to as the ´heaven storehouse´. Additionally, this area serves as a significant national and regional economic hub, spearheading the majority of such as developmental and innovative endeavors. In contrast, the western part is characterized by mountain ranges and rough terrains. Here, natural resources and animal husbandry prevail as the main occupations (MoFA, 2017, pp. 3-5: McNally, 2004, p. 431).

Development Trajectory

During the mid-twentieth century, the national government of China elevated the national imperative to revitalize and streamline agricultural output through the modernization of industries, enterprises, and transportation networks. In response to external threats, Sichuan emerged as a focal point for national technological and scientific endeavors in the 1960s, to enhance physical infrastructure and facilitate exploration of regional resources. Furthermore, this catalyzed increases in both human and physical labor within the region. Concurrently, with the onset of reforms in 1978, Sichuan transformed collective agriculture and initiated state-owned enterprise reforms (Yang, 2023, pp. 211-214).

The structural transformation accompanied both beneficial outcomes such as GDP growth of 9.3% per annum and substantial growth in the industrial and service sector. However, the growth rates were not aligned with average national growth reaching 9.76% per annum triggering a disadvantageous position at the national stage. The disparity was exacerbated by challenges such as limited market integration of newly established firms which stressed a weakened competitive position both domestically and internationally. Additionally, the mismanagement of natural resources and potential for productivity accompanied by the difficulties with the reconstruction of state firms causing social stress did not attract FDIs nor national investments in the region.

Moreover, the region experienced relative growth during the latter part of the twentieth century, contributing to overall economic expansion growth and enhanced productivity. However, due to national competition Sichuan fell behind which increased the gap between inland and coastal provinces (McNally, 2004, pp. 429-432).

The National "Open up to the West" Campaign

Amid persistent socioeconomic disparities between inland and coastal regions in China, the campaign of Open Up West was launched in 2000 to recalibrate the development policies. The 10-year plan included five main objectives whereas three are of high importance for this thesis:

> Objective 1, *"Accelerate The Development of Infrastructure*", highlights the importance of initiating the construction of communication projects and networks of and around Sichuan. The main development areas are within electricity, natural gas water, and information networks.
>
> Objective 3, *"Adjust the structure of Production Actively"*, captures the importance of increasing the comparative advantage locally and globally through use of regional advantages. The focus was on commercializing agriculture and animal husbandry to promote both outcomes and the service sector. Additionally, to manage the advantage of natural resources more efficiently and to promote its role as the biggest region in the West to become a center for technology, finance, networks, ICT, etc. to further attract capital, skill, and technology from the coastal provinces.
>
> Objective 4, "*Develop Technology and Education"*, encourages support for regional high-tech zones (HTZ). Technological management is intended to be accelerated to

quickly increase the regional role of technological enterprises. Furthermore, this is intended for major expansions of colleges and universities both in quantity and quality, both in urban and rural areas. To attract talents, researchers, and developers (mainly in the technological sectors), preferential policies and benefits were implemented (McNally, 2004, pp. 435-438).

The Impact of the Objectives

The Objective achieved positive results in various sectors, especially public services and infrastructures which attracted international support and investments which further triggered both direct and indirect economic development such as business services and telecommunications. The campaign catalyzed rapid, continuous, and systematic economic growth and structural transformation (Holtz, 2020, p. 24). Furthermore, the growth rates reached 7.7% in 2016 exceeding the average national of 6.7%, and was ranked among the top provinces by GDP in 2017. FDIs have exponentially increased synchronized with regional development. Additionally, the national government opened up seven more provincial free trade zones (FTZs) three of which were located in Sichuan, additionally, zones included six economy and technology development zones, four high-tech development zones, and two national-level bonded zones. Additionally, the private enterprises in service sectors more than doubled between the years 2008 and 2015 (MoFA, 2017, pp 5-9: 14-15). Furthermore, it triggered various shifts in the regional economic structure. First, Sichuan obtained the title of a national leader in agricultural production, natural resources, and infrastructure for communication and transportation. Second, with the combination of both heavy and light industries, FDIs, and national government investments, Sichuan has obtained both the role of the most developed industrial sector and the largest gross production scale of high-tech production in western China. The rapid growth of ICT industries is reflected in a high-tech boom in the province providing for a steep exponential rise in GDP and further expanding the manufacturing sector. Third, both the service sector and the energy sector grew dramatically as a result of an increase in various sectors (Ibid, 2017, pp. 11-12).

Disparities in Sichuan

Despite efforts to develop campaigns to integrate more rural populations, disparities remain among the population. Mainly in the western and eastern regions. As a consequence of the combination of a large quantity of rural population and the superior nature of the government, development plans were not always aligned or communicated with the entirety of the

inhabitants. This further resulted in over-investments in certain sectors, income inequality, and dependence on a small share of industries minimizing sustainable development (Holz, 2020, pp. 24-26: McNally, 2004, p. 435). Even though the growth rates exceeded the national values, the urban residents obtained a total of 26,205 RMB in GDP per Capita while the rural residents presented 10,247RMB GDP per capita. However, the rural GDP per capita growth rate exceeded the urban one with 2.9% per annum (MoFA, 2017, p. 5).

2.4. Differentials and Parallels

The following variations and similarities between the regions of Guangdong and Sichuan are delineated to simplify the exploration of potential explanations from the results.

This paper has highlighted four observations between Sichuan and Guangdong to demonstrate the parallels. First, both regions have experienced rapid economic development accompanied by political incentives creating beneficial possibilities for provincial growth such as the implementation of SEZs, FTZ, and HTZ. Second, the incentives in 2000 and after indicate knowledge-oriented economic development in both regions. Third, the geographical position has favored the regions financially, though through different factors. Fourth, increasing disparities are tangible in both regions, especially among the rural and urban populations.

Furthermore, the following three observations emphasize the disparities among the regions. First, the time spectrum of technological integration is diversified. Moreover, Guangdong's headstart after the reforms indicates rapid growth in the late twentieth century which allowed for a financial downward spiral after the loss of comparative advantage and vulnerable industrial foundations. It was not until the downfall the region transformed towards incentives of sustainable economic growth. Contrarily, incentives for development were dominantly introduced in 2000 whereas knowledge and sustainability were included (see objective 4.) Second, Guangdong focused mainly on labor-intensive industries in the secondary industries (manufacturing) whereas is argued to not Sichuan transformed the economic structure as dramatically though with an emphasis on the development of secondary and mainly tertiary industries (SI and TI), however, with the inclusion of sustainable management of primary industries (PI)(see objective 1). Third, the regions have different sets of economic structures with Guangdong at the forefront of SI and TI focusing on heavy industries, and with Sichuan in the comparative advantage of PI and high focus on high-tech rather than manufacturing indicating both light and heavy industries.

3. Literature Review

The following section will incorporate contemporary and historical complementarity measures of technological integration in the labor market to assist in general identifications and previously determined patterns relevant to the comparative time scope of the study.

3.1. Artificial Intelligence Exposure Index (IMF)

The IMF has incorporated substantial analyses of AI exposure in industries depending on the national economy level. The previous index of the Artificial Intelligence Exposure Index (AIOE) created by Felten et al., (2021) is developed by mitigating the complementarity rate and substitution of industries in the index (C-AIOE). Previous definitions of AI exposure dominantly focus on the overlapping capacities between AI and human abilities needed for certain occupations, though with the absence of the developed variables. The dimensionalization of the index includes the spectrum of adaptiveness with the aspects of the level of economy and industry exposure. The outcome remains agnostic in the labor market though perceptions dependent on preconditions are evaluated, examined, and calculated (Pizzinelli, 2023, pp. 1-3). To generate cross-country analyses among the cases examined of both Advanced economies (AE) and emerging economies (EM) work-level microdata is applied including the AIOE and C-AIOE measures. The results are examined with both internal and external comparisons. The result demonstrates the following:

1. *AEs presented higher values of AIOE than EMS due to the differences in industry compositions including higher-skilled cognitive intensive occupations.*
2. *Advanced Economies also demonstrate higher values of C-AIOE even though there are beneficial instruments (skills etc.) to operate in conjunction with human labor.*
3. *The level of the economy suggests the level of complementarity depending on the industry structure. Furthermore, the mechanisms of AI in the labor market depending on the level of the economy seem to be "polarized" in the sense of exposure but also complementarity.*
4. *Within economies, the variables of age, education, and gender suggest the substantial impact of AIOE. First, women are more exposed to AI than men independent of the national economic level. The only deviation refers to nations where most women work in the agricultural sector. Second, people obtaining tertiary degrees demonstrate*

higher exposure to AI thus increasing opportunities for occupational benefits from conjunction. Third, no correlation is identified between age and AI exposure.

5. *People with high incomes are more vulnerable to AIOE, though, with a higher potential for AI benefits and adaptation in their occupations.*
6. *Nations with higher employment in the agricultural sector (primary industry) present lower risks for AI exposure.*

(Pizzinelli, 2023, pp. 3-5; Cazzaniga, 2024, pp. 22-23).

In other words, higher skills, wages, and education at all levels of economies indicate greater exposure to Artificial intelligence. This also includes occupations with higher AI complementarity (Ibid, 2023, pp. 5-6). In contrast to previous automatization and technological revolutions that mainly affected middle-income and skilled workers (Acemoglu & Restrepo, 2018), AI is spread out in the entire industry market (IMF, 2024, pp. 22). However, it is important to recognize the relationship between AI and society in context. Preferences/attitudes of AI integration in services reflect the potential of AI exposure in the labor market.

Additionally, Pizzinelli (2023) and Cazzangia (2024) both conclude that the implications of AI preparedness and national position to leverage the technology can result in potential widening income disparities and the digital divide (Cazzangia, 2024, p. 22: Pizzinelli, 2023, pp. 30-32). In the context of income inequality, AI integration has the potential to enhance disparities and offset negative outcomes of labor displacement as a consequence of shifts in demand and individual ability of technological transition.

3.1.2. China as an Emerging Economy in the AIOE-Index and the Global Integration of AI

Moreover, in the context of China, one can conclude that even though the term agnostic is applicable in the long run, heavy investments in AI could potentially present identifications in occupations. Even Though China has emerged as one of the global leaders in artificial intelligence (AI), with significant investment and advancements in various AI technologies, it is not included in the IMF reports (see text above). With significant government support, a growing pool of skilled researchers, and a booming tech industry, China has rapidly expanded its AI capabilities across sectors and industries. Leveraging its vast data resources, research initiatives, and partnerships, China continues to solidify its position as one of the leading nations driving the development and adoption of AI on a global scale (Stanford University, 2023).

3.2. Historical Adaptation to Technology and its Impact on the Chinese Labor Market

Furthermore, In the context of historical comparative measures Goldin and Katz (1998) highlight the original measures of technology-skill complementarity. Moreover, the authors indicate the tendencies of technological adoption in the early twentieth century. Continuous processes of technology indicate increasing demand for complementary abilities. The authors also suggest that increasing the supply of skilled workers potentially prevents increasing disparities with technological transformations (Goldin and Katz, 1998, pp. 1-3). Furthermore, increasing technology is historically associated with increasing labor efficiency. Though as demonstrated by Kogan et al. (2021) the increasing productivity accompanies declining labor share as a result of "worse labor market outcomes" which, the authors refer to employment values and wage equality (Kogan et al., 2021, pp. 1-2). The study using data from 150+ years back on complementarity between technology, occupational exposure, and labor demands presents various findings relevant to this research. First, non-routine and routine manual tasks have been demonstrated exposed to technological pre-1980 indicating displacement and disparities. However, together with increasing ICT post-1980, the relationship continuously inclined with cognitive tasks. Second, less educated persons historically demonstrate higher exposure values. Third, lower income in all income groups since all obtain characteristics of occupational exposure (Ibid, 2021, p. 40).

Nonetheless, the paper highlights the difference of association with more "contemporary" technological development such as ICT-revolution in the regions referring to sections 2.2, 2.3, and 2.4. This further indicates differences in historical occupational exposure.

4. Theoretical framework

This section elucidates the applied theoretical framework underpinning the thesis. The theoretical framework serves as the foundation of the analysis guiding its direction while ensuring contextual relevance. The section starts by delineating the conceptual foundation and progressively expounds upon the formulations through which the thesis will be examined. While the core theoretical framework is SBTC, complementary aligned theories will be acknowledged. The aim of this is to demonstrate a broader applicability to the contemporary context, thereby enriching the analysis with a multidimensional perspective encompassing both internal and external factors of the regions under the study.

4.1. Skill-Biased Technological Change

The research will be situated in the skill-biased technological change (SBTC) paradigm. The theoretical framework operates in economics to explain the phenomenon where technological development disproportionately benefits more skilled and qualified labor forces resulting in transformations of labor demand. In other words, increasing technological progress affects its relative productivity and therefore the labor force since it tends to complement or substitute certain types of human labor, often resulting in increased demand for skilled workers and decreased demand for unskilled or low-skilled workers (Violante, 2008, p. 1).

> *"The notion of 'skill bias' and the literature that has recently blossomed around it has introduced the theoretical possibility that technological progress benefits only a sub-group of workers, placing technical change also at the center of the income distribution debate." (Violante, 2008, p. 5).*

SBTC obtains linkages with the framework of Total Factor Productivity (TFP) developed by Solow (1953). The growth model seeks to explain long-term growth by analyzing the interplay between capital accumulation, labor force, and technological progress. Accomplishment of neutral technical growth prevailing agreement of sustainable and efficient growth of GDP per capita. To relate it to TFP, a technical progression that impacts all factors in the absence of transforming the input ratio.

However, Violante (2008) argues that this operates as a foundational framework for the labor-capital-technology relationship though in the absence of contemporary adjustments of features of SBTC. First, it demands conceptualization in terms of further elaboration to address conceptual challenges aligned with the development trajectory and transformed dynamics. Second, it does not include the phenomenon of supply and demand in the labor market and its relation to relative prices. In other words, the factor-neutral framework needs to be analyzed through a factor-biased perspective to pan out the technological change in the twenty-first century (Violante, 2008, pp. 1-3).

In the subsequent sections, the paper will demonstrate the formulations proposed by Violante (2008) and further elaborate with supplementary scholars to underline the hypothesis and examine their theoretical underpinnings and empirical implications in greater detail. By elucidating the formulation the thesis aims to provide a comprehensive understanding of the intricate interplay between technological change and labor market

dynamics through a skill-biased lens. This will further operate as the foundation of the answering of the research questions, primarily the second RQ, and act as a foundation in the discussion. All formulations will be applied in the analysis of the results.

4.1.1. Formulation 1 - Capital-Skill Complementarity (production processes)

The first formulation is based on the decrease in input prices such as technology-progressed equipment. Krusell et al., (2000) demonstrate how the relationship between increased equipment investments (due to lower prices) correlates with the increase in demand for skilled labor. This is further calculated through an aggregate production function is demonstrated as:

$$y_t = f(k_t, u_t, s_t) = (k_t + u_t)^{\theta} s_t^{1-\theta}$$

To visually demonstrate correlations among the variables. Additional equation demonstrates the relative productivity comparison between skilled and unskilled labor captured by the ratio of their respective marginal productivities:

$$\frac{f_{s_t}}{f_{u_t}} = \left(\frac{1-\theta}{\theta}\right)\frac{k_t + u_t}{s_t}$$

The aggregate production function shows that output (denoted as yt) consists of three factors: capital equipment (k), skilled labor (s), and unskilled labor (s). Moreover, the function predicts that equipment and unskilled labor are perfect substitutes and have a unit elasticity of substitution with skilled labor. The ratio further demonstrates how increases in capital equipment (k) synchronized increases the productivity of skilled labor (s) which further fuel the skill premium. On the other hand, the marginal product of unskilled labor (u) is decreasing as capital equipment and capital stock grows. Furthermore, this reflects the hypothesis that the relative demand for skilled labor is increasingly synchronized with the growth of equipment capital. This further provides the empirical basis and justification of the framework demonstrating its economic reality rather than primary theoretical. Moreover, it provides economic content for capital-skill complementarity when including the relationship between skilled labor and increasing equipment which refers to the concrete explanation for the occurrence of SBTC (Violante, 2008, p. 2: Krusell et al., 2000, pp. 1030-1030).

This is further highlighted by Acemoglu and Restrepo (2018) stating that automation will always indicate a reduction of labor share, demand, and equilibrium wage unless the labor gains from the technological adaptation in productivity. Furthermore, labor substitution is

only applicable to labor-augmenting technologies, not capital-augmenting technologies (Acemoglu & Restrepo, 2018, p. 48). However, this stresses the importance of recognition of the equipment capital (K) to identify the outcome of the demand for supply. To clarify, capital-augmenting equipment does not necessarily subsidize labor, though it increases the demand for skilled labor. Labor-augmenting equipment triggers labor displacement, however, not necessarily dependent on skill-level.

4.1.2. Formulation 2: Human Capital Complementarity

The second formulation is navigated towards the role of education in processes of technological progress and labor shifts. Labor obtaining higher degrees of education and knowledge tend to adjust better aligned with technological change. Author Nelson-Phelp (1966) discusses how human capital and the effect of education on the process of technological evolution. Moreover, the theory contends that skilled workers are demonstrating higher complementarity with innovative measures in the labor market partially due to the accessibility of gaining extended knowledge aligned with the technology. Rapid technological changes are therefore hypothetically stated to be biased toward workers of higher knowledge (Nelson-Phelp, 1966, p. 70).

The hypothesis also aligns with the TFP slow-down since all sectors need to learn the mechanisms of the technology before efficient input, and output can be enforced. Whether the skill premium is constant or not is agreed upon. Nelson-Phelp (1966) indicates the transitionary measures meaning that the skills will eventually reach all labor though in different time frames which eventually will contribute to the ultimate output (Ibid, 1966: Violante, 2008, p. 4). This differs from Goldin and Katz (2007) indicating the constant disparity as a consequence of ongoing technological development. Therefore, the race between education and technology is of high relevance in the conversation of technological development. If the educational infrastructure would expand parallel with the integration of technology, the relationship between supply and demand of skilled workers would be balanced and prosperity shared.

Estimates of relative skill supplies in America are used to explain empirical evidence of transformations of skill premium by estimating substitution elasticity among different levels of education. The authors use a framework applied over almost the entirety of the twentieth century until the twenty-first century which indicates that the race was lost to technology from 1980 and onward, meaning an increase in skill-premium. The result reveals the slowdown in education correlated with the increased pace of technological advancement.

This demonstrates the central importance of education for supply (Goldin and F. Katz, 2007, 26-28).

4.1.3. Formulation 3: Labor structures complementarity (internal impact)

The third and final formulation describes the internal impact of technological progress. Similarly to the first formulation, it examines the direct effect on supply when innovations are increasingly integrating the labor market, however, this formulation focuses on internal reconstruction and is extended to include contemporary technological progress.

The formulation is based on the premise that increasing technological investments changes the organizational structure depending on the skill level of labor. This will be divided into two sub-formulations to reflect upon the monotonic relation between skill level and employment growth:

1. Technological change results in job displacement since it subsidizes less skilled workers due to an internally competitive environment.
2. The internal structure determines the complementarity of technological change in society (abilities to become skilled workers)

First, Milgrom and Roberts (1990) suggest that the reconstruction that follows integrating technology enterprises (especially ICT and computerization) triggers shifts in the hierarchical structure. Tasks and routines are reassigned and introduce a more flat structure among employees, though the adaptation to these new routines favors more adaptable workers obtaining more skills. Additionally, this is supported by Autor et al. (2003) providing microeconomic findings interpreted to demonstrate how technologies, especially ICT, substitute for unskilled labor in repetitive tasks at the same time as complementing workers with problem-solving and analytical skills. The occupational data reveals an exponential increase in non-routine analytic and interactive tasks relative to routine cognitive and manual tasks since the 1970s (Milgrom & Roberts, 1990, p. 525-527: Violante, 2008, p. 4: Autor et al., 2003). It is important to emphasize the main volatility in industries experiencing rapid technological development.

Second, the internal structure contributes to the complementarity rate and adaptive nature of the labor. Acemoglu (2002) states that Research and Development (R&D) incentives are determined by both internal and external factors. The driver of large and rapid revenues can indirectly increase disparities through directly not implementing adapting

measures of exposed industries (Acemoglu, 2002). Similarly, Brynjolofsson et al. (2023) state that the influence of AI tends to replace workers rather than empower them. In the context of automation productivity and financial gains, the people in control of the technologies amplify the market power. Furthermore, Acemoglu and Restrepo (2019) found through analytical statistics that robots replaced a substantial amount of workers in various industries between 1987 and 2016. Moreover, this promoted wage gaps and inevitably increased inequalities.

In contrast, Acemoglu and Restrepo (2019) describe how technological innovations (in the absence of automatization) to increase productivity, do not necessarily indicate substantial differential effects. Additionally, the positive opportunities of the accessibility of AI tools are demonstrated by Brynjolofsson et al. (2023). The usage of Generative AI has the potential to increase productivity with great heterogeneity and impact across labor. The contemporary study provided empirical evidence on how AI technologies in the workplace tend to complement workers and increase job opportunities and productivity. The largest effect is concentrated on the lower-skilled workers and has little effect on higher-skilled workers. The study additionally suggests that internal cooperation and communication developed among different levels of workers related to the theory of flattening hierarchy in the firm by Milgrom and Roberts (1990) and the third formulation (Brynjolofsson et al., 2023, pp. 1-2, 27-28, Acemoglu and Restrepo, 2019).

4.2. Hypotheses Based on the Theoretical Framework

Based on the theoretical framework of Skill-Biased Technological Change and the previously presented formulations (4.1.1. - 4.1.3.), the hypotheses this thesis aims to examine are:

RQ1. Have transformative technological shifts reshaped the structure, dynamics, and socioeconomic implications of the labor market in Guangdong and Sichuan?

Hypothesis 1 (H1):

> The structure, dynamics, and socioeconomic implications have been reshaped as a result of technological shifts changing the nature of labor demand.

RQ1.1. How can potential transformation be identified and explained in economic structures and socioeconomic implications?

Hypothesis 2 (H2):

> Formulation 1: The adoption of transformative technologies has increased the demand

for skilled labor relative to unskilled labor. Moreover, economic structures in both regions have been reshaped to favor industries and sectors that rely heavily on technological capital, resulting in a higher skill premium in the labor market. Furthermore, technological development has contributed to the widening income gap between industries and higher unemployment reflecting on capital-skill complementarity.

Formulation 2: The regions have experienced a growing disparity in skill premiums due to differences in educational attainment levels and their respective capacities to adapt to technological advancement.

Formulation 3: The implementation of technologies has resulted in job displacement for less skilled workers which has contributed to an incline in regional unemployment. The internal structure of the industries will be transformed favoring more skilled workers while substituting for repetitive and routine tasks in the late twentieth century, though with a higher capacity to complement different skill levels of labor in contemporary progress.

RQ2. What are the multifaceted parallels and disparities between the historical adoption of technology in the late twentieth century and the contemporary technological adoption in Guangdong and Sichuan?

Hypothesis 3 (H3):

Increased complementarity capacities in contemporary technological adoption is revealed in socioeconomic implications. However, more tangible disparities will be identified among the industries in contemporary adaptation due to the exponential pace of technology in the labor market which triggers larger gaps in the economic structure.

RQ2.1. What differences/similarities can be identified in the findings between the regions?

RQ2.2. How can potential differences and parallels be explained?

Hypothesis 4 (H4):

The similarities will be discovered in the trends of the initial increase of technological integration. The differences will primarily be revealed in contemporary technological development. Additionally, the gaps between the industries will be observed to be

larger in Guangdong than in Sichuan. The differences can be explained in educational infrastructure, implementation of regional development strategies, and current economic structure which contributes to variations in the pace and scale of technological adaptation in the respective region, shaping the socioeconomic trajectories and complementarity of technology.

5. Method

This section will introduce the methodology and analytical framework employed in the research serving as the template for the subsequent analysis. Moreover, the collection of both quantitative and qualitative data is included. The sources of the data are highlighted and discussed and criticized.

5.1. Methodology

This research intends to apply the typology of the mixed method of a sequential explanatory design with a dominant emphasis on the quantitative paradigm. The nature of the research objectives advocates for a fixed design of pre-determined indicators of quantitative data. The substantial element of quantitative data will incorporate statistical values of employment in China and the different regions from the late twentieth century to the present day. Indicators, of sectoral employment distributions, and unemployment rates, are examined accompanied by socioeconomic-oriented indicators, to assess the impact of technological revolutions on labor market outcomes. Statistical methods, including trend analysis and correlation analysis, are employed to identify significant patterns and relationships in the data (McBride, 2019: Robson & McCartan, 2016).

The qualitative resources consist of both context analysis focusing on a technological trajectory, and policy incentives relevant to the study and literature on technological complementarity throughout the time scope of the study. The resources are aligned with the aim to assist in analyzing and explaining the quantitative results. This phase aims to provide insights into the underlying mechanisms, factors, and dynamics shaping labor market changes and technological transformations. The qualitative resources will assist in the contextual understanding of quantitative measurements and results with the ambition to explain the identification of causal relationships.

Corroboration among both quantitative and qualitative data is applied through triangulation. The cross-validation intends to advocate for an in-depth explanation of results

and increase credibility and robustness. This is argued to be necessary due to the nature of the data in the selected context. By triangulating findings from both phases, this study aims to develop robust insights into the socioeconomic implications of technological transformations in economic zones across China (Robson & McCartan, 2016, pp. 100-101: 139: 178).

5.2. Analytical Framework

Research Questions	Quantitative Findings	Qualitative Explanations	SBTC
***RQ1*: Have transformative technological shifts reshaped the structure, dynamics, and socioeconomic implications of the labor market in Guangdong and Sichuan?** *1.1. How can potential transformation be identified and explained in economic structures and socioeconomic implications?*	Graphical demonstration of indicators presented in 5.2.1. RQ1.1. = Analyzation of Indicators 1-4 by applying Indicators 5-7 in the context of indicators 1 and 2	Apply qualitative resources from Context (2.1) and results from Literature Review (3.) to identify potential general and national explanations of graphical demonstration	Analyze the quantitative and qualitative data coherent with the graphical demonstrations from the SBTC perspective using the three formulations (4.1.1., 4.1.2., 4.1.3.)
RQ2: What are the multifaceted parallels and disparities between the historical adoption of technology in the late twentieth century and the contemporary technological adoption in Guangdong and Sichuan? *2.1. What differences/similarities can be identified in the findings between the regions?* *2.2. How can potential differences and parallels be explained?*	RQ2.1. Comparative analysis of the graphical demonstrations to identify variation and patterns.	RQ2.2. Apply qualitative resources from Context (2.2-2.4.) and results from Literature Review (3.) to discuss potential explanations and patterns of variation and similarities	Apply using the three formulations (4.1.1., 4.1.2., 4.1.3.) to assist in the historical comparative analysis of the findings between the regions.

Table 2: Analytical Framework

5.3. Data Collection

5.3.1. Quantitative Data

The data is collected through unobtrusive methods of existing values to answer the research questions. Furthermore, the *Quantitative* data will be accessed through databases and statistical yearbooks 1998-2023 from the National Bureau of Statistics of China, China Data Online, and the Sichuan Statistical Yearbook of 2020. To follow the theoretical framework of SBTC the key indicators that are examined are the following:

1. Number of people employed in each industry in Guangdong (primary, secondary, tertiary, % of the employed population) (1998-2022)
2. Number of people employed in each industry in Sichuan (primary, secondary, tertiary, % of the employed population) (1998-2022)
3. Registered Unemployed Persons (10,000 persons) and Unemployment rate (%)) in Urban Areas per Region (1990 - 2022)
4. Average Wage in Urban State-Owned Institutions per Region (yuan), (1995-2022)
5. Number of Total Enrollment of Students, Regular Primary Schools per Region (10000 persons) (2003-2022)
6. Number of Total Enrollment of Students in Higher Education Institutions per Region (10000 persons)(2003-2022)

Indicators 1 and 2 operate to answer the main research questions and Indicators 3-7 operate to assist in the analysis, discussion, and potential explanation of the results. Due to the large number of yearbooks the title of the indicators varies throughout the years. Furthermore, the presentation of the quantitative data will be through appropriate graphical presentations to be provided in the analysis of results.

5.3.2. Qualitative Resources

The qualitative resources will dominantly focus on the explanation of RQ1.1. and RQ2-RQ2.2 with included subquestions. It consists of regional historical trajectory, socioeconomic implications, policy changes, and political incentives and, disparities related to technological transformations presented in the context (2.1 & 2.2.). In Guangdong, secondary sources are used to gather information about policy changes deriving from the Chinese Academy of Social Sciences and the Hu Administration. In Sichuan, secondary academic sources are used to present the structural changes from national incentives. Additionally, the information from previous comprehensive research presented in the literature review (3.1.) of C-AIOE and AIOE will be applied to reflect upon the result of the quantitative findings. The two papers *"Labor Market Exposure to AI: Cross-country Differences and Distributional Implications"* and *"Gen-AI: Artificial Intelligence and the Future of Work"* by The International Monetary Fund (IMF) are summarized to identify findings applicable to the analysis of contemporary changes. Also, empirical studies by

Goldin and Katz (1998) and Kogan et al. (2021) on occupation complementarity are collected.

5.4. Methodology Limitations

The main methodological limitation primarily refers to the external validity and causality discussed in the introduction (see section 1.4.). In addition, the sequential explanatory design accompanies ethical considerations regarding the selection of the contexts and indicators. Moreover, McBride et al. (2019) confirmed the subjectivity in deciding and concluding both initial indicators and what findings to be analyzed with qualitative measures. The process of the method is also argued to be time-consuming due to the variation of data collected which further emphasizes the need for data selection and prioritization (McBride, 2019).

Furthermore, the collection of data is accompanied by limitations of availability. Moreover, statistics on rural unemployment and wages were absent which navigated the indicators towards a more urban perspective. Additionally, particular data for some indicators was not available such as earlier information on per strata allocation than 1998 which defines the time-scope of the research. Additionally, indicator 4 is provided every five years potentially resulting in the absence of crucial deviation. However, the paper argues for the robustness of the data to identify causal correlations and reflect upon potential explanations.

5.4.1. Source Criticism and Biases

As a result of the political landscape in China, the validity of national sources needs to be acknowledged. The main issue includes the possibility of data manipulation potentially generating distorted perceptions of the quantitative and qualitative findings. Moreover, the government of China has historically demonstrated tendencies to censor and suppress statistics and information to align desired narrative or agenda (Kabir & Marlow, 2021). This is associated with the notion that particular demographic segments have the possibility of generating inadequate representations due to incomplete or manipulated data. Additionally, the judicious utilization of secondary sources due to language barriers, mainly in the qualitative resources and the regional statistics of Guangdong, facilitates the replication of system intermediates. However, the study has prioritized possible single-transformed information. Moreover, the research is considering the political context and is undertaking an objective and transparent analysis of the collected data to mitigate risks of misinformation and biased findings. Additionally, the research highlights the aim of identifying correlations, themes, and patterns to reflect upon the general conclusions of the findings. The paper argues

for the potential of this due to similarities in political environment among the regions selected to indicate the reliability of the research, though, with smaller external validity.

6. Results

This section will graphically illustrate the outcomes derived from the quantitative data obtained through the collection (Appendix A) while also providing commentary on notable deviant findings pertinent to the analysis. These findings contribute to addressing both research questions, the elucidation of which will be subsequently expounded upon in the ensuing analysis (section 7).

6.1. Strata of Industry

The ensuing graphs (Figure 1 and Figure 2) elucidate the statistical representation of indicators 1 and 2 (Appendix A, Table 5, 6) presented in section 5.2.1. In Guangdong, the erstwhile dominance of Primary Industries (PI) ceased in 2004, yielding ground to Tertiary Industries (TI) (see Figure 1). Conversely, In Sichuan, PI retained its dominance until 2016, akin to the trajectory observed in Guangdong, subsequently ceding precedence to TI (see Figure 2). The decrease in PI between the years 1998 and 2022 is demonstrated with a parallel magnitude in both regions, registering a decrease of -30.9% in Guangdong and 26,8% in Sichuan. This underscores the variation in the pace of ascension observed in both secondary and tertiary industries.

Furthermore, secondary industries (SI) demonstrate a large role in Figure 1 (Guangdong) where it shifts from a slow decline to an increase in the years 2000-2011 with ≈ +16%, followed by a decline of approximately 7% between years 2011-2022. In Figure 2 (Sichuan) the manufacturing sector is rather constant providing approximately 20% of the labor force between the years 1998-2006, there is a slow incline between the years 2006 and 2018 with 7.2% followed by a rapid decrease of 4.5%. The industry is always the smallest in Sichuan.

Finally, TI provides a rather slow increase in Figure 1 (Guangdong) between the years 1998 and 2010 demonstrating about 6,7% followed by an abrupt decrease of -5.1% between 2010-2011 and finally continued with the exponential increase of an additional 19.2% until 2022. TI in Figure 2 (Sichuan) demonstrates a continuous linear increase of 14,5% between the years 1998 - 2018 with an additional incline between 2018 and 2021 with 7%. Afterward, employment in TI has declined by approximately 1%.

Additionally, the variation within the regional economic structure (see Table 3) is observed as demonstrably tangible in Guangdong in 2022 compared to Sichuan where the variation is mainly notable in 1998.

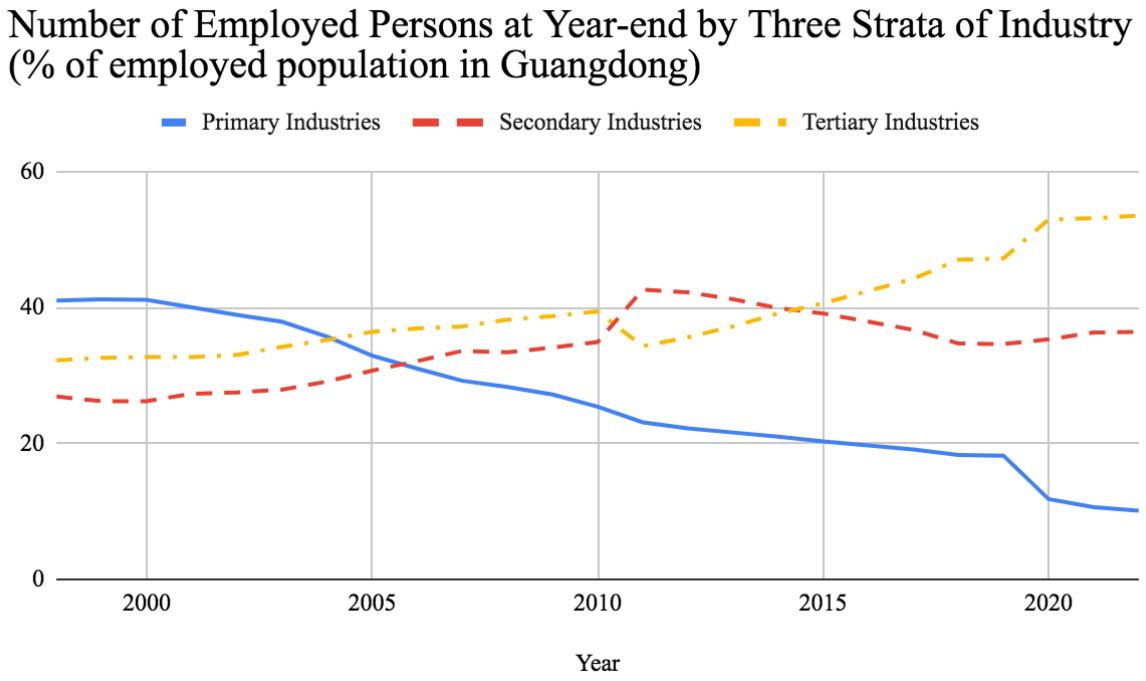

Figure 1: Number of employed Persons by three Strata of Industry and Region. Data Source: National Bureau of Statistics of China, China Statistical Yearbook: China Data Online.

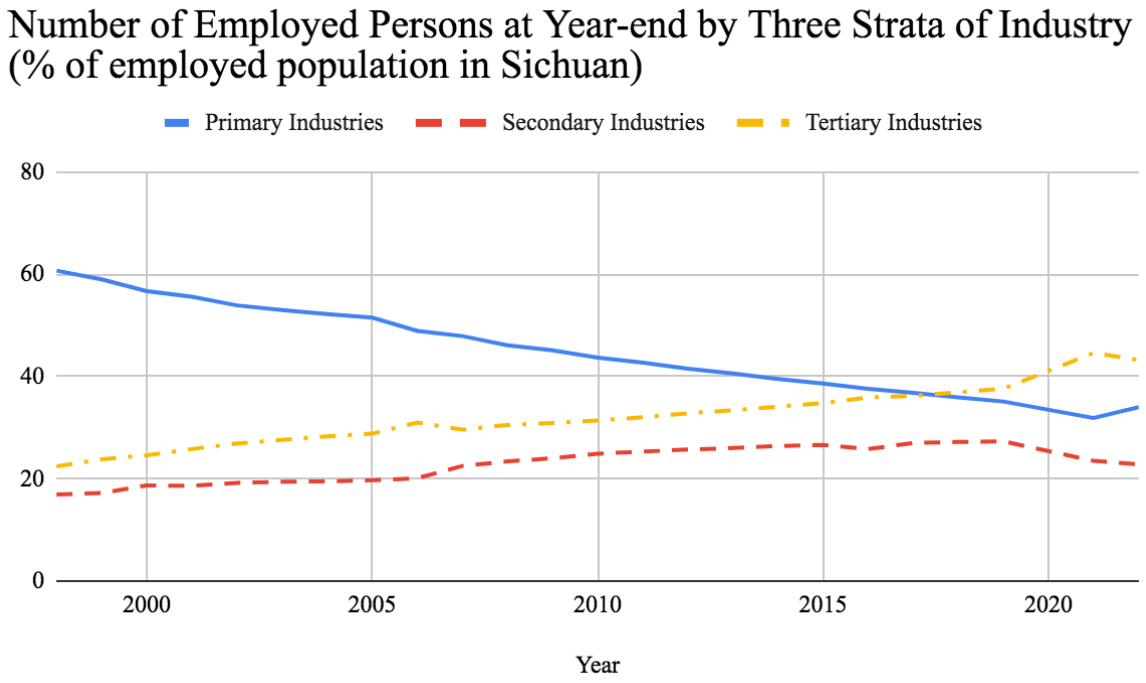

Figure 2: Number of employed Persons by three Strata of Industry and Region. Data Source: Sichuan Statistical Yearbook 2020. Statistical Bureau of Sichuan NBS Survey Office in Sichuan

Index	*1998*	*2022*
Guangdong	41: 26.9: 32.2	10.1:36.4: 53.5
Sichuan	60.7: 16.9: 22.4	34: 22.8: 43.2

Table 2: Economic Structure Allocation in the order Primary Industries, Secondary Industries, and Tertiary Industries in Guangdong and Sichuan (% of employed population). Data Source: National Bureau of Statistics of China, China Statistical Yearbook.

6.2. Socioeconomic Implication

6.2.1. Unemployment

The subsequent representations delineate the trajectory of unemployment in the regions encompassing various notable identifications. First, Guangdong exhibits a discernible escalation in the number of unemployed persons in urban areas from 1995 - 2003 (Figure 3). Complementary this increase mirrors statistically reported in the unemployment rate (Figure 4). Notably, there exists a relative constancy in unemployed persons between the years 2003 and 2020, accompanied by a marginal decline in the unemployment rate of approximately 0.6%. The statistics show a rapid increase of unemployed persons between years 2019 and 2022 with 19,3 with the main emphasis on the year 2021 though the unemployment rate registers a relatively minor increment of 0.2%.

Second, Sichuan presents an increase of 11.2 unemployed persons between the years 1995-2008 followed by a 3.24 decrease between 2008 - 2010. Furthermore, the number of employed persons significantly increased by 21.7 in the following six years. The unemployment rate notably between the years 1990-2008 with approximately 1%. followed by a decrease of 0.5% and a stagnate position until 2016 where the value declines almost 1% until 2022.

The principal differences discerned in the unemployment trends are the inclines in Guangdong in the 90s and early 2000s succeeded by a decreasing unemployment pattern. Conversely, Sichuan´s trajectory illustrates a more modest incline until 2010, after which a notable surge in the count of unemployed persons occurred synchronized with stagnant unemployment rates (Figures 3 and 4) Additionally, Guangdong demonstrates historically higher magnitudes of unemployed persons, juxtaposed with Sichuan's historical trend of declining unemployment rates (table 4). However, the main similarities include the incline of both regions' unemployed persons in urban areas (table 4) and the parallel decline in the

unemployment rate in 2016 (Figure 4). Finally, the rapid increase in unemployment values is argued to derive from the COVID-19 pandemic in 2020.

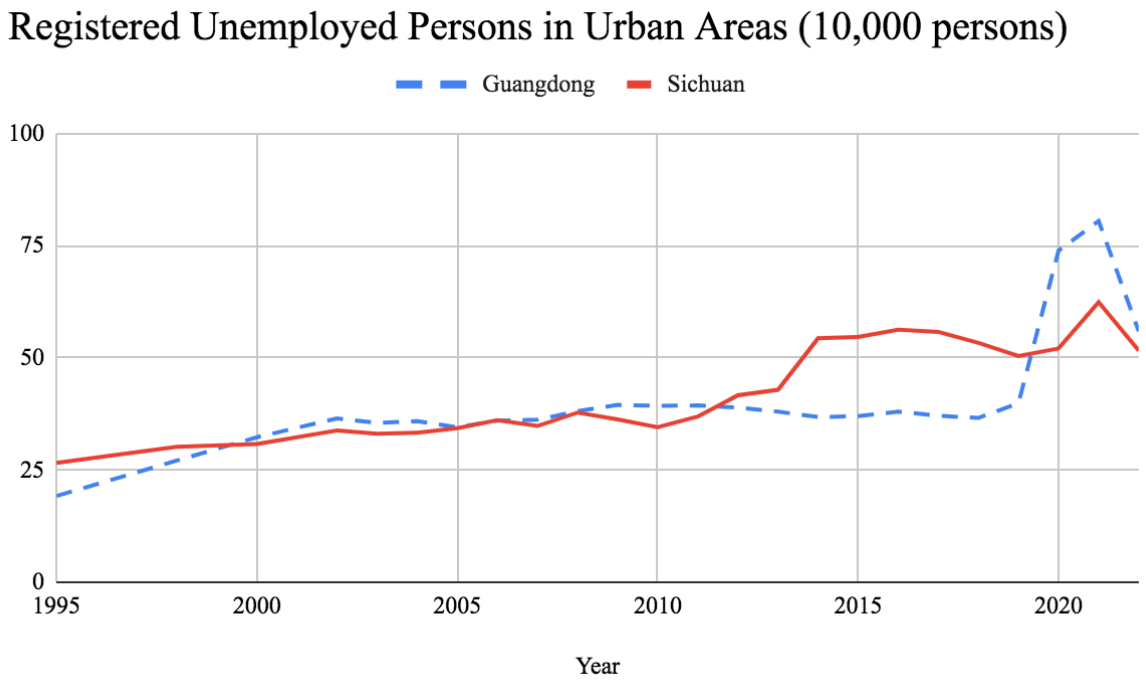

Figure 3: Number of Unemployed Persons in Urban Areas by Region. Data Source: Sichuan Statistical Yearbook 2020. Statistical Bureau of Sichuan NBS Survey Office in Sichuan: National Bureau of Statistics of China, China Statistical Yearbook.

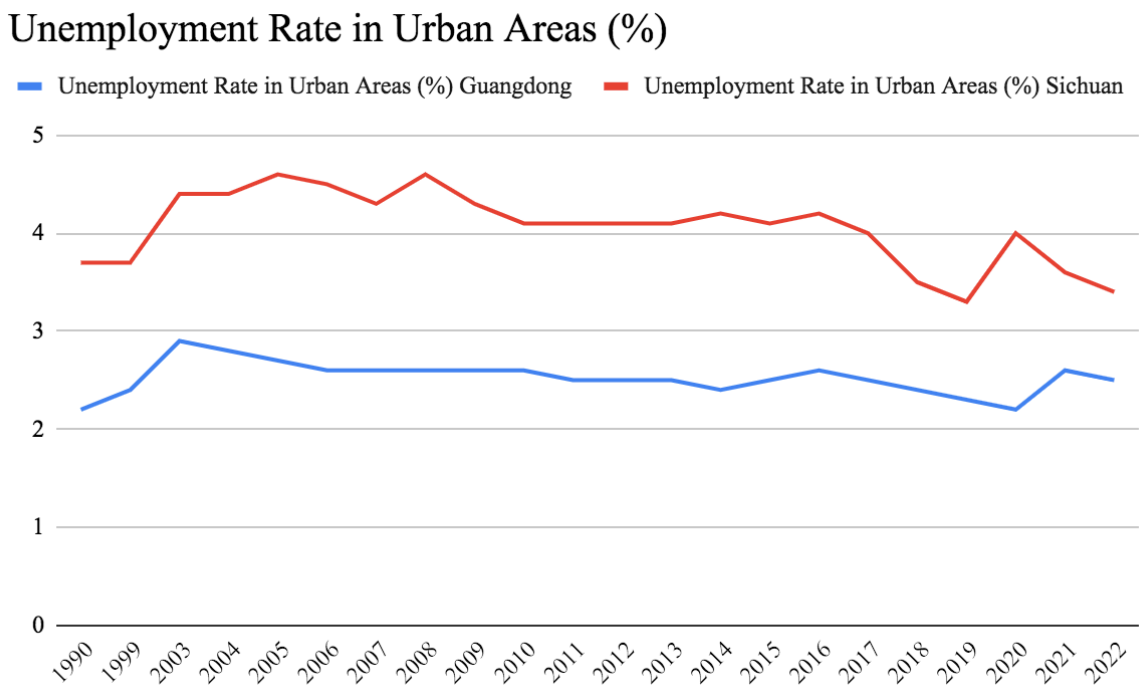

Figure 4: Unemployment Rate (%) in Urban Areas by Region. Data Source: Sichuan Statistical Yearbook 2020. Statistical Bureau of Sichuan NBS Survey Office in Sichuan: National Bureau of Statistics of China, China Statistical Yearbook.

Index	*1990*	*1995*	*2022*
Guangdong UER	2.2%		2.5%
Guangdong NUP		19.2 (10,000 persons)	55.9 (10,000) Persons
Sichuan UER	3.7%		3.4%
Sichuan NUP		26.6 (10,000 persons)	51.6 (10,000 persons)

Table 4: Unemployment Rate (%) (UER) and Number of Unemployed Persons (NUP) in Urban Areas Per Region. Data Source: Sichuan Statistical Yearbook 2020. Statistical Bureau of Sichuan NBS Survey Office in Sichuan: National Bureau of Statistics of China, China Statistical Yearbook.

6.2.2. Income and Educational Dynamics

The section delineates the outcomes of the transformation in socioeconomic dynamics directly affected by and directly affecting the labor market. First, Figure 5 and Figure 6 elucidate the wage differentials across state-owned urban units between the industries among the regions. It can be identified that a trajectory trend of escalating wage disparities through history between Tertiary Industries (TI) compared to SI and PI exists in regions. However, the pronounced wage differentials are predominantly palpable in Guangdong, notably after 2010 (Figure 5). Similarly, Sichuan demonstrates increasing variation among the industries after 2010, although with a less pronounced gradient. Noteworthy is the diminishment in wage differentials between the economic structures of TI and SI between 2016 -2020, however, the gap rapidly accelerated after 2020 while SI declined (Figure 6). Moreover, the salient observation entails the similarities among the regions in terms of a continuous spectrum of industry wages of TI, SI, and PI, counted from higher to lower average wages, and, how the TI is demonstrating a significant gap to SI in 2022.

Furthermore, the educational data reveals a downward trend in primary school enrollment for both regions between years 2002-2013 (figure 7). Nonetheless, disparities are evident, notably in the tangible larger number of primary enrollment, where enrollments in Guangdong reached approximately 250 (10,000) more than in Sichuan until 2013, after which the gap continuously widened to about 500 (10,000) more enrolled students in 2022 in Guangdong. Additionally, Guangdong exhibits higher values in enrollment in higher education institutions compared to Sichuan. Nevertheless, both regions demonstrate a congruent trajectory of increasing enrollments. However, the gap has been continuously increasing since 2005(Figure 7) (see Appendix B, Fig. 10 for more elucidated results).

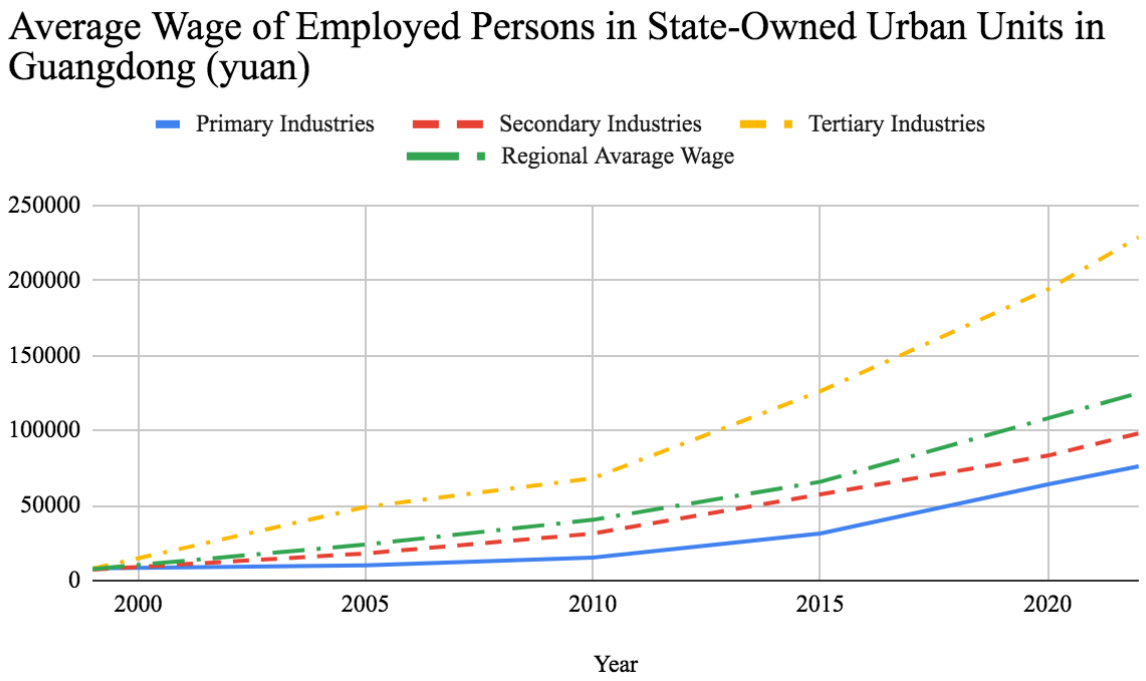

Figure 5: Average Wage and Number of Employment in Urban State-Owned Institutions. Data Source: National Bureau of Statistics of China, China Statistical Yearbook.

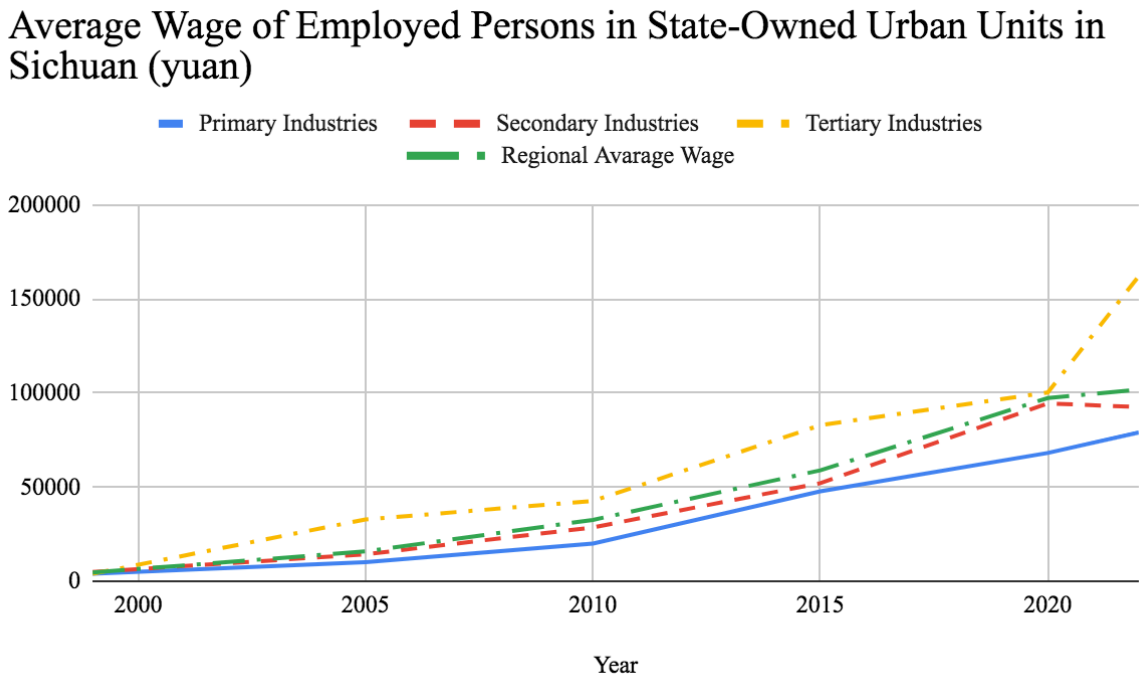

Figure 6: Average Wage and Number of Employment in Urban State-Owned Institutions. Data Source: Sichuan Statistical Yearbook 2020. Statistical Bureau of Sichuan NBS Survey Office in Sichuan

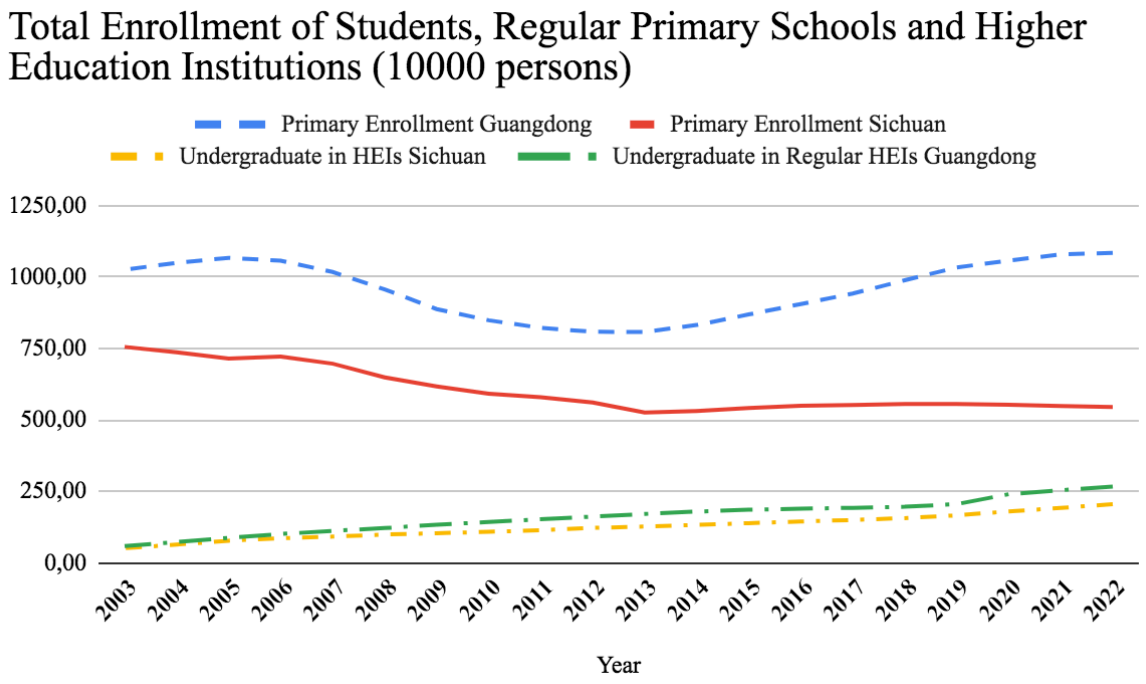

Figure 7: Education Enrollment - Number of Total Enrollment of Students in regular Primary Schools and HEI (10000 persons). Data Source: National Bureau of Statistics of China, China Statistical Yearbook

7. Discussion and Analysis

In this part, the quantitative results (section 6.) will be analyzed and discussed to assess the extent to which they support or refute the hypotheses delineated in section 4.2. Additionally, the application of indicators 5 to 7 will serve as potential explanations and reflections of the results observed in indicators 1 to 4. Moreover, qualitative resources will be integrated to provide explanatory insights to align with the aim of the study. RQ1 will be analyzed in a general perspective including a reflection of the SBTC- hypotheses (See section 4.2.) based on the findings. Moreover, the analysis of RQ2 will predominantly center on explanatory dimensions from a comparative perspective.

7.1. The Relationship between Economic Structures and Technological Development

The paper argues that the shifts in economic structures can be explained by the incentives of technological change supporting the first hypothesis of RQ1. In other words, the political incentives promoting technological development in both regions can be identified in shifts in the results (see Figure 1 and Figure 2). The identification of increased demand for labor in the tertiary and secondary sectors is aligned with the continuously increasing technological

development demonstrated in 2.2. and 2.3. Additionally, it can be argued that the changes in economic structures are observed with the values related to unemployment, income disparities, and educational participation.

7.1.1. Reflection upon Hypotheses (RQ1)

As previously mentioned (Section 7.1.), hypothesis 1 (H1) is argued to be backed in the measures of the paper. Furthermore, hypothesis 2 (H2) is now discussed to be both supported and disproved in the subsequent formulations.

> H2 - Formulation 1: Transformative technologies are argued to partially increase the demand for skilled labor. First, skilled labor is identified to be in a beneficial position in technological transitions, both in the late twentieth century, but also in contemporary technological adaptation. However, technological innovations do not necessarily only rely on skilled labor, but also on the quantity of labor for that particular industry and technology. In other words, capital-augmenting equipment increases labor demand absent of skill level. This is mainly observed in Guangdong after the year 2000 and Sichuan after 2010 (Figure 1-2). However, the skill biases are argued to be enhanced and definite in the period before this (Figure 3-4).
>
> Formulation 2: When looking at Figure 3 - 7, one can identify the absence of a theme among educational enrollment and unemployment in both regions. However, a potential correlation can be identified between increased education (HEI) and an increasing gap in wages (urban state-owned units) among TI and the other labor sectors. As presented by Holz (2020) and Cheng (2018) in 2.2. and 2.3, both regions have experienced increased income disparities among the population. This paper therefore draws the conclusion that integration of increasingly contemporary technologies likely generates exponentially increasing income inequality among the economic structures, due to skill-premium, however, not necessarily increasing unemployment in the long run.
>
> Formulation 3: This paper argues for the corroboration of the hypothesis on the premise that the major incentives of technological incentives is correlated with unemployment (Figure 1 - 4) which can be explained with subformulation 1, however,

contemporary advancement does not indicate rising unemployment for this particular research, which can be explained by sub-formulation 2 (section 4.1.3.).

7.2. Comparative Explanatory Analysis

As mentioned in the previous section (7.1) shifts in the economic structure is argued to be correlated with technological integration in the labor market. However, as presented in Figures 1-4, one can identify differences between the regions over time. The paper will now break down the deviating findings presented in section 6 and apply indicators 5-7 and the qualitative resources to provide potential explanations through a comparative perspective within the formulations of the theoretical framework of SBTC. Furthermore, the analytical framework (5.2.) will be used in terms of the order of the analysis. In other words, the analysis will operate in the following order: quantitative identification, contextual qualitative explanations, qualitative reflection of literature review, and the structural outcome from the perspective of SBTC.

7.2.1. Guangdong - Explanatory Analysis

In Guangdong, the historical adaptation to technology is deeply intertwined with economic reforms. As stated by Cheng (2018), the region is the earliest national financial powerhouse. Moreover, Guangdong had already initiated technological incentives in the late twentieth century together with SEZs which facilitated an influx of FDI fueling the export-oriented industries and therefore directly increasing labor in secondary industries (SI) and tertiary industries (TI). This could explain the relatively small gap between the industries in 1998. The rapid decline of primary industries by 30.9% between 1998-2022 (see Appendix A: Table 5.) can partially be explained by the usage of land to prioritize industries (Chang, 2018: Laurence & Chusheng, 1993)(Figure 1).

Nevertheless, one can identify the increase of TI and mainly SI accompanied by an increase of the number of unemployed persons in urban areas and in the unemployment rates (see Figures 3 and 4). Whereas the values of unemployment are substantially increasing with 17,3 (10,000 people) and 0.7% in 2003 reaching the highest unemployment rate for the years examined in this paper. It can be discussed that the combination of enhanced reforms for intensive labor policies (Cheng, 2018), accompanied by weak foundations of the developing industries (Wuttke, 2011) resulted in increased unemployed persons.

Additionally, the incentives of the industrial and scientific campaign in 2008 “Decision on the Acceleration of the Promotion of a Modern Industrial Structure” and 2010 “Overall Planning of Guangdong Modern Industrial Structure” could potentially explain the increase of SI from TI, in 2011. However, the shift was short since the previous trajectory of TI demonstrated a more exponential line in the years after as SI was declining. Since there are no signs of this in the unemployment values, this paper suggests that this can be explained by a labor shift of SI employees towards TI indicating industrial complementarity.

In the context of the SBTC formulations, this paper argues that the increased unemployment has the potential to be explained from three angles. First, as presented by Acemoglu and Restrepo (2019) automation reduces labor shares which naturally substitutes labor. However, this refers to only labor-augmenting equipment which this paper first argues upon. Second, the intensive catch-up economy did not emphasize education (Wuttke, 2011) which further aligned with the theory of little complementarity possibilities presented by Nelson-Phelp (1966). Third, internal structures were weak due to rapid development (Wuttke, 2011) which replaced rather than empowered workers as presented in Formulation 3 by Milgrom and Roberts (1990) among others. Furthermore, the knowledge-based development objectives for sustainable development initiated in the early 2000s, 2008 and 2010 could potentially explain the decrease in unemployment from 2003 to 2022 even though no notable changes in the trajectory of the labor market and population growth (Appendix B, Figure 8). Additionally, this partially aligned with the production function (see formulation 1) indicating that the demand for skilled labor is increasingly synchronized with equipment capital. In other words, due to the increased education enrollment (Figure 7), skilled labor increased which enhanced complementarity instead of labor substitution. This can be seen as a shift from labor-augmenting equipment to capital-augmenting equipment. Furthermore, this emphasizes the importance of education in complementarity abilities due to the ongoing progress of technology highlighted by Goldin and Katz (2007).

7.2.2. Sichuan - Explanatory Analysis

Comparatively, the primary industries (PI) in Sichuan obtained the role of the largest sector until 2018 also indicating a less dramatic increase in Secondary Industries (SI) and Tertiary Industries (TI). This can be explained by the emphasis of the comparative advantage dependent on the environment in the region. Furthermore, even though the objectives presented by McNally (2004) initiated technological and industrial development,

sustainability in the primary sectors was encouraged. However, increasing urbanization accompanied by increasing labor demand in SI and TI decreased the values of PI (Appendix A, Table 6).

Furthermore, compared to Guangdong, labor allocation in the SI was significantly smaller and relatively stagnant. This could be explained by the main emphasis on PI and TI due to advantageous benefits, increasing education focusing on technological skill (figure 7), and little comparative advantage in labor-intensive manufacturing as in many national SI (Such as Guangdong) (McNally, 2004: Holtz, 2020). Moreover, the small increase of 7.2% in SI between 2006-2018 decreased with -4.5% in 2018-2022. This is argued to have two potential explanations. First, the displacement of workers due to contemporary technologies (AI) presented by Pizzinelli (2023) and Cazzangia (2024) since the transformation of the economic structure increases regional AIOE-indexes. Second, a labor shift towards tertiary industries due to higher C-AIOE and therefore complementarity abilities across the industries.

Parallel with the decrease, Tertiary Industries (TI) increased. Moreover, the development objectives (McNally, 2004) were highly aimed at the synchronization of technological development and the ICT revolution. Furthermore, as demonstrated by MoFA (2017) the objectives developed initiated High-Tech Zones (HTZ) and Free-Trade Zones (FTZ) which potentially could explain the linear incline. Also, the benefits attracted talents and researchers which increased the labor force.

Nevertheless, the impact of the technologically focused political campaigns initiated in 2000, can potentially be identified in the substantially increasing unemployment values between 2000-2008 (Figure 3, Figure 4). The increase could partially be explained by a later effect of the objectives or the major increase of private enterprises in the service sector between 2008 and 2015. Nonetheless, after 2016 the unemployment values substantially decreased, notably the unemployment rate, as a result of increasing urbanization (Appendix A, Table 3 & 4). Moreover, looking at the economic structure, one can identify a rapid increase in TI and a parallel decline in SI (Figures 2, 3, and 4). This paper discusses that the reason for the decreasing unemployment rate can be explained by a labor transformation towards TI and PI. Moreover, this shows values of higher complementary abilities of contemporary technologies (C-AIOE) due to skill and adaptation capacities such as previous experiences and increased education (Figure 7).

Additionally, in the perspective of SBTC, the late downfall of SI could potentially be explained by the higher complementarity capacities such as education (Figure 7) and the creation of new jobs to empower workers presented by Brynjolofsson et al. (2023) in formulation 3. The decreasing unemployment rates can potentially indicate a labor shift, which could be explained by the creation of jobs in TI related to SI due to skill complementarity. Also, this paper reflects upon the increasing internal structures where the complementary not only exists among labor and technology but that it stretches across the industries. Furthermore, as demonstrated by the decrease in SI after 2018 and the parallel increase in TI, one can discuss that the adaptation was simplified due to previous skills. The thesis highlights the acknowledgment of human capital in formulation 2 and the second sub-formation in formulation 3.

The rapid increase in the unemployment rate and unemployment persons after the initiation of the objectives can be explained by increasing labor-augmenting equipment (formulation 1), a smaller share of people obtaining an education (Figure 7)(Formulation 2), and unfavorable internal structures towards labor (formulation 3.) Finally, the shifts in PI towards SI are explained by the increase in capital-augmenting equipment generating increasing demand in SI and TI, as presented by Acemoglu and Restrepo (2018). However, this potentially shifted towards more labor-augmenting equipment in the SI, though not in TI, again highlighting the cross-industry complementarity.

7.2.3. Final Discussion of Hypotheses and Identified Patterns

Sections 7.2.1. and 7.2.3. elucidates themes, correlations, and disparities among the regions through time. The main identification will now be discussed against each other to support or disprove hypotheses 3 - 4.

The third hypothesis (H3) is partly supported by the premise of observations in Figure 1, suggesting larger gaps across the industries in both labor allocation and income (Figure 5-6) in Guangdong, thus, not in Sichuan (Figure 2) referring to confirmation of (H4). Moreover, Sichuan is additionally demonstrating fewer income disparities than in Guangdong, the correlation between industry gaps and income disparities is therefore notable. However, a similar complementarity increase is identified in both regions through different times due to the variation in unemployment (Figures 3 & 4). Additionally, it can be discussed that the gaps between the industries eventually will increase in Sichuan similar to the trajectory of Guangdong's increasing income disparities.

Nonetheless, H4 is partly disproved. This paper argues that the differences are not revealed in contemporary technological development but in the time spectrum and the socioeconomic effects. Moreover, Sichuan is demonstrated to present more scattered findings than Guangdong. Even though the amount of unemployed persons in the regions can be explained by increased urbanization. The differences between the regions are tangible, this paper discusses on the premise of Formulations 2 and 3, that the cause of this can be explained by the regional skill availability in the sectors and therefore complementarity abilities. Additionally, the decrease in SI in the later years of the study in Sichuan together with increasing other sectors could potentially explain the decreasing unemployment values. In contrast, Guangdong is demonstrating higher values of SI which could explain the increasing unemployment rate (Table 4, Figure 3). Therefore, this paper reflects upon the main volatility of the SI in technology and labor displacement.

However, notable in both regions, the unemployment values are decreasing together with increasing skill, even though contemporary technology is rapidly increasing in society such as AI. Moreover, this potentially confirmes Nelson-Phelps's (1966) theory (formulation) on how the valuable skill eventually will reach the entire society, however, as mentioned by Goldein and Katz, one correlation notable is how the “education against technology race” is already lost which further increases disparities, potentially observed in Figure 5 and 6.

Furthermore, the paper acknowledges the deviating results deriving from the pandemic in 2020 and is not commenting on the outcomes of this, but recognises the large impact of unemployment. Additionally, the thesis highlights the absence of data on the rural population (Figures 3-6) due to little data availability.

Finally, from the perspective of AIOE and C-AIOE, one can determine that even though Sichuan is demonstrating characteristics of lower AIOE values in terms of finding economic structure (see findings 1,5 and 6 in section 3.1.), the C-AIOE values are also smaller. Comparing this to the findings in Guangdong, and related unemployment values (Figures 3 and 4) this paper concludes that the C-AIOE is dominant in the regions in this study.

8. Concluding Remarks

To conclude, technological transformations have been observed to significantly directly alter employment patterns and demonstrate indirect socioeconomic impacts. The study underscores the complexity of assessing these changes due to substantial variation of

perspectives and objectives. However, the material of the research has generated notable trends and correlations aligned with the aim and research questions.

First, the earlier stages of technological development investigated in the paper indicate trends of labor displacements primarily explained by skill biases and premiums aggravating inclusive complementarity measures. Moreover, earlier technological implementations demonstrate increasing unemployment rates potentially related to increasing labor-augmenting equipment. Therefore, this paper concludes the presence of higher skill biases in the early stages of technological adaptations. However, this is dependent on contextual economic structure. As presented in 2.2., Guangdong focused on labor-intensive industries which resulted in smaller unemployment values, though, with increasing income disparities (Cheng, 2018: Figure 5).

Second, this paper highlights the observation of the potential relationship between capital-augmenting equipment and labor-augmenting equipment. Capital-augmenting technologies allow labor to develop skills that enhance complementarity, fostering better positions for future development. Conversely, labor-augmenting equipment is argued of a historically increasingly skill-biased nature. On the other hand, labor-augmenting capital is argued to mainly be skill-biased towards labor without educational capacities in the contexts of the research. Additionally, this can be applied the other way around, whereas labor-augmenting equipment could adapt into capital-augmenting equipment as skills and complementarity are increasing.

Third, rapid technological integration potentially aggravates the maintenance of stability of socioeconomic implications. Trends of this are demonstrated in regional unemployment This stresses the need for adaptive measures and careful analysis to ensure sustainable complementarity capacities rather than labor substitution. However, the development also correlates with increasing educational measures further generating greater complementarity possibilities. Moreover, this is supported by the identifications on the education and technology relationship. Moreover, the paper concludes the partial correction by Nelson-Phelp (1966) indicating an eventual hegemony between technology and skill which can explain the decrease in unemployment. However, the thesis also concludes the reality of Goldin and Katz (2007), indicating a constant gap due to constant technological development, possibly explaining the correlation of increasing education and income disparities.

Furthermore, when reflecting on disparities, the thesis found a correlating relationship between income inequalities among industries and increasing technological integration.

However, no relationship between income inequalities and unemployment values was identified. Therefore, the paper concludes that complementarity does not necessarily include declining disparities. Additionally, the paper reflects upon the exponential increase of technology and its potential impact on income disparities. This could potentially be explained by the theory of Brynjolofsson et al. (2023) indicating the creation of new jobs and cross-industrial complementarity, however, with a hierarchical internal structure. Moreover, this further suggests the environment of higher skill premiums in contemporary development rather than skill biases.

In the context of the theoretical framework of Skill-biased Technological change, the paper found that the theoretical underpinnings, demonstrated by Violante (2008), partially align with the findings dependent on time period and capacities. However, the thesis highlights the possibilities of various explanations and emphasizes the inclusion and consideration of all formulations. Finally, also mentioned by Violante (2008) technological development is concluded to be favoring a subgroup of workers. However, this group argues for a transformative nature depending on skill level, context, and labor industry. This further demonstrates the importance of updated research to follow the outcome of consciousness technological development.

To conclude, the observations show the importance of acknowledging the nature of the technical advancements, the context capacity, and internal and external dynamics when determining technological complementarity. Furthermore, the paper recognizes the constant presence of skill-premium and/or biases, either in income disparities or employment patterns. Finally, as articulated by Heraclitus, the only constant in life is change, however, the paper emphasizes the exponential trend of technological change. By arguing for the increasing magnitude of technology in the constant present, future researchers must persist in exploring the complex relationship to mitigate adverse effects and harness the full potential of technological progress for inclusive and equitable growth.

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10. Appendix A

Table 5: Number of Employed Persons at Year-end by Three Strata of Industry (% of the employed population in Guangdong)

INDEX	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Primary industries (% of employed population)	41	41,2	41,1	40	38,9	37,9	35,7	32,9	31	29,2	28,3	27,2	25,4	23,1	22,2	21,6	21	20,3	19,7	19,1	18,3	18,2	11,8	10,6	10,1
Secondary industries (% of employed population)	26,9	26,2	26,2	27,3	27,5	27,9	29,1	30,7	32,1	33,6	33,4	34,1	34,9	42,6	42,2	41,2	39,9	39,1	37,9	36,7	34,7	34,6	35,3	36,3	36,4
Tertiary industries (% of population)	32,2	32,6	32,7	32,7	33	34,2	35,2	36,4	36,9	37,2	38,2	38,7	39,4	34,3	35,6	37,2	39,1	40,6	42,4	44,2	47	47,2	52,9	53,1	53,5

Table 6: **Number of Employed Persons at Year-end by Three Strata of Industry (% of the employed population in Sichuan)**

INDEX	**1990**	**1994**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2021**	**2022**
Primary industries (% of employed population)			60,7	59	56,7	55,6	53,9	53	52,2	51,5	48,9	47,9	46,1	45,1	43,7	42,7	41,5	40,6	39,5	38,6	37,6	36,8	35,9	35,1	31,9	34
Secondary industries (% of employed population)			16,9	17,2	18,7	18,6	19,2	19,4	19,5	19,7	20,1	22,5	23,4	24	24,9	25,3	25,7	26	26,4	26,6	25,8	27	27,2	27,3	23,5	22,8
Tertiary industries (% of population)			22,4	23,8	24,6	25,8	26,9	27,6	28,3	28,8	31	29,6	30,5	30,9	31,4	32	32,8	33,4	34,1	34,8	35,9	36,2	36,9	37,6	44,6	43,2

Table 7: Registered Unemployed Persons in Urban Areas (10,000 persons)

Year	1995	1998	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Registered Unemployed Persons in UA (10,000 persons) Guangdong	19,2	27,1	32,3	36,5	35,5	35,9	34,5	36	36,2	38,1	39,5	39,3	39,4	38,9	38,00	36,80	37,00	38,00	37,10	36,60	39,90	73,9	80,5	55,9
Registered Unemployed Persons in UA (10,000 persons) Sichuan	26,6	30,18	30,79	33,82	33,1	33,3	34,3	36,1	34,8	37,8	36,28	34,56	36,93	41,67	42,87	54,36	54,64	56,26	55,78	53,31	50,4	52,1	62,4	51,6

Table 8: Unemployment Rate in Urban Areas (%)

Year	1990	1999	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Unemployment Rate in Urban Areas (%) Guangdong	2,2	2,4	2,9	2,8	2,7	2,6	2,6	2,6	2,6	2,6	2,50	2,50	2,50	2,40	2,50	2,60	2,50	2,40	2,30	2,20	2,60	2,50
Unemployment Rate in Urban Areas (%) Sichuan	3,7	3,7	4,4	4,4	4,6	4,5	4,3	4,6	4,3	4,1	4,1	4,1	4,1	4,2	4,1	4,2	4	3,5	3,3	4	3,6	3,4

Table 9: Average Wage of Employed Persons in State-Owned Urban Units in Guangdong (yuan)

INDEX	1999	2005	2010	2015	2020	2022
Agriculture, forestry, animal husbandry, and fishery	8142	10163	15270	31380	64023	76074
manufacturing (yuan)	7286	18019	31277	57419	83201	98026
Technical services/ information transmission, Software and information tech (yuan)	7927	48972	68204	126083	193867	228692
Average Wage	7663	23959	40432	65788	108045	124912

Table 10: Average Wage of Employed Persons in State-Owned Urban Units in Sichuan (yuan)

INDEX	1999	2005	2010	2015	2020	2022
Agriculture, Forestry, Animal Husbandry, and Fishery	3919	10152	19980	47729	68143	79016
Manufacturing	4877	14275	28577	52110	94452	92572
Information Transmission, Software and Information Tech	3888	32828	42615	82883	100248	162081
Average Wage	4639	15826	32567	58915	97330	101800

Table 11: Total Enrollment of Students, Regular Primary Schools and Higher Education Institutions (10000 persons)

INDEX	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003
Guangdong Number of Total Enrollment of Students, Regular Primary Schools(10000 persons)	1084,05	1079,00	1057,11	1033,43	988,37	941,96	905,22	868,88	831,91	807,94	808,24	822,06	848,55	887,65	956,47	1017,62	1056,99	1067,03	1049,62	1025,37
Sichuan Number of Total Enrollment of Students, Regular Primary Schools(10000 persons)	545,02	549,00	552,91	555,77	555,46	551,84	549,52	541,74	531,32	525,95	560,74	579,80	592,11	617,05	648,82	696,53	721,78	714,51	736,58	755,43
Sichuan Undergraduate in Regular HEIs (10000 persons)	205,15	192,00	180,09	166,17	156,47	149,97	144,66	138,79	132,83	127,08	122,37	113,93	108,62	103,59	99,11	91,84	86,06	77,54	63,73	51,27
Undergraduate in Regular HEIs(10000 persons)	267,09	254,00	240,02	205,40	196,32	192,58	189,29	185,64	179,42	170,99	161,68	152,73	142,66	133,41	121,64	111,97	100,86	87,47	72,69	58,78

11. Appendix B

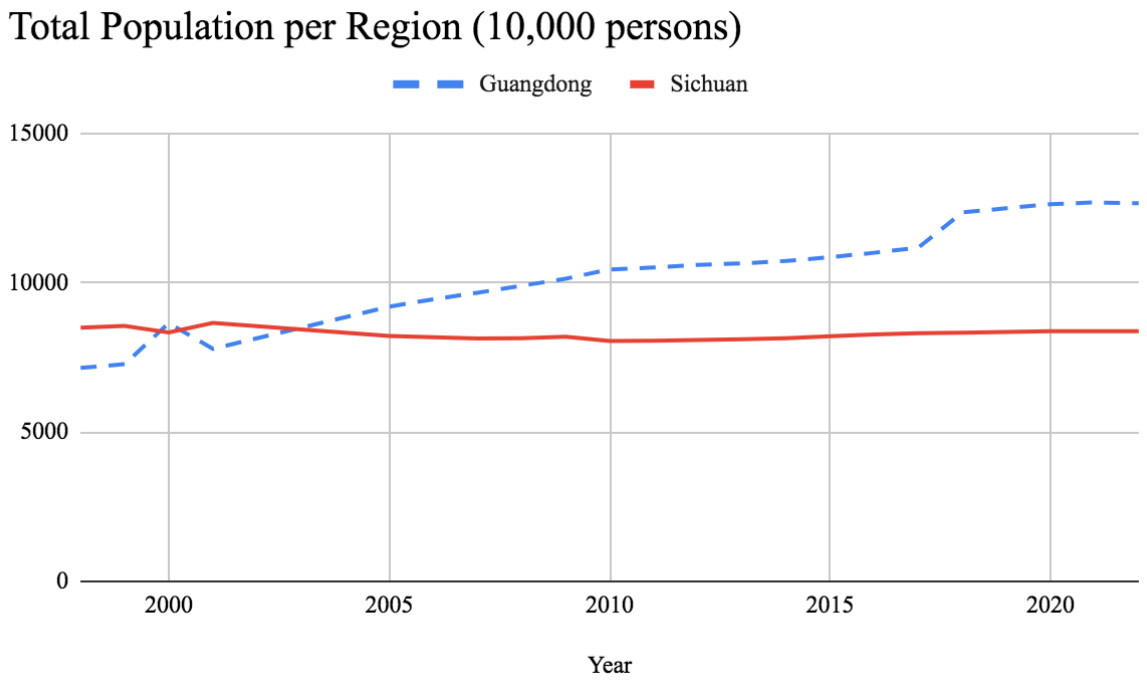

Figure 8: Total Population per Region (10,000 persons) Data Source: National Bureau of Statistics of China, China Statistical Yearbook

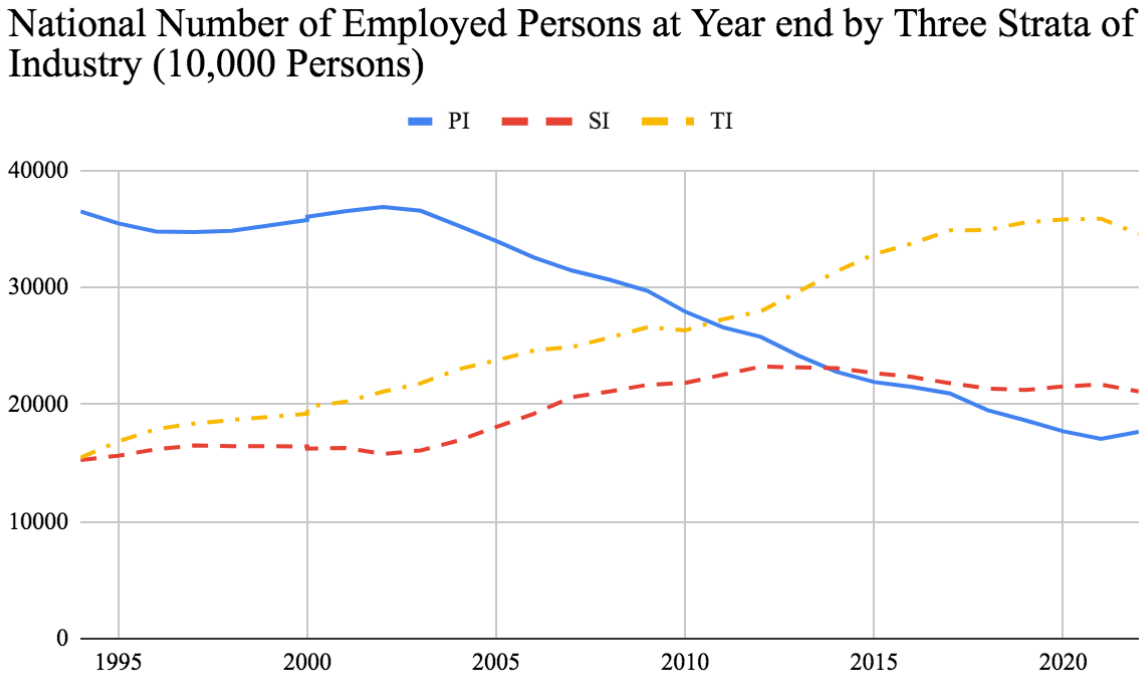

Figure 9: Employed 10,000 people per industry in China. Data Source: National Bureau of Statistics of China, China Statistical Yearbook 2023, 2020, 2016, 2010, 2005, 2002, 1999. PI = Primary Industry, SI = Secondary Industry, TI = Tertiary Industry

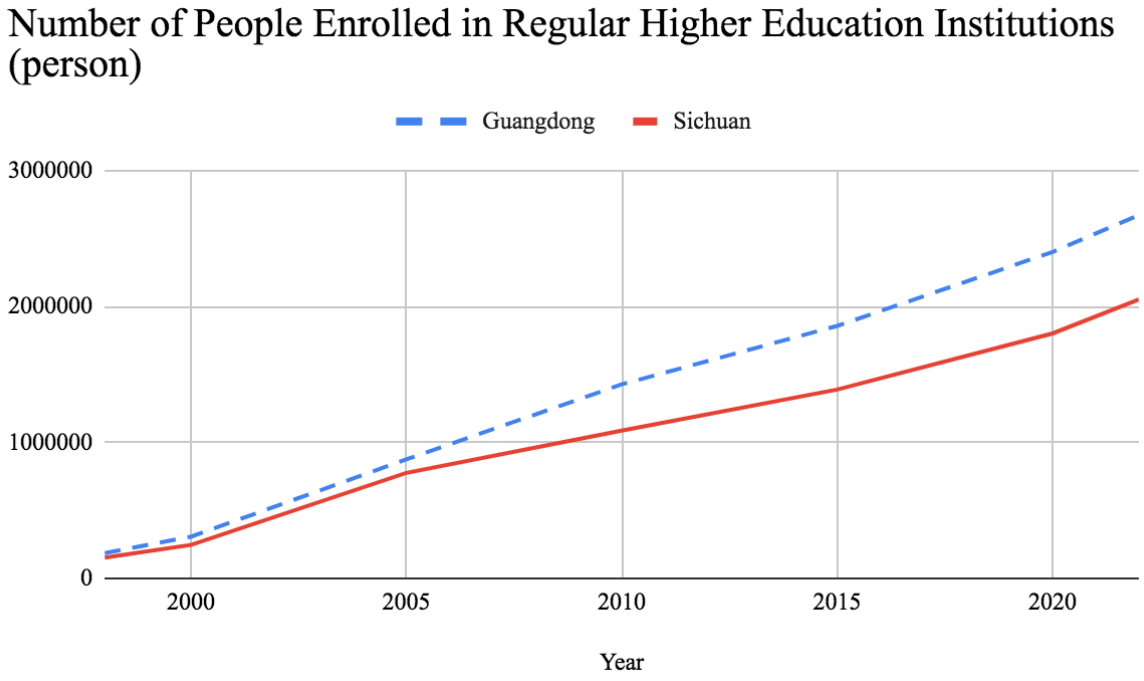

Figure 10: Education Enrollment - Number of Total Enrollment of Students in HEI (10000 persons). Data Source: National Bureau of Statistics of China, China Statistical Yearbook