BEYOND CONVERGENCE: SPACE, SCALE, AND REGIONAL INEQUALITY IN CHINA

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ABSTRACT

Since the late 1980s there has been a renewed interest in regional inequality, fuelled by the concern over the effects of globalisation and liberalisation, and facilitated by theoretical and methodological developments in geography and economics. In essence, the new convergence theory, like the old convergence theory, is another theory devoid of space and time. Research on China has unfolded a complex landscape of regional development, the existence of distinct models of regional development, and the significant role of institutions. This paper examines regional inequality in China, especially Zhejiang Province, and attempts to uncover the trend and driving forces of regional inequality. It adopts a top-down and bottom-up strategy and employs recent developments in exploratory spatial data analysis (ESDA) and geographically weighted regression (GWR). We have found that regional inequality is sensitive to geographic scales and spatial organisation, and that conventional approaches mask spatial agglomeration and the significance of regions in shaping trends of regional inequality. Overall, regional inequality in Zhejiang rose during the reform period and a division between coastal and interior Zhejiang formed, additionally sustained by weak linkages between the two regions and the significance of location and nonstate enterprises in development. This paper further reveals the emergence of Wenzhou, and discusses its effect on regional inequality.

Key words: Regional inequality, the Wenzhou model, China, ESDA, GWR

INTRODUCTION

Jared Diamond’s (1997) award-winning book Guns, Gems, and Steel was inspired by Yali’s question: ‘Why you white men have so much cargo and we New Guineans have so little?’ This question is not just for New Guineans, but a question fundamental to human society. Naturally, it is a geographical question as well. Questions on regional or spatial inequality lie at the heart of the discipline of geography and are also a major concern of governments, particular in former socialist countries influenced by socialist ideology and currently under reform. The new convergence theory developed by Barro and Sala-i-Martin (1991, 1992) has become a mainstream theory of economic growth and regional inequality.

Issues of regional/spatial inequality have been particularly important in China. The failure of state socialism prompted the launch of economic reforms in 1978, and since then, China has been undergoing profound change. During 1979–2004, China’s annual growth rate of GDP was 9.4 per cent and its industry grew at 11.3 per cent annually. China has quickly emerged as a
world-manufacturing/assembly centre. However, there are various layers and dimensions to the transition, and scholars have been very concerned with the social and spatial ramifications of reforms. Research on China has unfolded a complex landscape of regional inequality, and the significance of globalisation, institutions, and local agents in regional development (e.g. Fan 1995; Lin 1997; Wei 1999, 2007; Ma & Cui 2002).

Recent research on regional inequality has attempted to strengthen the study of intra-provincial inequality by incorporating the recent developments in GIS and spatial analysis (e.g. Ying 2003; Yu & Wei 2003; Ye & Wei 2005). This paper deepens the existing literature on regional inequality in China. First, through a study of China using provincial statistics (SSB 1999, 2000–2005), we move beyond the new convergence theory, which is devoid of space and time. This paper argues for a geographical perspective emphasising the importance of space and scale in the research on regional inequality. Second, given the fact that much of the work on regional inequality adopts a top-down ‘black box’ approach, this paper employs both top-down and bottom-up strategies and scales down the research through a case study of Zhejiang Province, which is at the forefront of reform and growth in China, and is known for its Wenzhou model of development centred on the private enterprises. This practice has the potential to link macro studies of regional inequality to the micro locality studies of regional development. Last, this paper investigates the role of regions and institutions in regional development. We will illustrate the significance of the Wenzhou model in regional development in Zhejiang. We have not only built an extensive county-level data base of Zhejiang statistics unmatched by those available for other provinces (ZSB 2000, 2000–2005), but also conducted several rounds of fieldwork in Zhejiang. Our years of experience with Zhejiang, plus several recent rounds of fieldwork in Wenzhou Municipality, have been essential to our understanding of the complexity of this dynamic area. During 2003 to 2005, we made several trips to Wenzhou to conduct face to face interviews with more than a dozen local government officials and private enterprises in both Wenzhou City and its surrounding counties/cities of Yueqing, Ruian, and Yongjia, which make up the core of the Wenzhou economy.

THE LIMITS OF THE NEW CONVERGENCE THEORY

Regional inequality has been a subject of intense debates among the convergence (i.e. the dispersion of per capita income or outputs across regions declines over time) (e.g. neoclassical growth model), divergence (e.g. cumulative causation, Marxist uneven development school), inverted-U, and endogenous growth theories. Neoclassical convergence theories have been among the most influential schools of thought in regional inequality. The idea of long-term convergence is also consistent with the growth pole theories and the inverted-U thesis of regional inequality. Scholars such as Perroux, Hirchman and Friedmann promote the development of growth poles and the active participation of government. This paradigm of regional development is also known as top-down development, or development from above. Such an idea of inverted-U is complementary with Kuznet’s inverted-U theory of income inequality, and was summarised by Alonso (1980) as one of the five bell shapes in the process of development.

A great deal of empirical work was conducted in the late 1960s and 1970s to test the neoclassical convergence theories. While some supported the convergence and inverted-U theories, others found a lack of convergence and that regional inequality even increased in some countries. The findings of persistent poverty and inequality prompted new thinking on development and inequality, and the promise of neoclassical convergence received severe critiques. Schools of cumulative causation, dependency, and neo-Marxism became popular alternatives. With the problems in former socialist countries and the end of the Cold War, Marx’s vision of socialism faded. Marxism has been criticised for economic determinism, and for its capitalistic logic devoid of space, time and agents.

A renewed interest in regional inequality has been generated since the late 1980s and early 1990s, fuelled by the debates over the effects of globalisation and liberalisation, the reform and transition in former socialist countries, the rediscovery of regions and geography in social sciences, and new developments in the disciplines of economics and geography. Scholars working on the former socialist countries have debated intensely over the consequences of reforms,
especially whether reform has intensified regional inequalities and policies for future action (e.g. Petrakos 2001; Bradshaw & Vartapetov 2003; Anderson 2005). A miracle resurgence of new growth theories and alternative schools such as institutional economics and new economic geography has totally reconfigured economics. Institutional turn in economic geography and development in analytical geographical techniques have also revitalised geographical research on regional development and inequality.

Barro and Sala-I-Martin (1991, 1992) in particular have published a series of papers on regional inequality promoting convergence, which has since become the most influential contemporary theory of regional inequality. The concept of $\beta$ (beta)-convergence refers to the tendency for initially poorer regions to grow more rapidly than the richer regions. They argue for the convergence of income across regions, with the estimates of $\beta$ about 2 per cent per year in the various contexts. The new convergence theory has fuelled fresh debates and empirical testing, and we give them huge credit for their contribution in revitalising the study of regional inequality in mainstream economics. Empirical testing, like those tests conducted in the 1970s and 1980s, is inconclusive, and has in many cases found a lack of convergence (e.g. Lopez-Bazo et al. 1999). Like the neoclassical theory, the new convergence theory has recently been criticised for its ignorance of cyclical effects and different size in the units of analysis (Petrakos et al. 2005), to which we fully agree. More significantly, the new convergence theory is another theory devoid of space and time. Given the fact that the study object, the ‘region,’ is intrinsically spatial in nature, ignorance in not including space and scale has seriously limited its applicability and power in interpretation.

First, the new convergence theory is insensitive to geographical scale. Most convergence analyses are conducted at the subnational level across first administrative units, and to a less degree, at the national level (e.g. EU). Regional inequality is multi-scale layered in nature (Wei 1999). It can be manifested at the global scale such as global inequality and the inequality within the European Union. Within a country, the issue can be studied at the regional scale as well as within provinces. Sources or underlying forces of regional inequality are also specific to geographic scale. Such a scalar perspective presents a topology of regional inequality, and has potential to link inequalities at the macro scale to the micro scale, even every day life experiences.

Second, the new convergence theory adopts a black-box approach and ignores the nature of geographical space. Inequality indexes such as coefficient of variation and Gini coefficient are often used to measure regional inequality. Geographical space or regions are heterogeneous in nature, which is masked by the conventional inequality indexes. Regional inequality is heavily influenced by spatial heterogeneity and association and the development trajectories of regions. Scholars have found that regional inequality in China is sensitive to geographical clustering and agglomeration, and that changing trajectories and fortunes of leading or lagging regions often have a huge impact on regional inequality (Yu & Wei 2003, 2008). Analysing spatial association/heterogeneity and regional trajectories can therefore deepen the understanding of regional inequality. The notion of club convergence is an improvement, although it still does not treat space seriously. The development of GIS and spatial analysis has provided powerful tools to uncover the impact of spatial association and spatial heterogeneity on regional inequality (e.g. Rey & Montouri 1999; Le Gallo & Ertur 2003; Yu & Wei 2003; Ertur et al. 2006).

Third, the new convergence theory is devoid of time. The neoclassical convergence theory often ignores the temporal process of development and the influence of cyclical effects on growth. Convergence or divergence trends depend on the initial levels of development and cycles of economic development, and therefore the choice of time period for study (Petrakos et al. 2005) and the level of economic development matter. China is at a lower level of development with a faster pace, which should have an imprint on the behavior of its regional inequality. However, the finding that a period of expansion is associated with rising regional inequality, which is heavily emphasised in Petrakos et al. (2005), may not hold because the expansion is not necessarily led by the traditionally richest regions, and its effect on regional inequality also depends on scale, space and development trajectories of regions.

Last, the new convergence theory is weak in understanding the process and bottom-up forces
at work. Sources of regional inequality are also sensitive to scale, and change with the contexts of globalisation and region specific factors. The scale of analysis for the new convergence theory is often at the interstate or interprovincial level, and relies heavily on modelling approaches and macro variables. In geography, much of the work on regional development belongs to locality studies at finer geographical scales emphasising bottom-up, local variables. The macro modelling approach can provide an overall picture, but is weak in understanding the process and bottom-up forces at work. The notion of conditional convergence is limited since it removes a number of structural and local variables that significantly influence regional inequality (Petrakos et al. 2005). Micro studies of regional development, on the other hand, are also inadequate because they often discount broad patterns and common forces of regional inequality. These two approaches are actually complementary, and by integrating top-down and bottom-up strategies together and connecting them to regional development theories, we can better understand the forces shaping the trajectories of regions and the evolution of regional inequality. This paper therefore adopts both top-down and bottom-up strategies, and promotes the understanding of multi-mechanisms in regional development.

The notion of transitional institutions considers China’s reform process as a gradual, experiential, and evolutionary process, and argues that the Chinese institutions, especially the post-socialist state, are transitional in nature, which is essential to understanding policy change and transitional problems in China (Wei 2005). Traditional industrial bases favoured by socialist planning and dominated by state-owned enterprises (SOEs) have fallen behind, while coastal localities with effective local states and better positioned for marketisation and globalisation have emerged as the biggest winners of economic reforms. Through the case study of Zhejiang, we will explore the role of regions and institutions in the emergence of the Wenzhou model. This paper therefore emphasises a geographical perspective by emphasising space and scale. This line of enquiry also has potential to link the macro level studies of regional inequality to the micro level studies of regional/local development.

REGIONAL INEQUALITY IN POST-MAO CHINA

Regional inequality has long been the subject of intense academic debates on development and inequality across China’s regions (Figure 1). Starting in the mid-1970s (e.g. Lardy 1975), scholars debated the nature of Mao’s socialist practice, and its effects on regional inequality. Earlier work applauded Mao’s approaches to industrialisation and self-reliance, and conventional wisdom is that socialist ideology led to interregional resource transfer and more equitable development. Work since the 1980s has unfolded persistent poverty and inequalities during Mao’s regime. Considerations of economic growth, national defence, and decentralisation limited the resources for regional development, generated policy failure and poor interior investment, and created new forms of uneven development and inequalities (e.g. Cannon 1990; Lyons 1991; Wei 1999). Scholars found that interregional and interprovincial inequalities actually increased, and no absolute convergence can be identified in Mao’s era.

Since the late 1970s, China has been undergoing economic reforms introducing market mechanisms and opening up to the outside world. Scholars have been intensely debating the nature, trajectory, and impacts of the reform, including the effects on regional inequality (e.g. Fan 1995, 2006; Wei & Ma 1996; Zhao 1996; Weng 1998; Wei 1999; Lu & Wang 2002; Wang & Zhang 2003; Yu & Wei 2003; Ye & Wei 2005). While some maintain that trickle down effects have benefited the whole country, many others argue that regional inequality has been intensified. Scholars have emphasised multi-scale and multi-mechanism approach, with a synthesis of global, state and local forces in understanding the process of regional development (Wei 1999), which provides a framework for this research.

First, recent research has revealed the complex multiscale patterns of regional inequality in China. Much of the earlier debates confuse the inequalities across the provinces and regions. Scholars have revealed that patterns of regional inequality differ with geographical scales. Interregional, interprovincial, and intraprovincial inequalities have performed differently, thus creating a multiscalar typology of regional inequality in China and challenging traditional
work de-emphasising geographical scales (Wei & Ma 1996) (Figure 2). With the growth of coastal provinces, interregional inequality across the Eastern, Central, and Western regions has been intensified, while interprovincial inequality across the provinces declined at first, it has since rebounded, as evidenced by changing coefficient of variances (CVs) (Figure 3). The evolution of regional inequality does not follow any systematic convergence pattern.

Second, conventional work on regional inequality masks spatial association and clustering (Yu & Wei 2003). Characterised by SOEs and socialist institutions (Figure 4a), the traditional leading industrial provinces under Mao in North and Northeast China have been challenged by a new cluster of provinces in Eastern China (Figure 4b). Such restructuring caused the decline of interprovincial inequality in the 1980s. In the 1990s, with the emergence of a new cluster of provinces and the rebound of Shanghai, interprovincial inequality returned. Meanwhile, the coastal regions as a whole have moved ahead of the poorer interior regions, causing the intensification of the coastal-interior divide, or the rise of interregional inequality, with the formation of a poorer cluster in southwest China. Development is also uneven within provinces, where new forms and clusters of regional development are emerging, from Greater Beijing in the North (e.g. Yu 2006), to Shanghai and Jiangsu and Zhejiang Provinces in the Southeast (Ma & Cui 2002; Wei & Ye 2004), to Guangdong Province in the South (Lin 1997).

Third, China’s reforms can be understood as a triple transition process of decentralisation, marketisation, and globalisation, giving rise to three dominant agents of regional development — the state, the locality, and the global investor (Wei 1999; Wei & Fan 2000). China’s open door policy and the process of globalisation have made China more integrated with the global economy, and foreign investment has become a major source of capital formation. Decentralisation and marketisation have transformed the Chinese state from a rigid, centralised socialist institution to a flexible, decentralised, and growth-oriented institution. The role of the state has changed from one of planning and the allocation of economic resources directly to one where the state manages the policies and adjusts the operation of markets. China’s reforms have

Figure 1. Regions in China and Zhejiang province.
given birth to a new diversity in organisational forms, a plurality of property rights and ownership arrangements, and local state corporatism. Reforms have empowered local states and institutions in seeking growth and development. Consequently, globalisation, the state, and localities have become the three dominant forces underlying regional development in China. Those regions and places favoured by those forces, such as Jiangsu and Guangdong provinces, and within provinces, southern Jiangsu and the Pearl River Delta, tend to grow faster than others.

Last, through scaling down the research, recent efforts have revealed complex patterns and
mechanisms of regional development at finer scales, with an emphasis on Jiangsu and Guangdong provinces (e.g. Fan 1995; Wei & Fan 2000; Gu et al. 2001; Wei & Kim 2002; Lu & Wei 2007). Overwhelming evidence has suggested that core-periphery and urban-rural inequalities have been rising within the provinces (Weng 1998; Wei & Kim 2002; Wei & Ye 2004). Given their significance in regional development, research has also addressed the trajectories and mechanisms underlying the rise of winning regions (e.g. Lin 1997; Shen 2002; Wei & Kim 2002). Three models of regional development embedded with diverse local institutions have drawn extensive attention. These include the externally-driven Pearl River Delta model of development, local state-led Sunan model based on the development of township and village enterprises, and the Wenzhou model centred on the development of private enterprises. These varied models of regional development testify to the argument that institutional regimes

Figure 4. Spatial clusters in China, 1978 (a) and 2004 (b).
vary not only among nations, but also among regions and localities.

**TOP-DOWN: REGIONAL INEQUALITY IN ZHEJIANG PROVINCE**

Zhejiang is a coastal province spearheading China’s phenomenal growth and is known for its Wenzhou model of development. As a lab for radical reforms based on privatisation, the trajectory of development in Wenzhou, where bottom-up reforms are initiated, has tremendous impacts on regional development in Zhejiang. While multiple mechanisms – the state, the locality, and the global investor are shaping regional development in China (Wei 1999), the configuration of these mechanisms varies with regions and geographical scales. As will be examined in detail, the Wenzhou model is heavily embedded in local institutions, which play a significant role because most producers are small, market oriented, and often located in rural areas.

As the smallest coastal province, Zhejiang was traditionally divided into Southwest (Wenzhou, Jinhua, Quzhou, Taizhou, Lishui municipalities) and Northeast (Hangzhou, Ningbo, Jiaxing, Huzhou, Shaoxing, Zhoushan municipalities) Zhejiang (Figure 1). Northeast Zhejiang, as part of the Yangtze Delta and the prosperous Taihu region, is flat, more developed, and industry-oriented, and where the earliest traces of civilisation in China are found. Southwest Zhejiang, on the other hand, is more mountainous and less developed, except for in a few places like coastal Wenzhou. Zhejiang is known for commerce, education, and handcraft production, where its market towns connected the cities with the countryside (Forster 1998). Its handcraft production and commercial trading during the Ming and Qing Dynasties made Zhejiang one of the most developed regions in China. Over the years, Zhejiang has developed a tradition of active entrepreneurship and commercial activities, and its place-based business networks, especially those based on Ningbo and Wenzhou, two booming port cities, have expanded across China and extended abroad. The strong presence, co-operation, and pro-business of local institutions in Wenzhou is hardly seen in other regions of China.

China’s development policies during Mao’s era (1949–1977) were inconsistent, earmarked by collectivisation and the Soviet-model of industrialisation in the early and mid-1950s, the Great Leap Forward (1958–1960), defence consideration, and social movement (the Cultural Revolution) in the 1960s and 1970s, and pragmatism and rural development in the 1970s. In the 1950s and 1960s, Mao invested heavily in China’s interior, and due to its coastal location and lack of natural resources for heavy industry, few SOEs were built in Zhejiang, which forced Zhejiang to develop small enterprises, and even underground economies. With the policy of rural industrialisation in the early 1970s, some township and village-run enterprises (TVEs) were established, which laid the foundation for post-Mao development. During Mao’s era, Zhejiang’s economy stagnated, and its average annual growth rate of per capita GDP was 3.5 per cent, slower than the national average. Zhejiang’s enterprises were small, and many were collectively-owned.

Since the reform of 1978, Zhejiang has been undergoing dramatic growth and transformation. It is one of the fastest-growing provinces. From 1978 to 2004, the growth rate of per capita GDP in Zhejiang was 12.4 per cent, much higher than the national average (nine per cent). In 2004, the provincial GDP grew to 1.12 trillion yuan, and with 3.5 per cent of China’s population, Zhejiang produced 8.2 per cent of China’s GDP (SSB 2005; ZSB 2005). Zhejiang’s miracle took place with poor natural resources, little central government support, and lagging transportation networks. Zhejiang has been leading the nation particularly in marketisation and the development of private enterprises. The contribution of SOEs to industrial output was 61.3 per cent in 1978, significantly lower than the national average, which declined to only 6.8 per cent in 1998, and 5.3 per cent in 2002. Zhejiang’s economy is based on small scale, private enterprises. The booming private enterprises have contributed significantly to the growth of Zhejiang. Zhejiang has also become increasingly integrated with the global economy. In 2004, Zhejiang’s exports amounted to US$58.1 billion, ranked fourth in the nation, and FDI was US$4.98 billion, with major investment coming from Hong Kong, the US, Taiwan, Japan, and the UK. However, Zhejiang is facing challenges in income and spatial inequalities. Regional inequality in Zhejiang also changes with scales. As evident in Figure 5, interprefectural, overall intercounty and rural intercounty
inequalities increased from 1978 to 2004. Overall intercounty inequality refers to inequality across all county level units (city districts, counties, and county-level cities), while rural intercounty inequality refers to inequality across counties and county-level cities (county-level cities are not exactly ‘cities’ because they usually contain rural areas many times the size of their built-up area). Overall inequality reached its peak of 0.64 in the mid-1980s when comprehensive urban reforms were implemented, and declined in the late 1980s for reasons related to the Tiananmen incident. It reached another peak of 0.64 in the mid-1990s, and had showed signs of convergence since 1995 before stabilising in the early 2000s when cities gradually started growing again through reform, globalisation and spatial restructuring. Interprefectural inequality resembles overall inequality, in spite of fluctuating trajectory. Such a trend of rising inequality is somewhat different from that of Jiangsu where overall intercounty inequality declined although rural intercounty inequality intensified, led by the struggling status of SOE-dominated cities in Jiangsu, such as Wuxi (Wei & Fan 2000). In Zhejiang, however, SOEs have been less important, and consequently, its negative impact on the development of leading cities is less dramatic than Jiangsu. Rural inequality has been rising substantially, without any sign of convergence. Except for a stable period during 1978–1982 and 1986–1991, rural inequality rose dramatically, indicating massive spatial disparities in rural Zhejiang, which has been masked by overall inequality. Such a trend of intensifying rural intercounty inequality has also been reported in other provinces, such as Jiangsu (Wei & Kim 2002).

Since CV lacks a spatial dimension, we analyse changing fortunes of municipalities and cities/counties through the change of location quotients (LQs), which can be classified into four groups based on their location and changing patterns. Hangzhou, Shaoxing and Ningbo (Group I), located in coastal Northeast Zhejiang, tend to have high values. In 2004, Hangzhou and Ningbo municipalities had the highest GDP per capita (34,938 yuan and 34,184 yuan respectively), much higher than the poorest municipality of Lishui (9,064 yuan). Group II includes three municipalities in Southeast Zhejiang: Wenzhou, Taizhou, and Jinhua, which have benefited the most from the development of private enterprises called the Wenzhou model. Jiaxing and Huzhou of Group III have huge SOEs burdens, and their economies have been slow to restructure. Group IV includes Quzhou, Lishui, and Zhoushan, which have disadvantageous locations and backward infrastructure, and are the poorest group. In the 1990s, coastal cities/counties in Wenzhou-Taizhou dramatically increased their economic status, while cities/counties in Southwestern Zhejiang were the losers of reform, with Kaihua County having the largest drop in economic status.
EXPLORATORY SPATIAL DATA ANALYSIS

Conventional inequality indexes, such as CV, measure overall inequality, and mask geographical spaces or regions, which are heterogeneous in nature and essential to the understanding of regional inequality (Yu & Wei 2003). The developments in GIS, especially exploratory spatial data analysis (ESDA) have provided powerful tools for analysing spatial patterns of regional development. We first adopted Moran’s I, a weighted correlation coefficient for detecting departures from spatial randomness (when values in nearby areas are similar, Moran’s I will be large and positive, and vice versa, to examine changing extent of spatial association and agglomeration).

From 1978 to 2004, intraprovincial global Moran’s I in Zhejiang rose quickly, from 0.17 to 0.50, much faster than interprovincial global Moran’s I in China overall (from 0.11 to 0.35). This suggests that intraprovincial agglomeration in Zhejiang has increased more substantially, and that spatial concentration has taken place in the fast-growing provinces of China. We have also found that spatial agglomeration relates positively with rapid economic growth. In 2004, Hangzhou-Shaoxing-Ningbo and part of coastal Wenzhou-Taizhou regions are rich clusters, while interior south Zhejiang formed an obvious poor cluster, exacerbating intraregional inequality (Figure 6). While the municipalities of Hangzhou and Ningbo have maintained their leading status in Zhejiang (comparing Figures 6a and 6b regarding the rich clusters), they have been challenged by emerging regions benefiting from marketisation and privatisation in southeast Zhejiang. In 2004, two rich spatial clusters can be identified: a cross shape of clusters in North Zhejiang and an emerging Wenzhou-Taizhou cluster, while the poorer counties are located in Southwest interior Zhejiang. In 2004, the highest per capita GDP was 34,938 yuan in Hangzhou City (the capital of Zhejiang province), much higher than the poorest county of Kaihua in Southwest interior Zhejiang (990 yuan). In 1978, Hangzhou was still the richest; however, the poorest county was Cangnan, located in coastal Wenzhou municipality.

The following exploratory space-time data analysis is conducted using the package STARS (Space-Time Analysis of Regional Systems), developed by Rey’s research group at San Diego State University (Rey & Janikas 2006). In Figure 7, linkages connecting polygons’ centroids are conditioned on the strength of the temporal covariance between each pair of contiguous counties/cities, with thin lines indicating weak temporal linkages while thick links indicating those above average (strong). The temporal similarity can be viewed as having some possible similar economic development mechanisms, which will be further explained in the next.

Figure 6. Spatial clusters in Zhejiang, 1978 (a) and 2004 (b).
section. Two interesting structures are demonstrated. First, there is a ‘rectangular-size’ cluster of strong segments in southwestern Zhejiang, where a poor trap has formed over years, while at the same time period there is a liner-shape of counties/cities with similar development paths displayed along the coast. Second, most of the weak segments are located between the coastal and interior Zhejiang, especially in inland south Zhejiang, which indicates the isolation of costal areas from the inland regions, especially the southwestern part of Zhejiang.

In Figure 8, we relaxed the contiguity constraints in Figure 7 and visualise the strong temporal covariances between a specific county with the rest of the system (all the county units). Using Ruian and Taizhou as examples, we find two interesting phenomena: both of their GDP dynamics have not only been similar to some of their geographical neighbours, but also in sync with those in Jinhua Municipality; both of them also have similar sets of linked counties/cities. This type of interaction indicates the spread of the Wenzhou model across space and time.

We considered a regional system as an evolving organisation of county/city groups, and used the Markov chain approaches to study the evolution of regional inequality. In Figure 9 (from darker grey to lesser), Group I shows the average shift of the counties below the average in the 27 years is moving further down. Group II means the average shift of those above the average is moving down. Group III shows the former positions are around the average and their average shift has no change. Group IV shows the former positions are below the average and their average shift is moving up. Group V includes those above the average with their average shift moving up. In this map, we can see a very obvious moving-down area
LOCAL ANALYSIS WITH GEOGRAPHICALLY WEIGHTED REGRESSION

By far the most common statistical modelling technique used in the regional inequality analysis is that of OLS regression. A major limitation with this technique when applied to spatial data is that the explanatory variables are assumed to be constant over space, which is in contrast with many geographical processes such as uneven regional development. Geographically weighted regression (GWR) has been developed to uncover the spatial variation of relationships with a set of spatially varied regression coefficients. In this way, GWR can be used to investigate the spatial heterogeneity in regional development in Zhejiang. Suppose \( u, v \) are the co-ordinates of a position in the study area:

\[
Y(u, v) = b_0(u, v) + b_i(u, v)X_i + e(u, v)
\]

where \( Y \) is the dependent variable, \( X \) are explanatory variables, \( b_0 \) is the locally varying coefficients, and \( e \) is a normally distributed disturbance term.

We conducted two GWR analyses in an exploratory manner to detect the spatially and temporally varying mechanisms in Zhejiang, compared to the traditional OLS approach. The dependent variables are the growth rate of GDP per capita in 1990–1998 and 1998–2004 respectively, which are used to evaluate the regional development trend of each county during the two periods in a comparative perspective.\(^1\) Based on our review of existing literature on regional development and work on China, as well as the conceptualisation of viewing China’s transition as a triple process of marketisation, decentralisation, and globalisation (Wei 1999), we have identified five independent variables as follows:

1. The importance of socialist institutions and the infusion of market mechanisms can be represented by the share of non-SOEs in fixed asset investment in 1990 and 1998 (NonSOE90 and NonSOE98).\(^2\)

\( Y(u, v) = b_0(u, v) + b_i(u, v)X_i + e(u, v) \)
2. Decentralisation and local state support can be represented by local fiscal expenditure per capita in 1990/1998 (LEXP90/98).

3. FDI is the most often used indicator to measure the extent of globalisation. Since the data of FDI is not available at the county level and most of the development zones are located in the coastal cities/counties in Zhejiang, a dummy variable representing coastal cities/counties defined as 1 and the others 0 (COAST) can partly indicate the effect of globalisation.

4. It has been widely acknowledged that socialist economies are traditionally investment driven, and fixed asset investment per capita (FIX90/98) is selected to represent the overall extent of investment with China’s shifting to a market economy.

5. The influence of the neighbouring Chinese economic engine, Shanghai, will also be explored using the distance from each county’s centroid to that of Shanghai (DISTANCE). These variables are broadly similar to those used to analyse Jiangsu Province (e.g. Wei & Fan 2000; Wei & Kim 2002) or China’s provinces (e.g. Yu & Wei 2003).

The results of the global regression analysis are reported in Table 1. In the first period (1990–1998), the variables of DISTANCE, COAST, and NonSOE90 are significant at the 5 per cent level. The significant variables are almost the same except for NonSOE98 for the period between 1998 and 2004. These global results suggest that regional development in Zhejiang is positively associated with the county’s location (coastal position is preferred) and the share of NonSOE investment (though it is not significant in the second period). The implication of the model is that coastal counties with investment channelling to nonstate (mainly private) enterprises and located at a distance from Shanghai absorb less of an impact from SOEs and tend to outgrow other counties, which singles out the significance of private enterprises in the uneven regional development in Zhejiang. Regional growth does not relate significantly to FIX90/98 and LEXP90/98.

While similar models perform well when used to look at Jiangsu or other provinces of China, the models for Zhejiang do not replicate the data very well; the adjusted R squares are 25 per cent (1990–1998) and 15 per cent (1998–2004). This indicates there are other significant factors that are not captured adequately by the conventional global models used in Zhejiang. The reason for this is that dramatic intra-provincial inequalities exist in Zhejiang, which is hidden from conventional regression. Unlike Jiangsu province manifesting its historically strong north-south divide, in Zhejiang, local variations in development are more substantial and more dynamic (Wei & Ye 2004; Ye & Wei 2005). Orthodox global regression models, while effective in analysing Jiangsu and other provinces of China, have failed to capture those local variations in

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**Table 1. Result of OLS global regression.**

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<tr>
<td>parameter</td>
<td>Estimate  Std Err  T-value  P-value</td>
<td>Estimate  Std Err  T-value  P-value</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.13     0.03      3.92      0.00</td>
<td>0.12     0.01      10.95     0.00</td>
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<tr>
<td>DISTANCE</td>
<td>−18.83   8.53      −2.21     0.03</td>
<td>−6.68    3.2       −2.09     0.04</td>
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<tr>
<td>COAST</td>
<td>0.037    0.012     3.923     0.00</td>
<td>0.014    0.006     2.578     0.01</td>
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<tr>
<td>Non-SOE90/98</td>
<td>0.10     0.03      2.89      0.01</td>
<td>0.017    0.016     1.11      0.27</td>
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<tr>
<td>FIX90/98</td>
<td>−0.64    0.46      −1.41     0.16</td>
<td>−0.45    1.59      −0.28     0.78</td>
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<tr>
<td>LEXP90/98</td>
<td>1.78     1.48      1.2       0.23</td>
<td>−8.72    9.8       −0.89     0.38</td>
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</tbody>
</table>

*R square: 0.32 Adjust R²: 0.25  R²: 0.22 Adjust R²: 0.15*

**Note:** The bold numbers are those significant to at least 5%. The bold parameters are those significant to at least 5% in both of the two periods.
Zhejiang. The performance of NonSOE share warrants attention, which is significant at the one per cent level in the first global model, but becomes insignificant in the second global model. This phenomenon justifies the exploration of local variations because existing literature and field work recognise the main role of private enterprises in the dramatic growth of Zhejiang. To explain spatial variations in development, it is therefore necessary to use spatially explicit regression models, and the advance in GWR makes such an analysis possible. GWR is run with the software package developed by Fotheringham et al. (2002). The results of GWR show great improvement in the interpretation of spatial data, which help to unmask the unevenness and clustering of regional development at the county level in Zhejiang. The F test suggests that both GWR models have been significantly improved (at 1% significant level) over the global models (Table 2). Moreover, we can examine the significance of the spatial variability in the local parameter estimates (Table 3). Monte Carlo tests indicate that there is significant variation in the local parameter estimates for the variables DISTANCE and NonSOE at both time periods. The spatial non-stationarity of NonSOE factor reinforces the finding that global OLS regression masks the local parameter variation for NonSOE’s contribution to the 1998–2004 growth. Global OLS regressions, which report that COAST is significant (0.00 and 0.01) in both periods, therefore hide the fact that the location factor works much more uniformly in the second time period. GWR models have presented significant local variations of regional development mechanisms in Zhejiang. These varying development mechanisms formed the spatial pattern of regional development, patterns such as the intensifying coast-inland

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<tbody>
<tr>
<td></td>
<td>SS</td>
<td>DF</td>
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<td>6.00</td>
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<td>GWR improvement</td>
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<td>GWR residuals</td>
<td>0.07</td>
<td>52.38</td>
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Note: SS = sum of squares, DF = degree of freedom, MS = mean of squares. The bold numbers are those significant to at least 5%.

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<tbody>
<tr>
<td></td>
<td>P-value</td>
<td>P-value</td>
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<td>Intercept</td>
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Note: The bold numbers are those significant to at least 5%. The bold parameters are those significant to at least 5% in both of the two periods.
inequality and the lagging behind of southwestern counties.

Maps for local estimates of NonSOE and COAST share further demonstrate a few interesting patterns ignored by traditional approaches (Figures 10 and 11). We find that both nonstate enterprises and location play significant roles in uneven regional development in Zhejiang. There are several issues worth noting. First, the number of clusters is the same as the number of value groups, indicating that NonSOE has strong local linkages. Second, the county group with the highest values (the darkest colour) is located around Wenzhou-Taizhou Municipalities during 1990–1998, and then spread towards Northeast Zhejiang (Figure 10). Taking a similar trend in Figure 11 into account, we see the importance of Wenzhou-Taizhou in shaping the economic landscape in Zhejiang. Thirdly, the spatial structure of the share of nonstate investment shows a strong coastal-inland division (Figure 10), while the function of coastal location shows a north-south spatial structure (Figure 11). NonSOE functions much better in coastal


Zhejiang than inland Zhejiang, which was emphasised in state investment during Mao’s era. At the same time, the status of coastal location influences the South more heavily than in the North. It explains the sharply different fortunes of inland counties in North and South Zhejiang. South Zhejiang, with relatively lagging transportation networks and limited access to the outside world, is more heavily influenced by access to the coastal line.

In sharp contrast to 1978 when a rich-poor relationship existed between central cities favoured by Mao’s policy and their surrounding rural areas, a broader spatial cluster across municipality borders has emerged. More counties, as opposed to central cities tend to have a more significant presence of SOEs and are surrounded by poor areas, indicating widening inequality among rural areas.

As illustrated by the above figures, the rise of the Wenzhou model and its prevalence in coastal Wenzhou-Taizhou therefore has significant implications for regional development in Zhejiang. The explosive development of private enterprises in Wenzhou has reshaped its development path, and contributed significantly to development patterns of Zhejiang. The observed new clusters and growth centres are closely related to the emergence of the places like Wenzhou, with booming private enterprises. We therefore in the following section provide a bottom-up analysis of regional development in Wenzhou.

**BOTTOM-UP: REGIONAL DEVELOPMENT IN WENZHOU MUNICIPALITY**

The above analysis reveals that regional development in Zhejiang is characterised by the emergence of coastal counties with a strong private sector, especially a southeast cluster centred on Wenzhou and Taizhou. Zhejiang is known in China for its development of private enterprises, originating from the Wenzhou model of development. We therefore further the research on Zhejiang via a bottom-up strategy through an investigation of the development of Wenzhou. Located in Southeastern Zhejiang (Figure 1), Wenzhou was one of the national centres of commerce, handcraft production, and international business, especially during the Southern Song Dynasty (AD 1138–1276). As a main coastal port, Wenzhou was known for craft production and light industry. During the Maoist era, due to the lack of strategic significance to the state, Wenzhou struggled due to state policy prohibiting the development of private enterprises and state investment avoiding coastal locations.

On the other hand, the less SOE-controlled economy provided Wenzhou with a more convenient environment to carry out reforms and develop private enterprises. Our survey of 35 enterprises in Ruian in 2002 found that half of the private enterprises were established in the 1980s, when the state preferred the development of SOEs and TVEs. By 1998, the share of SOE output in industrial output dropped to 3.87 per cent. In 2001, light industry accounted for 63 per cent of output, much higher than Zhejiang (56%) and Guangdong (53%). Major industrial products include footwear, clothing, auto parts, metal cigarette lighters, glasses frames, plastics products, and packaging printing, etc. Many of Wenzhou’s town/townships engage in specialised production. Known for ‘petty commodities, large markets’, the Wenzhou model represents a successful trajectory of regional development centred on small scale, family-based, manufacturing-oriented private enterprises, with distribution networks linking producers and consumers all over the country and extending to global markets (Wei et al. 2007).

The Wenzhou model has been conceptualised as development/urbanisation from below (Nolan & Dong 1989; Liu 1992; Ma & Cui 2002). While acknowledging the significance of development from below, we maintain the rise of Wenzhou is attributable to the synergy of multiple forces of globalisation, nation-states, and local factors. The essence of the Wenzhou model is the geographically embedded ‘thick’ local institutions and networks, which are historically rooted and geographically based. The local culture emphasises pragmatism and financial achievements, well reflected by the Yongjia School of thought. Small enterprises have traditionally formed the backbone of the economy, rooted in entrepreneurship and rural markets all over the municipality. Our survey found that half of the enterprises had output of less than 2 million yuan in 2000. Family units typically form the main production units, relying on social networks for acquiring capital, raw materials, and information, as well as for production and marketing. Most investment comes from private sources, and our survey
found that only 28.6 per cent of enterprises listed bank loans as the major source of financing enterprise development. Such place-based networks are intensely interwoven, bounded by trust and culture, and maintained by mutual exchanges and power relations.

Moreover, local governments in Wenzhou are locally embedded, and are pro-business by protecting private enterprises and improving the business environment. The Wenzhou government has been shaped not only by national policies, but more importantly, local geographies and institutions. The underground economy was never totally eliminated during Mao's era, largely because local governments were often sympathetic to the tradition of local capitalism. The local institutions of business creation and networks have created a strong presence of business owners who not only influence public policy, but are often government officers themselves. Local governments have implemented a series of reform policies one step ahead of other places in China through innovatively labelling privatisation as ‘Socialism with Chinese Characteristics’, with results including the designation as an open coastal city in 1984, the establishment of the Wenzhou Reform Policy Experiment Zone in 1987, and implementation of the first local regulation promoting the development of private enterprises in China. In the 1990s, the Wenzhou government shifted their focus to improve the business environment, demanding improvement in production quality, education and infrastructure. Since the mid-1990s, Wenzhou has been making efforts to support the scale and scope of economies by encouraging spatial agglomeration and the development of conglomerates, and further improving production efficiency and quality management.

Last, globalisation also plays an important role in the development of Wenzhou. Historically, millions of Wenzhounese have migrated overseas to abandon the harsh life there and seek economic opportunities, all further facilitated by a seaport and local mindset of risk taking and wealth creation. They have connected Wenzhou to the global market places and provided capital, markets, information and equipment for Wenzhou’s business. Wenzhounese associations are among the most active Chinese associations abroad, and local governments also actively nurture and promote global-local networks. Although Wenzhou companies have been more focused in the domestic market recently, they have increasingly imported modern equipment and promoted international trade. From 1998 to 2002, exports grew by an average 39 per cent per year to reach US$2.65 billion. Footwear and clothing, major sectors of Wenzhou, are the main export items, accounting for over half of the total exports. By 2002, Wenzhou traded with 170 countries and regions. Those networks connect Wenzhou to the global economy, and provide capital and markets for Wenzhou’s products. Wenzhou has become one of the leaders in institutional innovation and richest places in China. Although dominated by small enterprises and personal networks, a group of private firms has emerged as the largest private enterprises in China. The operation of the largest firms has also become multi-regional, often benefiting from the intense competition of local governments for external capital.

With the rocketing economy, regional inequality in Wenzhou has risen as well. As shown in Figure 12, coastal municipalities of Zhejiang, particularly Wenzhou and Taizhou lead Zhejiang in the development of private enterprises, recorded soaring CVs, compared to other municipalities. Wenzhou’s CV was sixth among the 11 municipalities in 1978, but it rose to second in 2004. Although booming Wenzhou has challenged traditional rich areas in the north and changed the traditional core (northeast)-periphery (southwest) structure, inequalities within Wenzhou have risen drastically. The coast-interior divide has been intensified because of the development of coastal Wenzhou, spearheaded by private enterprise, which has also contributed significantly to the rise of the coast-interior divide in Zhejiang.

Within Wenzhou, a new pattern of uneven regional development between the core and the periphery has emerged. Before reform Wenzhou was already spatially more clustered than Zhejiang as measured by Moran’s I (Zhejiang: 0.17 vs. Wenzhou: 0.27), reflecting the existence of the gap between Wenzhou City and the rest of the municipality. Such a spatial pattern reflected the general pattern of spatial inequality between the city and the countryside, as found in other provinces such as Jiangsu (Wei & Fan 2000). Such a pattern of spatial inequality has been changed. While Wenzhou
City remains the place with the highest per capita GDP, Yueqing and Ruian, two county-level cities (counties) neighbouring Wenzhou City have been catching up, with the latter due to the rapid growth of private enterprises, while cities tend to have a heavier burden in SOEs. As shown in the change of location quotients representing regional status, inequality among cities and counties has been increasing substantially since the early 1980s, when reform expanded to the industry (Figure 13). By the late 1990s and early 2000s, three groups of counties and cities can be found in Wenzhou. Group I: richest regions with fastest growth, including Wenzhou, Ruian, and Yueqing; Group II: middle group, including Cangnan and Pingyang, and Yongjia; Group III: poor regions with slower growth, including Taishun, Dongtou, and Wenzheng, which are the traditionally poorest mountainous areas.

The rise of Yueqing and Ruian, both among the National Top 100 Counties, is worthy of particular attention. Yueqing, with 1.16 million...
Yueqing, is a prototype of the Wenzhou model. Yueqing houses two of the largest private enterprises in China: CHINT and Delixi, forming a cluster of low-voltage electrical industry. Yueqing is also the largest garment production base in south Zhejiang with 425 manufacturers, and 15 of them had annual sales over 100 million yuan. In 2002, the output of casual wear and business suits reached 32 million pieces, yielding 11.08 billion yuan in sales, 27 per cent of the industrial output. The county has also developed auto and motorcycle industries, supported by extensive external networks. South of Wenzhou is Ruian, another coastal county-level city with 1.18 million people. Over 60,000 Ruian people live in more than 60 countries and regions in the world, and they connect Ruian to the global markets. Ruian has five main industries: mechanical and electronic industry, automobile and motorcycle parts industry, knitting and shoe-making industry, fine chemical industry, and plastic products industry.

The LISA time-path plot (Figure 14) illustrates the pair-wise movement of a region’s GDP per capita and its average neighbour’s over time, which can identify levels of stability of a region with a given structural process. It is a powerful exploratory tool to detect individual economic unit and its local system’s dynamics in a temporal dimension (Rey et al. 2005). From the left to the right in the graph, each point represents one time point from 1978 to 2004. Both Ruian and Yueqing have been witnessing the general trend of ‘win-win’ relationships in their local linkages. First, the distinct performance of the two county-level cities’ neighbours reveals interesting location factors of Ruian and Yueqing in the economic landscape. Ruian is located on the south wing of Wenzhou and some neighbours are poor mountainous counties, however, Yueqing is located in the centre of the rich coastal area. Standardised GDP per capita of Ruian’s neighbour is generally poorer than Yueqing’s, that is, less-than-one values means below the average of Zhejiang’s. The former’s average neighbour is always below one while the latter’s always above one. Second, most of the big jumps in status move-up take place when the segments lean towards the X axis, which means the roles of Ruian and Yueqing are decisive in their local regimes. Last, Ruian grows much faster than Yueqing (comparing the two maps X axis). However, the former’s neighbour benefits less than the latter’s (Ruian’s Y values are in general smaller than that of Yueqing’s), which further validates the persistent poverty of Ruian’s neighbours at this finer scale.

However, the poorest counties remain the poorest. Most of the towns and villages in mountainous Wencheng and Taishun still struggle to improve their economies. Their gaps with the richer counties have been rising, leading to the sharp rise of coefficients of variation and divergent location quotients. Dongtou is an island isolated with mainland Wenzhou, consequently, two ‘Wenzhous’ have emerged: one

Figure 14. LISA time path: Ruian (a) and Yueqing (b).
coastal and rich, mainly Wenzhou, Ruian, and Yueqing, and another composed of interior, mountainous areas, which are poor and backward. There is no sign of decreasing inequality between these two groups.

CONCLUSION

This paper has investigated changing regional development in China, mainly through a study of Zhejiang Province. We have found that during the reform period rural, intercounty inequality soared, and overall intercounty inequality also rose. We also detected a trend of spatial concentration among Zhejiang’s counties, with the formation of three clusters: the emergence of coastal Wenzhou-Taizhou cluster and central Zhejiang cluster, which join the traditional Hangzhou-Shaoxing-Ningbo cluster. A group of rapidly growing counties in Wenzhou, Taizhou, and Jinhua, influenced by the Wenzhou model, have emerged as the biggest winners of reforms. Also, because of their excellent location and strong industrial bases, the traditional Hangzhou-Shaoxing-Ningbo cluster has embarked on further spatial transformation, with an inflow of domestic and foreign investments. Traditional interior industrial bases and many other rural areas, however, have fallen behind due to disadvantageous location and problematic SOEs, forming a poor trap in southwestern Zhejiang. Moreover, the weak linkages between coastal and interior Zhejiang blocked the infusion of development to the poor areas. Consequently, the gaps between coastal and interior Zhejiang and between rich and poor counties have widened dramatically, which directly contributes to the sharp increase of intercounty inequalities.

The results of GWR analysis show improvement over conventional global regression analysis. We found that both location and nonstate enterprises play significant roles in uneven regional development in Zhejiang. A broader spatial cluster across municipality borders has emerged. More counties, instead of central cities with more significant presence of SOEs, are surrounded by poor areas, indicating widening inequality among rural areas, consistent with the ESDA findings.

The development of private enterprises is the major reason for the rise and uneven development in Zhejiang. During the reform, the Wenzhou model, the Pearl River delta model, and the Sunan model have been widely recognised as the three major models of regional development in China. Each has developed under different institutional environments and has diverse mechanisms of development. Unlike the externally-driven Pearl River Delta model and the TVE-centred Sunan model, Wenzhou, with dense population and an isolated terrain, has led China in the development of private enterprises. The development of Wenzhou is closely related to the rise of private enterprises and the importance of entrepreneurs, and is facilitated by pro-business local states, and global forces. We have found that private enterprise development is also uneven within the Wenzhou Municipality. While Wenzhou City, Yueqing and Ruian, have moved ahead with private enterprises, the rest of Wenzhou has fallen behind, leading to the rising coastal-interior divide within the municipality.

Acknowledgements

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Notes

1. Because of data availability of some explanatory variables, GWR analysis is conducted to explore the regional mechanisms after 1990. Since other studies on Zhejiang (Wei & Ye 2004; Ye & Wei 2005) used pre-1998 data, it is interesting to analyse and compare the two time periods (1990–1998; 1998–2004).

2. We use non-SOEs instead of SOEs because non-SOEs are the major economic component in Zhejiang. NonSOE1990 is used as one of the explanatory variables for GDP per capita growth rate between 1990 and 1998 while NonSOE1998 is used for the analysis of the rate between 1998 and 2004. It applies to all the other variables.

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