Brunel University London

Department of
Economics and Finance

Working Paper No. 15-26

Economics and Finance Working Paper Series

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September 2015

http://www.brunel.ac.uk/economics

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June 23, 2015

Abstract

We investigate the relationship between unemployment and growth in China. We find considerable differences in the nature of this relationship across Chinese regions. We argue that this may reflect the different progress in transition across regions, in line with the Aghion-Blanchard model of optimal speed of transition. When we test this model, we find strong evidence of a hump-shaped relationship between unemployment and our proxy for the speed of reform. The current unemployment in China, furthermore, appears to be close to the level associated with optimal speed of transition.

JEL Codes: E24, E61, J64.

Keywords: Unemployment; Okun's Law; Growth; Optimal Speed of Transition; China.

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1 Introduction

China has been experiencing a rapid and steady economic growth since 1978 when it initiated a gradual reform of its economy. However, the last two decades brought about also a steady increase in unemployment, which has been seen as one of the most pressing problems facing the Chinese economy at present. Intuitively, we would expect that high output growth should help keep unemployment low. This would be in line with Okun's Law, one of the basic rules of macroeconomics, which postulates an inverse relationship between output growth and changes in unemployment (Okun, 1962). However, the Okun's Law has been formulated in the context of a mature market economy, the US. China, in contrast, has been undergoing a dramatic and multi-faceted transition since 1978: from central planning to a market economy, and from a primarily agrarian and closed economy to an industrialized and open one.

The process of economic transition has had a major impact on the urban labor market in China. As the other former communist countries, China started its transition with full employment. The pre-reform labor market was characterized by four key features. First, the bulk of the labor force was employed in the agriculture. Second, urban workers enjoyed life-long employment without any fear of dismissal or unemployment. Third, the *hukou* system of household registration restricted the ability of workers to move between rural and urban areas and across regions. Fourth, welfare policies including rationing of basic necessities, social security policy exclusive to urban regions and other public service provisions (the so-called 'iron rice bowl') further restricted labor mobility and equal treatment of residents in rural and urban areas (Cai and Wang, 2010). The reform lead to a liberalization of urban employment and *broke* the iron rice bowl. As a result, the allocation of labor in urban regions has become mostly market-based (however, the *hukou* system and differentiated provision of public goods and social security in urban and rural regions have remained in place and continue to impede labor mobility between rural and urban areas). The subsequent privatization of state owned enterprises in the late 1990s, in turn, has given rise to unemployment in urban areas (Cai and Wang, 2010). Around ten million workers were laid off from state owned enterprises and urban collectives in 1996 and in 1997 alone (Qian, 1999).

The experience of China has differed markedly from that of the post-communist countries in Eastern Europe. In the former, output grew steadily and at relatively high rates, while unemployment stayed, especially initially, modest. In the latter, the onset of transition was associated with a sudden and sharp contraction and a rapidly growing and persistently high unemployment, in a process labeled 'Transformational Recession' (Kornai, 1994). A number of studies have sought to shed light on the reasons behind these differences (see Roland, 2000, and Woo, 2014, for broad overviews). An important difference between China and Eastern Europe was in the speed and sequencing of reform. The Eastern European countries implemented multiple reforms at once and at a relatively high pace, in a big-bang fashion. China, in contrast, elected a more cautious approach: reforms were implemented gradually and in a dual-track fashion, the latter meaning that the centrally-planned sector was maintained but private initiative was allowed at the margin. Another important difference was high share of agriculture in the Chinese economy at the beginning of the reforms. This ensured a vast supply of potential labor for the manufacturing sector once the reform created favorable incentives for its expansion.

Aghion and Blanchard (1994) formulate a theoretical model of reform of centrally planned economies in which they seeks to explain some of the stylized facts of the post-communist transition, such as the differences in the pace of reform and the associated economic outcomes across countries. They posit that there is an important relationship between unemployment and the speed of reform. Specifically, unemployment, which arises when workers in ailing state-owned enterprises lose their jobs, puts a downward pressure on wages. This, in turn, helps facilitate the expansion of the private sector. At the same time, however, unemployment increases the tax burden imposed on the private sector, whose taxes are used to finance unemployment benefits. This results in an inverted U-shaped relationship between unemployment and the speed of reform. When unemployment is too low, the private sector workers require excessively high wages, so that the private sector grows only slowly or not at all. Under high unemployment, taxes become too high, which again impedes the expansion of the private sector. The inverted U-shaped relationship implies that there is a single intermediate level of unemployment that is

optimal in the sense that it maximizes the expansion of the private sector. The major insight of the Aghion-Blanchard model for China, therefore, is that growing unemployment need not undermine China's future prospects. In fact, while in several Eastern European countries unemployment may have exceeded the optimal level, the current unemployment in China remains relatively low and may well be lower than the optimal value.[1]

In this paper, we investigate empirically the nature of the relationship between unemployment and economic growth generally, and the speed of reform specifically, in China. There are only a few previous studies on this issue of China and those restrict their attention to the relationship between growth and unemployment at the aggregate level. To the best of our knowledge, no prior studies addressed the relationship between unemployment and the speed of reform in China. Moreover, since the existing studies only consider the Chinese economy as a whole (Wu, 2003; Cai and Wang, 2010), they ignore the regional aspects of this relationship. The regional dimension is likely to be crucial in China because of the way how the reform was implemented: the coastal provinces in Eastern China were allowed to implement reforms first, with the rest of the country following only gradually.

In the next section, we briefly discuss the literature on the relationship between unemployment and growth in mature market economies and in countries in transition from central planning. Section 3 presents the data used in our analysis. Section 4 estimates a standard Okun's relationship in China, while Section 5 approaches this relationship more generally, without being restricted by a particular theoretically motivated or empirically observed rule. Finally, Section 6 argues that the pattern observed in China can be explained in the context of the Aghion and Blanchard (1994) model on the relationship between unemployment and the speed of reform. Section 7 concludes.

2 The Relationship between Unemployment and Growth

In his original article, Okun (1962) suggests that, on average over the post-war period, each percentage point of the unemployment rate above four percent was associated with the real

[1] The average official unemployment rate during the period covered by our analysis is 3.5 percent. The World Development Indicators report unemployment as increasing from 4.2 to 4.6 percent between 2010 and 2013.

GNP being lower by approximately three percent. Since Okun's seminal contribution, this has become accepted as one of the fundamental rules of macroeconomics. The aggregate supply curve, for example, is derived by combining Okun's relation with the Philips curve (Moosa, 1997).

The negative sign of the Okun's coefficient has been confirmed in the literature, although its magnitude is sensitive to model specification, choice of control variables, econometric methods and sample periods. Smith (1975), Gordon (1984), Weber (1995) and Prachowny (1993) confirm it with US data. Kaufman (1988), Lee (2000), and Moosa (1999) present international evidence and find significant differences among countries. Courtney (1991), Harris and Silverstone (1993) and Silvapulle et al (2004), in turn, argue that the Okun's coefficient may be different in expansions and contractions.

While there are numerous studies on the Okun's law in the context of developed countries, little attention has been given to whether this relationship holds in formerly centrally-planned economies. Izyumov and Vahaly (2002), one of the few exceptions, investigate the Okun's relationship for 25 transition countries, which they divide according to their reform progress into leaders and laggards. They show that the standard Okun's relationship emerges in the transition countries only after the transformation has progressed sufficiently. Wu (2003), one of the few studies on China, found Okun's law to be non-linear in China over the period 1988-1998.

The Okun's Law is an empirically observed rather than theoretically derived relationship. As such, it stipulates correlation and says little as to whether the direction of causality goes from growth to unemployment or the other way around. Aghion and Howitt (1994), who build on Pissarides (1990), develop a model of the relationship between unemployment and growth, which suggests there are two types of effects: "capitalization" and "creative destruction". The capitalization effect reflects the fact that an increase in growth raises the capitalized returns by decreasing the discount rate which increases the present benefit of entry and hence increases the number of job openings. This, in turn, reduces the equilibrium rate of unemployment. This stands in contrast to the creative destruction effect, according to which an increase in

growth may reduce the life time of production units and thus raises the equilibrium level of unemployment by raising the job separation rate. In order to take advantage of innovation, the old machines need to be shut down by the firm. When this happens, workers become unemployed until matched with a new machine. Aghion and Howitt show that the 'creative destruction' effect dominates at low growth rates while the 'capitalization' effect dominates at high ones, leading to a hump shaped relationship between unemployment and growth. The sign of the relationship between growth and unemployment therefore can be either positive or negative.

The Aghion and Blanchard (1994) model has been formulated to capture the specific circumstances prevailing in the countries in transition from central planning to a market economy. They suggest that the speed of labor reallocation during transition and the rate of unemployment are connected in an inverted U-shaped fashion. Figure 1 depicts this relationship, with unemployment denoted as $U(t)$ and the growth of private-sector employment by $\dot{N}_p(t)$. This shape stems from the fact that unemployment affects the private sector in two ways. First, wages of private-sector workers are inversely related to unemployment: high unemployment raises the value having a job and therefore the private sector can get away with paying lower wages. Second, unemployment benefits are financed by taxes on the private sector. Therefore, excessive unemployment depresses after-tax profits of private firms. If there is no unemployment, the private sector cannot develop because it relies on the unemployment pool to recruit workers (and to depress their wage demands). In contrast, when unemployment reaches $1 - b/(1 - \rho c)$, the tax burden becomes too high and the private sector cannot exist either. Since the relationship between the speed of job destruction in the state sector (speed of reform) and unemployment is hump-shaped, there is an optimal level of unemployment, U^*, that maximizes $\dot{N}_p(t)$, the speed of expansion of the private sector. Note that the inverted U-shaped relationship posited by Aghion and Blanchard also implies that the relationship between unemployment and growth (or speed of reform) can be either positive or negative.

3 Data

In our analysis, we use data for Chinese administrative regions: these include 22 provinces, 5 autonomous ethnic-minority regions (Tibet, Xinjiang, Guanxi, Ningxia and Inner Mongolia) and 4 metropolitan regions (Beijing, Shanghai, Tianjin and Chongqing). For simplicity, we refer to all of them as provinces in the remainder of the paper. Although there are 31 provinces, we exclude Chongqing and Tibet due to insufficient data. We divide the provinces into three broad regions: East, Center and West: this division is motivated not only by geography but also by the spread of reforms throughout China. The provinces belonging to each group are shown in Table 1. The period considered is 1997-2006: the market mechanism should be more prominent in the determination of employment and output during this period (Izyumov, and Vahaly, 2002) and unemployment was limited before this period.

Output is measured as the real provincial GDP and has been obtained from the Chinese National Statistical Bureau. Unemployment is the registered urban unemployment rate as reported in the China labor statistical yearbook. Measuring unemployment poses a particular difficulty in China. Rural residents tend to be underemployed rather than unemployed because they can fall back on farm work when other paid work is not available (Giles et al., 2005). Furthermore, neither hidden unemployment nor the so-called *xia gang* (usually translated as laid-off) workers are counted as unemployed (Jackman, 1998; Clarke and Borisov, 1999). *Xia gang* workers are those who are temporarily unemployed but nevertheless continue to maintain formal employment relation with their enterprise. Often, although they receive no pay, they benefit from in-kind benefits such as living in company-owned housing and/or having their national insurance paid by their employers (Gu, 1999). Therefore, they are not officially reported as being unemployed.

There are a number of alternative estimates calculated based on published government data on employment, registered unemployment, and numbers of xia gang workers. However, Giles et al. (2005) point out that such estimates based on administrative data are subject to potentially serious shortcomings and none of them are calculated in a way that is consistent with standard international practice. They construct "true" unemployment rates calculated

based on the 2002 follow-up survey to the China Urban Labor Survey which complies with international practice for defining unemployment. Their estimates include the xia gang among the unemployed, as long as they meet the standard international criteria for being categorized as unemployed. The correlation between the official urban registered unemployment rate and their "true" unemployment rate is very high: 0.98. Therefore, the difference in the definition of the unemployment rate should not substantially affect the direction of the findings of our study. Since their estimates are limited in their coverage, in this paper we use the official urban registered unemployment as a proxy for the "true" unemployment rates.

Finally, we measure the speed of transition as the change in the number of private employees, which includes workers in firms belonging to individuals, share holders, joint ventures with stakes held by foreigners, foreign funds, investors from Hong Kong, Taiwan or Macao, share cooperatives, and limited liability companies.

4 Is there a Relationship between Unemployment and Growth in China?

There are two conventional specifications for estimating the Okun's relationship: the "first-difference" and "gap" models. The first-difference model uses the real GDP (or GNP) growth and the first difference of unemployment, as given by the following expression:

$$\Delta U = a - b(\Delta Y/Y) \tag{1}$$

The gap model, instead, considers the difference between the observed and natural rate of unemployment, and the difference between the observed and potential GDP, or output gap:

$$U - \bar{U} = a + b(Y - \bar{Y}) \tag{2}$$

where $\bar{U}$ and $\bar{Y}$ stand for the natural rate of unemployment and the potential GDP, respectively.

For China, there are no reliable estimates of potential GDP, NAIRU, or similar macroeconomic benchmarks. Therefore, only the first-difference model is feasible for our study. We follow Izyumov and Vahaly (2002) and estimate the following relationship:

$$y_{i,t} - y_{i,t-1} = \alpha + \beta(u_{i,t} - u_{i,t-1}) + \varepsilon_{i,t} \tag{3}$$

where i denotes provinces, t represents years, $y_{i,t}$ is the log of real output (GDP), $u_{i,t}$ is the unemployment rate, α is the intercept reflecting the average real GDP growth rate, β is the Okun's coefficient, and $\varepsilon_{i,t}$ is the disturbance term. Okun's law suggests that the growth rate of output should be negatively related to the first difference of the unemployment rate: $\beta < 0$. We estimate this relationship with LSDV (Least Square Dummy Variable) approach, both at the national level (including all Chinese provinces) and for the three broad regions discussed above: East, Center and West. The results are reported in Table 2. The Okun's coefficient for all of China is negative but insignificant for the full period, 1997-2006. When we consider sub-periods, the coefficient is positive but insignificant for the first half (1997-2001), but negative and strongly significant during the later period, 2002-2006. As expected, Okun's law holds only after the market-oriented reforms have progressed sufficiently. The results for East and Center are similar to each other: there is a negative and significant relationship between changes in unemployment and growth during the full period, in line with the pattern observed for developed countries. When considering sub-periods, the coefficients are negative but insignificant for 1997-2001. For 2002-2006, the coefficients are negative and significant which implies that an Okun's type of relationship is present. The West region, however, is strikingly different from East and Center. During the full period, 1997-2006, the estimated relationship is positive and highly significant. Neither of the results for the sub periods is significant: it is positive during the early sub-period and negative (and almost significant at the 5% level) during the late sub-period.

These results are in line with the findings of Izyumov and Vahaly (2002) who examine post-communist transition countries and find that Okun's Law holds only in those countries that have made enough progress in market-oriented reform. The pattern observed in the West sub-sample, however, goes against Okun's law: during the full period, 1997-2006, the relationship between the GDP growth rate and changes of unemployment rate is in fact positive and significant while it is not significant in either of the sub-periods. These differences in the

nature of the relationship between growth and unemployment may be driven by the uneven progress in implementing economic reform in China. The coastal areas of the East region were exposed to the reform measures and the market economy much earlier than the interior areas of Center and especially West. That would explain also why Okun's relation can be found in East and Center during the later sub-period for but not during the earlier one and in neither sub-period for West. We address this issue in the following two sections.

5 The Relationship between Growth Rate and Unemployment Rate

Much of the previous empirical literature on this topic is concerned with the effect of growth on unemployment. However, there are also likely to be forces running in the opposite direction. High unemployment may have an adverse effect on growth in the presence of a learning-by-doing effect, reducing the pool of saving available for investment in physical or human capital or knowledge-creating activities (Bean and Pissarides, 1993). We therefore investigate both possibilities: the impact of growth on unemployment and that of unemployment on growth. We consider both linear and non-linear regression specifications and find the explanatory power of the latter to be greater. Therefore, we adopt a non-linear LSDV (Least Square Dummy Variables) specification.

Table 3 shows how growth affects unemployment. It is clear that there is a hump-shaped relationship between unemployment and growth in the full sample, as well as in the East, Center and West sub-samples. These results confirm the prediction of Aghion and Howitt (1994) that the sign of the effect of growth on unemployment can be either positive or negative. Specifically, high rates of growth are negatively correlated with unemployment while low rates of growth are positively correlated with unemployment. The turning points (peak points), that is the rates of growth at which the effect changes from positive to negative, are 22%, 13%, 19% and 15% for the full sample, and East, Center and West sub-samples, respectively. Given that most provincial growth rates (see Figure 2) are below these turning points, unemployment may in fact increase further if Chinese growth goes up. In other words, in the context of the Aghion

and Howitt (1994) model, the creative destruction effect dominates in China at present.

Table 4, in turn, considers the effect of unemployment on growth. The results are more mixed and less clear cut than those above. There is again a hump-shaped relationship between unemployment and growth in the full sample, and in the West and East sub-samples. However, the relationship estimated for the Center sub-sample is neither significant for 1997-2006 nor for 1997-2001. The turning points, that is, values of unemployment associated with peak growth for the full data set and the East and West sub-sets are 5.28%, 2.53% and 4.9%, respectively. In East China, unemployment should always lower growth as most of observation of unemployment are greater than the turning point of 2.53% (Figure 3). Hence, further increases in unemployment may inhibit economic growth in this region. In West China, unemployment is mainly lower than the turning point of 4.9% which implies that a positive relationship between unemployment and growth should prevail in that region.

Crucially, although the aforementioned results suggest the presence of a relationship between unemployment and growth, it is merely indicative of correlation between them, not of the direction of causality going one way or another. In such a situation, one can either attempt to resolve this question by using instrumental variables or take guidance from theory. The former is notoriously difficult, especially when it comes to finding suitable instruments. As for the latter, we believe the Aghion-Blanchard model (1994) on the relationship between unemployment and the speed of reform is particularly instructive.

6 Trade-off between Speed of Reform and Unemployment

The major insight of the Aghion-Blanchard model is that there is an intermediate optimal level of unemployment whereas too much or too little of it can hurt the economic prospects of a country in transition. Given that China started its transition with essentially no unemployment, increasing unemployment should therefore be associated with a faster expansion of the private sector, at least initially. Assuming that the private sector is the main driving force behind economic growth, this relationship would also explain the pattern identified in the preceding section: the effect of unemployment on growth being negative in East China, where

reforms have progressed relatively far, insignificant in Central China, and positive in the West.

Since the model stipulates a hump shaped relationship between the speed of reform and unemployment, we regress the change in the number of private employees, our proxy for the speed of reform, on a quadratic polynomial of the unemployment rate. The results based on the full sample, reported in Table 5, strongly support the model: there is an inverted U-shaped relationship between the speed of transition and unemployment rate in China and this relationship is significant at the 1 percent level. Hence, at low levels, increasing unemployment should increase the speed of transition whereas the opposite should be the case in regions with already high unemployment. The optimal speed of transition is predicted to be attained at an unemployment rate of 3.53 percent. In fact, China's average unemployment rate was 3.54 percent over the period covered in this analysis.[2] Hence, the relatively moderate unemployment prevailing in China at present should not be seen as a necessarily negative phenomenon. Rather, it may be necessary to help facilitate China's transition and economic reform. Short-term hardship thus will be outweighed by long-term economic gain (Valev, 2004).

7 Conclusions

Based on the above analysis, we can shed some light on the economic implications of growing unemployment in China. We find that the negative relationship between growth and unemployment, the well-known Okun's Law, is only emerging in China. Specifically, we find evidence that such a negative relationship prevails in Central and Eastern China, especially in more recent times, but not in Western China where the relationship may in fact be positive. This mirrors the fact that the reforms were initially limited only to Eastern China and thereafter spread inland gradually, from East to West. China has thus implemented its reform following a pattern of geographical gradualism.

So far, the unemployment level in China remains moderate: the latest figure, for 2013,

[2] This appears very low, compared to developed economies as well as other transition economies as we use the registered unemployment rate. This should be interpreted as a proxy for the actual true unemployment rate, which is certainly higher. However, as we mentioned earlier, the use of registered unemployment rate as a proxy should not affect the sign and the direction of our results.

reports the official unemployment rate as 4.6 percent.[3] The Aghion and Blanchard (1994) model suggests that an intermediate level of unemployment is necessary to achieve an optimal speed of transition. Our empirical estimates suggest that the current unemployment rate in China is indeed close to the optimal rate. Unemployment is thus the price that China needs to pay for future prosperity.

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Table 1: Sub-groups

Sample	Observations
East	Beijing, Tianjin, Shanghai, Liaoning, Shandong, Jiangsu, Zhejiang, Fujian, Guangdong, Hainan
Central	Hebei, Shanxi, Neimenggu, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hunan, Hubei
West	Guangxi, Guizhou, Yunan, Sichuan, Shanxi, Gansu, Ningxia, Qinghai, Xinjiang

Figure 1: The Optimal Level of Unemployment U^* And The Maximal Speed of Transition $\dot{N}_p^*$

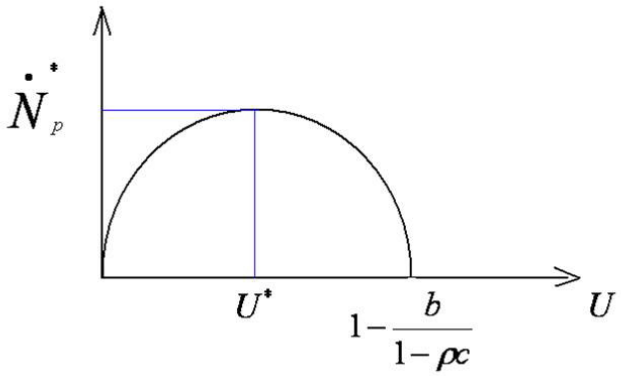


Table 2: Okun's Coefficient, LSDV Panel approach

	Period	Okun's coefficient	t-Statistics
China	$1997-2006$	-0.000924 (0.001780)	-0.519247
	$1997-2001$	0.000212 (0.000578)	0.367136
	$2002-2006$	-0.015068^{***} (0.002877)	-5.237059
East	$1997-2006$	-0.013416^{***} (0.003695)	-3.630902
	$1997-2001$	-0.001656 (0.003376)	-0.490475
	$2002-2006$	-0.009531^{***} (0.002803)	-3.399882
Center	$1997-2006$	-0.011868^{**} (0.005477)	-2.166914
	$1997-2001$	-0.001420 (0.002992)	-0.474572
	$2002-2006$	-0.034073^{***} (0.007618)	-4.472599
West	$1997-2006$	0.004012^{**} (0.001985)	2.021445
	$1997-2001$	0.000343 (0.000623)	0.551241
	$2002-2006$	-0.011758 (0.006111)	-1.924081

Standard errors in parentheses. *** 1% significance, ** 5% significance.

Table 3: Unemployment as function of growth during 1997-2006

Variables	Full sample	EAST	CENTRAL	WEST
constant	1.703510^{***} (0.301767)	-2.561383 (2.143907)	0.974850^{**} (0.395113)	2.297389^{***} (0.206061)
g^2	-54.49003^{***} (21.56805)	-371.2240^{***} (161.2112)	-90.15515^{***} (25.72050)	-78.43072^{***} (23.78040)
g	23.75909^{***} (5.166393)	95.36929^{**} (37.65610)	34.41178^{***} (6.549670)	24.05964^{***} (4.459429)
R^2	0.78	0.81	0.78	0.92

U is the unemployment rate. g is the growth rate.

Standard errors in parentheses. *** 1% significance, ** 5% significance.

Table 4: Growth as function of unemployment during 1997-2006

Variables	Full sample	EAST	CENTRAL	WEST
constant	0.019748**	0.067158***	0.050354	−0.045893***
	(0.010074)	(0.015763)	(0.041436)	(0.011111)
U^2	−0.003442***	−0.005454***	0.001544	−0.006269***
	(0.000570)	(0.001560)	(0.003659)	(0.000490)
U	0.036363***	0.027556***	0.009283	0.061769***
	(0.004883)	(0.010182)	(0.024942)	(0.004794)
R^2	0.40	0.81	0.30	0.71

U is the unemployment rate. g is the growth rate.

Standard errors in parentheses. *** 1% significance, ** 5% significance.

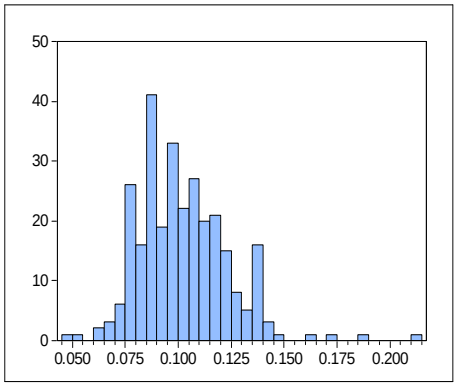
Table 5: Interaction between the speed of transition and unemployment during 1997-2006

variables	Full sample
constant	−287.1233***
	(52.11857)
U^2	−24.97831***
	(3.890164)
U	176.3222***
	(28.81680)
R^2	0.3

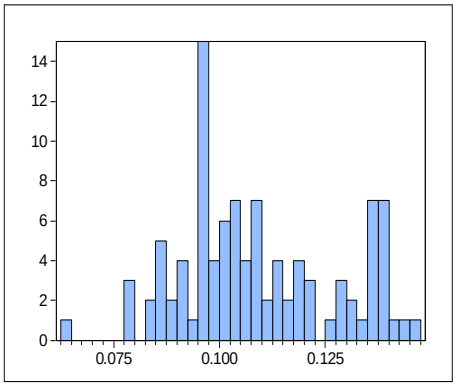
U is the unemployment rate..

Standard errors in parentheses. *** 1% significance, ** 5% significance.

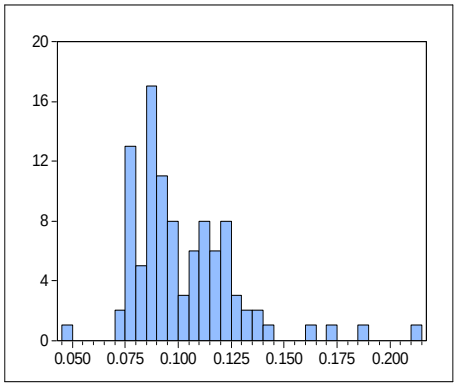
Figure 2: Growth rate: Chinese regions



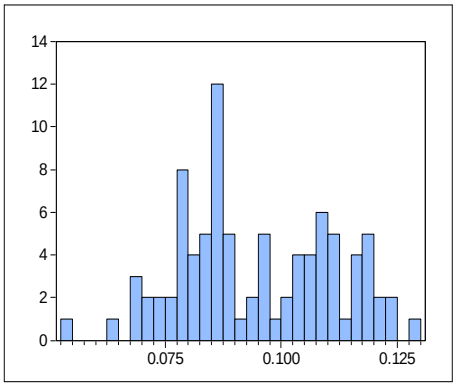
Growth-Full Sample Mean: 0.102



Growth-East Sample Mean: 0.109

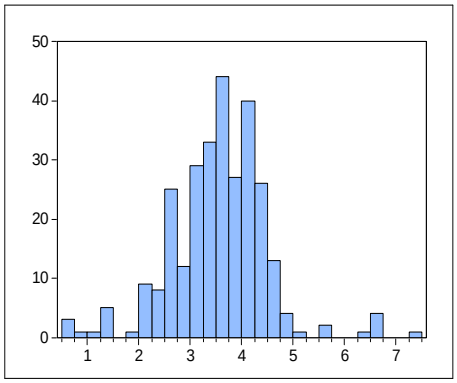


Growth-Central Sample Mean: 0.103

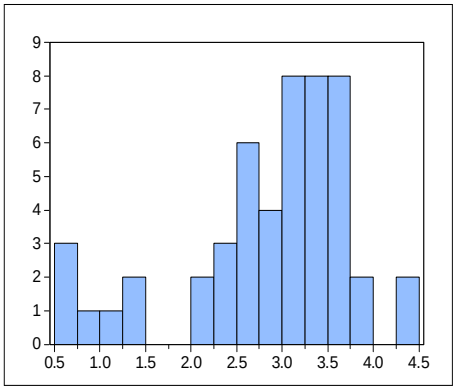


Growth-West Sample Mean: 0.095

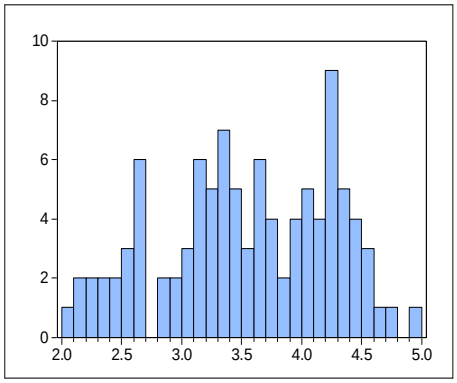
Figure 3: Unemployment rate: Chinese regions



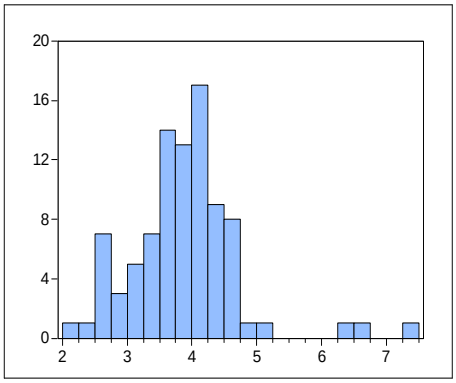
Unemployment-Full Sample Mean: 3.54



Unemployment-East Sample Mean: 2.85



Unemplayment-Central Sample Mean: 3.50



Unemployment-West Sample Mean: 3.85