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Unemployment, Growth and Speed of Transition in China

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 indeed find 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-Code: E240, E610, J640.

Keywords: unemployment, Okun's Law, growth, optimal speed of transition, China.

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1 Introduction

China has been experiencing 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 become one of the most pressing problems of Chinese economic development at present. Intuitively, we would expect that the high output growth rate should reduce unemployment. 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). Arthur Okun, using U.S. data, concluded that "in the post-war period, on the average, each extra percentage point in the unemployment rate above four percent has been associated with about a three percent decrement in real GNP." Previous studies have largely confirmed the existence of the trade-off between unemployment and output in mature market economies (Izyumov and Vahaly, 2002). In this paper, we investigate the nature of this relationship in China, a country undergoing wide-ranging systemic economic reform. In particular, we are interested in seeing whether the growth-unemployment relationship is different in a rapidly-growing transition economy, compared to mature economies.

The process of economic transition has had a major impact on the urban labor market in China. Like other former communist countries, China started its transition from a situation of full employment. Initially, the labor market was characterized by three key features. First, urban workers were assigned to their posts at which they would enjoy life-long employment without any fear of dismissal or unemployment. Second, the *hukou* system of household registration restricted the ability of workers to move between rural and urban areas and across regions. Third, welfare policies including rationing of basic necessities, social security policy exclusive to urban regions and other public service provisions further restricted labor mobility and equal treatment of residents in rural and urban areas (Cai and Wang, 2010). After the reform of urban employment system was accomplished and the so-called 'iron rice bowl' was broken, 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). Privatization of state owned enterprises in the late 1990s has lead 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, respectively (Qian, 1999).

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. As such, they ignore the regional aspects of this relationship (see Wu, 2003; Cai and Wang, 2010). However, both the progress in reform and the fruits of reform differ substantially across regions. As a result, large differences in the degree of economic development between the three broad regions of China – East, Center and West – have emerged. The coastal areas in the East have particularly benefited from the open-door policy, developing much more quickly than the interior areas in the Center and West regions. Therefore, an examination of the growth-unemployment relationship at the regional level is as important and interesting as the aggregate-level analysis.

In the next section, we estimate this relationship at the national and regional levels and for two different sub-periods. We expect the relationship to emerge gradually, reflecting the progress of the market-oriented reform. We anticipate evidence of this gradual progress both in time and space: the relationship should appear stronger during the second sub-period but it should also appear strongest in the East region in the latter period as that region experienced faster progress than the remaining two regions. In Section 3, we extend the analysis by considering the interaction between unemployment and growth, again both at the national level and regional level. In Section 4, we address the specific nature of the reform period by exploring the link between unemployment rate and the speed of transition as postulated by the Aghion-Blanchard model. Section 5 offers conclusions and discusses policy implications.

2 Does Okun’s Law Hold in China?

2.1 Overview

Okun’s law is a macroeconomic relation between output and unemployment. In his original article, Okun (1962) found that, on average over the post-war period, each percentage point of the unemployment rate above four percent was associated with the real 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) re-estimate the Okun’s relationship with US data and the coefficient varies depending on the methodology used: ordinary least square, autoregressive transformation instrumental variable procedure, cyclical data series, and other factors added in. Kaufman (1988), Lee (2000), and Moosa (1999) evaluate the Okun relationship in order to check its robustness across 29 industrialized countries and find significant differences among them. Lee (2000) points out that the results are sensitive to whether one estimates the “first-difference” model or the “gap” version of the model. Courtney (1991, see also Harris and Silverstone, 1993) are the first to consider asymmetry, arguing that the Okun’s coefficient may be different in expansions and contractions. Harris and Silverstone (2001) test the Okun’s coefficient in an asymmetric model for seven OECD countries (Australia, Canada, Germany, Japan, New Zealand, the United Kingdom and the United States) and their results support the asymmetric model. Silvapulle et al (2004), based on US data over the post-war period, similarly find that Okun’s law is asymmetric. Izyumov and Vahaly (2002) investigate Okun’s relationship for 25 transition countries, which they divide into two groups, leaders and laggards, according to their reform progress. They show that the standard Okun’s relationship emerges in the transition countries only after the transformation has progressed sufficiently.

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 China. Wu (2003), one of the few exceptions, found Okun’s law to be non-linear in China over the period 1988-1998. In this paper, we revisit this question with a more extensive data set and we allow the Okun’s relationship to vary both over time and across the regions of China.

2.2 Model Specification

In Okun's original article (Okun, 1962), there are two standard specifications: the so-called "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:

$$\Delta U = a - b(\Delta Y/Y) \quad (1)$$

The "gap" model, instead, considers the difference between the observed and natural rate of unemployment, representing the cyclical rate of unemployment, and the difference between the observed and potential GDP, or output gap. The "gap" specification is given by

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

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

For China, as is the case with other transition countries, there are no reliable estimates of the potential GDP, NAIRU, or similar macroeconomic benchmarks (Izyumov and Vahaly, 2002). Therefore, only the first-difference model seems feasible for our study. We follow Izyumov and Vahaly (2002) and use the following equation.

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

where $i = 1, 2, 3, \dots, m$ denote provinces, $t = 1, 2, 3, \dots, n$ 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 usual 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 (all of China) and for the three broad regions discussed above: East, Center and West.

2.3 Data

Output is measured as the real provincial GDP. Unemployment is the provincial registered urban unemployment rate. Both are in annual frequency and were obtained from the Chinese National Statistical Bureau and the China labor statistical yearbook. Chongqing and Tibet are excluded due to lack of data. The period 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.

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 laid-off workers (*xia gang*) are counted as unemployed (Jackman, 1998; Clarke and Borisov, 1999). Laid-off (*xia gang*) workers are temporarily unemployed workers who nevertheless continue to maintain formal employment relation with their enterprise and may be receiving in-kind benefits such as living in company-owned housing and/or having their national insurance paid by their employers (Gu, 1999). As such, they are not registered as being unemployed. Giles et al. (2005) argue that a substantial numbers of laid-off (*xia gang*) workers may actually be working part- or even full-time or may no longer be looking for work.

There are a number of alternative estimates calculated based on published government data on employment, registered unemployment, and laid-off (*xia gang*) workers. However, Giles et al. (2005) point out that 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 laid-off (*xia gang*) workers 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 instead of the “true” unemployment rates.

2.4 Results

The question we consider in our empirical analysis is whether Okun’s relationship exists at the national or regional level in China. Table 1 reports the results for all of China. The Okun’s coefficient is negative but insignificant for the full period, 1997-2006. When we consider sub-periods, the coefficient is positive but insignificant for the early period (1997-2001). However, we find support for Okun’s law during the later period, 2002-2006, when the coefficient turns out negative and strongly significant. As expected, it appears that Okun’s law holds only after the market-oriented reforms have progressed sufficiently.

Next, we split the data into three regional sub-groups: East, Center and West. The provinces belonging to each group are shown in Table 2. The results for East, Center and West are reported in Table 3, Table 4 and Table 5, respectively. Those 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 again negative but insignificant for the early sub-period, 1997-2001. For the later sub-period, 2002-2006, the coefficients are negative and significant which implies that an Okun’s type of relationship is present. The West region appears 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: the relationship is appears positive during the early sub-period and negative (and almost significant at the 5% level) during the late sub-period.

2.5 Summary

This section has examined the Okun’s type of relationship in China, both for the country as a whole and for broad regional groups that reflect the differentiated progress towards liberalization and opening the economy across China. When considering the full period, we find that Okun’s Law does not hold for the whole sample, but it is found to be valid for the East

and Center sub-samples. 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.

3 The Relationship between Growth Rate and Unemployment Rate

3.1 Overview

The bulk of the existing theoretical literature has focussed on the effects of growth on unemployment. A significant innovation occurred with Pissarides (1990) who derived a theoretical model that was the first to introduce the link between long run growth on unemployment and argued that a higher rate of productivity growth reduces unemployment through a positive "capitalization effect" on investment in job creation. Building up on Pissarides (1990), Aghion and Howitt (1994) develop a model that combines "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-Howitt model encouraged a number of follow-up studies. Hoon and Phelps (1997) show that no relationship exists in the long run between the rate of growth and unemployment in their model. Acemoglu (1997) proposes a simple extension of the standard search model of Diamond, Mortensen and Pissarides (see Pissarides, 1990) and discusses the link between skills and technological change and the interaction of unemployment and technology. He also argues that technological progress is likely to be slower in labor markets where the job tenure is low. Mortensen and Pissarides (1998) develop a model that analyzes both the capitalization and creative destruction effects. They suggest that it is not easy to find clear-cut associations between growth and unemployment in aggregate data since technological progress can lead to job destruction but can also create new jobs because of innovation.

There is similarly no consensus in the empirical literature regarding the sign of the correlation between growth and unemployment either across countries or across longer periods of time within the same country. A number of authors, such as Saint-Paul (1993), argue that there is a positive relationship between unemployment and productivity growth. Davis and Haltiwanger (1992) suggest the possibility of a positive long-run relationship between growth and unemployment, since they show that periods of high unemployment tend to be periods of high job-turnover at the establishment level. Caballero (1993), in a time-series framework with quarterly data, finds evidence of a weak positive relationship between growth and unemployment in the UK and US between 1966 and 1989. Hoon and Phelps (1997) confirm their theory-based hypothesis in their analysis of G7 countries: they find that increases in the unemployment rate tend to slow down productivity growth. Muscatelli and Tirelli (2001) find negative correlation for five G7 economies (Japan, Germany, Italy, France, Canada). Bean and

Pissarides (1993) show that bivariate correlation between unemployment and growth can be either positive or negative depending on the differences in economic structures across OECD economies.

The above literature focuses on the effect of growth on unemployment. However, there are also likely to be forces running in the other direction, which is also of interest. 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.

3.2 Methodology and data

We seek to examine the interaction between growth and unemployment. In the absence of clear-cut theory on the nature of the relationship, we investigate both the impact of growth on unemployment and unemployment on growth.

This section uses the same data as the preceding section: unemployment rate is the registered urban unemployment rate, growth rate is calculated as the annual difference in the log of the annual provincial real GDP with data spanning the period from 1997 to 2006. The whole data set includes 29 provinces for which data are available. As before, we carry out the analysis first for the whole sample and then for the same regional sub-samples as before (see Table 2).

3.3 Results

The question which we consider in this section is two-fold: we want to see how growth affects the labor market (and unemployment in particular), and how the labor market (unemployment) affects growth. We tried both linear and non-linear regression specifications. The explanatory power of the non-linear model is greater than that of the linear model. Therefore, we adopt a non-linear LSDV (Least Square Dummy Variables) specification.

Table 6 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 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.

Table 7, 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 the sub-period 1997-2006 nor for 1997-2001. The turning points (peak points) for the full data set, and East and West sub-sets are 5.28%, 2.53% and 4.9%, respectively.

3.4 Summary

This section has investigated the link between unemployment and growth. The main finding is that there is a hump-shaped relationship between them, which may go either from growth to unemployment or from unemployment to growth. The former is consistent with Aghion and Howitt's (1994) theory that stipulates two different kinds of effects of growth on unemployment. Given that most provincial unemployment rates (see Figure 1) are below the turning points implied by our results, growth should increase unemployment in China. In other words, the Aghion and Howitt (1994) model predicts that the creative destruction effect should dominate in China at present.

When considering the relationship going from unemployment to growth, the results are more heterogeneous. In East China, unemployment should be associated with lower growth as most of observation of unemployment are greater than the turning point of 2.53% (Figure 2). 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. Finally, the relationship is insignificant for Central China.

The aforementioned results suggest the presence of a relationship between unemployment

and growth but cannot be used to ascertain the direction of causality. In such a situation, one can either attempt to resolve this question using instrumental variables or take guidance from theory. The former is notoriously difficult, especially with respect to identifying suitable instruments. As for the latter, we believe the Aghion-Blanchard model (1994) of the relationship between unemployment and the speed of reform is particularly instructive. In particular, this model (discussed in greater detail below) is consistent with the regional pattern that we observe in China: positive relationship between unemployment and growth in the West, absence of any relationship in the Center and negative relationship in the East may appear peculiar at first. We turn to this question in the next section.

4 Trade-off between Speed of Reform and Unemployment

4.1 Overview

China has been experiencing rapid economic growth on the background of increasing unemployment rate, especially during the last decade. As a result, rising unemployment has become one of the most pressing problems of the Chinese economy today. This increasingly mirrors the situation in other economies in transition where excessive unemployment has threatened government's survival and may have contributed to (partial) reform reversals (Fidrmuc, 1999, 2000). Therefore, a relevant question is whether the speed of reform in these countries, as in China, can make the burden of transition excessive.

Aghion and Blanchard (1994) present a theoretical model which argues that the speed of labor reallocation during transition and the rate of unemployment are connected to one another in an inverted U-shaped fashion. As a result, there is an optimal speed of transition, one that generates neither too much nor too little unemployment. Figure 3 depicts the relationship between unemployment, $U(t)$, and the growth of private-sector employment, $\dot{N}_p(t)$: an inverted U-curve. 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 pay lower wages when unemployment is high. Second, unemployed workers receive unemployment benefits that

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.

The major insight of the Aghion-Blanchard model, therefore, is that there is an intermediate level of unemployment is optimal whereas too much or too little of unemployment 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 faster expansion of the private sector, at least initially. Assuming that the expansion of the private sector accounts for significant part of economic growth, this relationship would also explain the pattern identified in the preceding section: the effect of unemployment on growth is negative in East China, where reforms have progressed relatively far, insignificant in Central China, and positive in the West.

4.2 Results

Aghion and Blanchard (1994) suggest that the relationship between the speed of reform and unemployment is hump shaped. Therefore, we estimate a quadratic relationship, with the change in the number of private employees as the dependent variable regressed on a quadratic polynomial of the unemployment rate.

The data on unemployment is the same as the above. The speed of transition is measured as the change in the number of private employees which include the number of workers in firms belonging to private owners: individuals, share holders, foreign companies with stakes in joint ventures in China, foreign funds, investors from Hong Kong, Taiwan or Macao, share cooperatives, and limited liability companies.

Empirical test results based on the full sample are reported in Table 8. The results strongly

support the model of Aghion and Blanchard (1994): 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 unemployment, higher unemployment leads to faster the speed of transition whereas at high unemployment, higher unemployment leads to lower the speed of transition. The optimal speed of transition is predicted to be attained at the unemployment rate of 3.53%.

4.3 Summary

In this section, the link between the speed of transition and unemployment in China has been investigated. The main finding is that the data display an inverted U-shaped relationship consistent with the theory of Aghion and Blanchard (1994). To the best of our knowledge, this is the first time that this theory has been tested empirically.

Aghion and Blanchard (1994) model tells us that an intermediate level of unemployment is optimal during the transition process because it maximizes the job creation in the private sector. The optimal level of unemployment according to our empirical results is 3.53%, based on data covering the period 1997-2006 (see Table 8). In fact, China's average unemployment rate was 3.54% over this period.¹ Hence, the current level of unemployment 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).

5 Conclusions

Based on the above analysis and investigation, we can shed some light on the validity of Okun's law in China. We find that the law does not hold universally in China. We argue that this reflects the different progress in economic reform in time and space. In particular, we find that Okun's law holds in Central and Eastern China in the later sub-period but not in Western

¹This 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.

China. This mirrors the fact that the reforms were initially limited only to Eastern China and thereafter spread inland gradually. China has thus implemented its reform following a pattern of geographical gradualism. Our findings concerning the validity of Okun's Law in China reflect this fact.

So far, the unemployment level in China remains moderate. 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: Okun's Coefficient, LSDV Panel approach, Whole sample (29 provinces)

Period	Okun's coefficient	t-Statistics
1997 – 2006	−0.000924 (0.001780)	−0.519247
1997 – 2001	0.000212 (0.000578)	0.367136
2002 – 2006	−0.015068*** (0.002877)	−5.237059

Figures in parentheses are standard errors. *** 1% significant level

Table 2: 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

Table 3: Okun's Coefficient, LSDV Panel approach EAST sub-sample (10 provinces)

Period	Okun's coefficient	t-Statistics
1997 – 2006	−0.013416*** (0.003695)	−3.630902
1997 – 2001	−0.001656 (0.003376)	−0.490475
2002 – 2006	−0.009531*** (0.002803)	−3.399882

Figures in parentheses are standard errors. *** 1% significant level

Table 4: Okun's Coefficient, LSDV Panel approach Central sub-sample (10 provinces)

Period	Okun's coefficient	t-Statistics
1997 – 2006	−0.011868** (0.005477)	−2.166914
1997 – 2001	−0.001420 (0.002992)	−0.474572
2002 – 2006	−0.034073*** (0.007618)	−4.472599

Figures in parentheses are standard errors

*** 1% significant level, **5% significant level

Table 5: Okun's Coefficient, LSDV Panel approach WEST sub-sample (9 provinces)

Period	Okun's coefficient	t-Statistics
1997 – 2006	0.004012** (0.001985)	2.021445
1997 – 2001	0.000343 (0.000623)	0.551241
2002 – 2006	-0.011758 (0.006111)	-1.924081

Figures in parenthese are standard errors. ** 5% significant level

Table 6: 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 unemployment rate. g is growth rate. [†]WEST area used fixed effect with SUR

Figures in parenthese are standard errors. *** 1% significant level, **5% significant level

Table 7: Growth as function of unemployment during 1997-2006

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

U is unemployment rate. g is growth rate. [†]EAST area based on period 1997-2001

Figures in parenthese are standard errors*** 1% significant level, **5% significant level

Table 8: 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 unemployment rate

Figures in parenthese are standard errors. *** 1% significant level

Figure 1: Growth rate sample

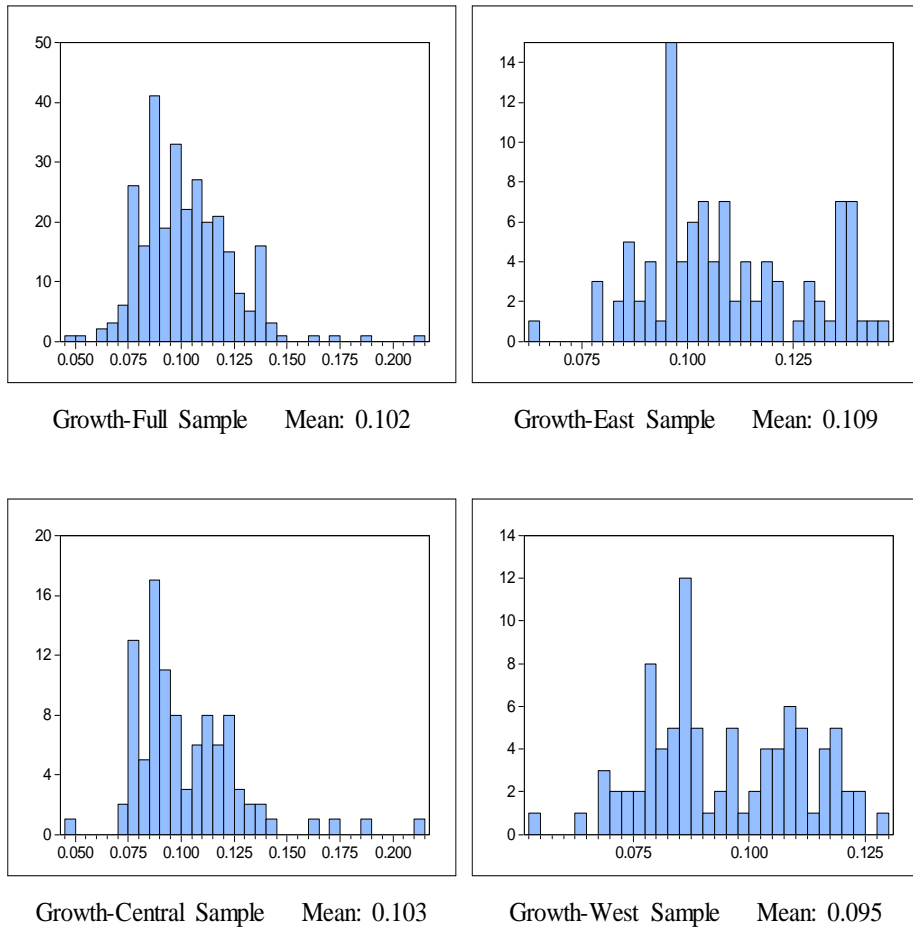


Figure 2: Unemployment rate sample

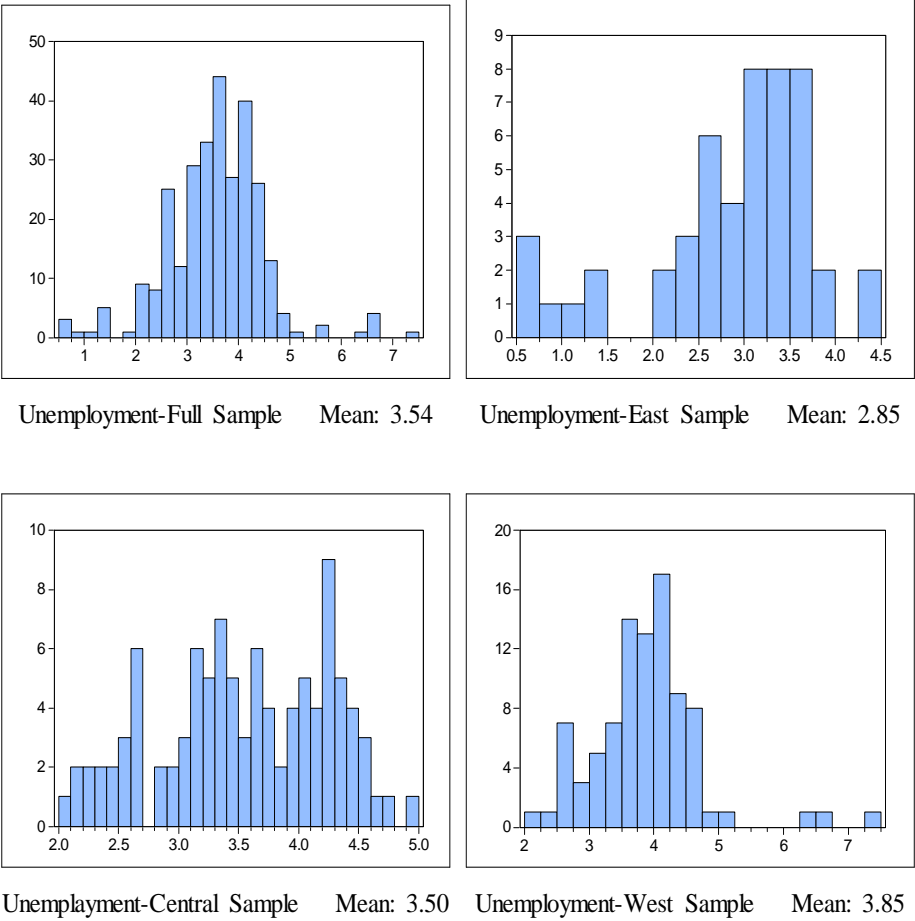


Figure 3: The Optimal Level of Unemployment U^* And The Maximal Speed of Transition \dot{N}_p^*

