

Testing for Unemployment Hysteresis in Selected Transition Economies

Qaiser Munir • Kok Sook Ching • Fumitaka Furuoka • Hanafiah Harvey

Abstract This study aims to examine the hysteresis hypothesis in unemployment using panel data of 11 Asian countries covering the period 1980-2012. We employ the second generation panel unit root tests recently advanced by Smith et al. (2004). These tests have an advantage as they are able to exploit the cross-section variations of the series. This study provides strong empirical evidence against the hysteresis hypothesis in unemployment for the Asian countries. Finding shows that the unemployment rates of these countries have a tendency for mean-reverting. As such, an increase in the unemployment rates is most likely only temporary. Hence, policy makers may not require short-run policies to curb the problem of rising unemployment. Instead, they may consider to pursue long-run strategies for strengthening the fundamental of the domestic labour markets. More importantly, the finding suggests that these countries will benefit from having a wider choice of fiscal and monetary policies as the policies may not result in the long-run negative impact on the unemployment rates.

Keywords Hysteresis - Unemployment rate - Panel stationarity tests
Cross-sectional dependence

JEL Classification B23 - C12 - C2

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Introduction

The hysteresis hypothesis in unemployment is considerable important to policy makers and thus it has attracted much attention from researchers. Based on the theory, if unemployment is $I(1)$ process, shock that affects a series will have a permanent effect. As such, it will shift the unemployment equilibrium from one level to another. Should this be the case, from the standpoint of policy makers, policy action is indeed necessary so as to return unemployment to its previous equilibrium level. On the other hand, if unemployment is $I(0)$ process, the effect of shock is merely transitory. As a result, the need for policy action is less mandatory. This is because unemployment will eventually return to its previous equilibrium level. Literature refers the second case as the natural rate of unemployment hypothesis (NAIRU). In which, it characterizes unemployment dynamics as a mean reversion process.

In their early works, Phelps (1967) and Friedman (1968) claim that unemployment should converge to a natural rate in the long-run, often referred to as the natural rate hypothesis. If this hypothesis correctly describes the time series properties of unemployment rates, deviations from the natural rate are short-lived and will die out eventually. Blanchard and Summers (1987), however, argue that the movement of unemployment has a characteristic of hysteresis, implying that economic shocks will have a permanent effect on unemployment rates. These two competing hypotheses are empirically testable by employing conventional unit root tests on unemployment rates. The Eevidence of a unit root will be supportive for the hysteresis hypothesis. While rejecting a unit root serves as the evidence for the natural rate hypothesis. In the context of Asian countries, presently, there is no clear consensus on whether these countries' unemployment rates are characterized by NAIRU or exhibiting hysteresis in unemployment. This is mainly due to only handful of past studies have focused on the Asian countries. As a comparison, the literature of the OECD countries is plentiful.

The objective of this study is to empirically investigate the nature of 11 selected Asian countries' unemployment rates, by incorporating the most recent data and allowing for cross-section dependence among these Asian countries. The time span (1980-2012) is not so long that the univariate unit root tests might suffer from low power in this case. However, the panel unit root test used here may alleviate this shortcoming. Based on the cross sectional dependence (CD) test proposed by Pesaran (2007), we find strong evidence of cross-section dependence and motivation for the use of second generation panel unit root tests. Contrary to the many previous studies, we utilize the second generation panel unit root tests proposed by Smith *et al.* (2004). By using these panel unit root tests, we find strong support against the hysteresis hypothesis in unemployment for the selected Asian Countries

The remainder of this paper is organized as follows. Next section is literature review. The third section is the discussion of econometric methodology and unit root tests applied. The data and empirical results are presented in the fourth section. Last section concludes.

Literature Review

As hysteresis is associated with nonstationary unemployment rates, unit root tests have been widely used in the literature to empirically investigate its validity (Blanchard and Summers 1986; Brunello 1990; Mitchell 1993; Arestis and Mariscal 2000; Roed 1996). Although these studies seem to support a unit root in unemployment rates and therefore hysteresis, critics of the hysteresis theory counterclaim that earlier empirical support may have been a result of the lower power of the conventional unit root tests employed. In line with this, recent studies have, in fact, find that conventional unit root tests not only have failed to consider information across regions, thereby leading to a loss in efficiency in the estimations, but also have low power against near unit root but stationary alternatives. These factors obviously cast considerable doubt on the many findings from earlier studies of a unit root in unemployment rates.

In recent years, a number of alternative procedures have been proposed to test for the presence of unit roots in panels that combine information from the time-series dimension with that from the cross-section dimension, such that fewer time observations are required for these tests to have power. The most commonly used unit root tests applied to panels include Maddala and Wu (MW) (1999) and Im, Pesaran and Shin (IPS, 2003). These tests are used for testing the joint null hypothesis of a unit root against the alternative of at least one stationary series, by using the augmented Dickey–Fuller (ADF) (1979) statistic across the cross-sectional units of the panel. Song and Wu (1997) use a panel unit test by Levin and Lin (1992) which the result rejects unit root of unemployment rates in 48 US states while fails to reject it for most of the individual states. Later on Song and Wu (1998) apply the Levin and Lin (1992) test to unemployment series of 11 EU countries and find no evidence of hysteresis. A recent study that employs panel data methods is León-Ledesma (2002). This study has confirmed hysteresis for 11 EU countries and the natural rate for 51 US states using the IPS test. It should, however, be noted that IPS (2003, p.73) warns that due to the heterogeneous nature of the alternative hypothesis in their test, one needs to be careful when interpreting the results, because the null hypothesis that there is a unit root in each cross section may be rejected when only a fraction of the series in the panel is stationary. A further issue of concern is that the presence of cross-sectional dependencies in the data generating process. Phillips and Sul (2003) point out that panel unit root tests

that do not allow for cross-section dependence are over-sized when the true data generating process contains substantial cross-section dependence. To some extent, these concerns are addressed by Camarero and Tamarit (2004) and Chang et al. (2005) who conduct ADF unit root tests within a seemingly unrelated regression framework. Camarero and Tamarit (2004) have rejected the hysteresis effects in 12 of 19 OECD countries, while Chang et al. (2005) have confirmed the hysteresis hypothesis for 8 of 12 European countries.

Another group of studies are based on panel unit root tests (with and without structural breaks), which try to exploit the cross-sectional variation of the series. The most commonly used panel unit root tests for the case of no breaks are the tests of Levin et al. (2002) and Im et al. (2003); and in the case of breaks the test of Im et al. (2005) that allows for up to two mean shifts. For instance, Song and Wu (1997, 1998) analyze 48 US states and 15 OECD countries, respectively. Both works find strong evidence against the hysteresis hypothesis. León-Ledesma (2002) has detected a higher degree of persistence in the EU than in the US. The author uses data up to 1999 and applies the Im et al. (2003) test. Camarero and Tamarit (2004) apply a panel SURADF unit root test to study 19 OECD countries and find evidence in favor of NAIRU hypothesis in most of these countries. On the other hand, Chang et al. (2005) apply the same test in 10 European countries and have confirmed the hysteresis hypothesis for 80% of the sample. In the case of breaks, Murray and Papell (2000) employ the test of Levin et al. (2002), which is extended to allow for a homogeneous break in the unemployment mean, to annual data of 17 OECD countries over the period 1955-1990; this test has strongly rejected the joint null hypothesis of hysteresis. Lee et al. (2001) use a panel LM unit root test with structural changes to analyze the unemployment in 17 OECD countries. They have strongly rejected the unemployment hysteresis hypothesis. Camarero et al. (2006) allow for a different number of endogenous break points in the unemployment series, as they examine the hysteresis hypothesis in unemployment rates by using panel data for 19 OECD countries covering the period 1956–2001. The finding gives support to the natural rate hypothesis of unemployment for majority of the countries analyzed. In the path, Camarero et al. (2008) offer similar detections for transition countries. Lee H-Y et al. (2009) apply the structural break panel unit root test of Im et al. (2005) to unemployment rates from nine Asian countries. The test allows for one or two endogenously determined structural break(s). Although the results are mixed, for the whole sample they have rejected the unit root hypothesis of unemployment rates, however, after excluding few stationary series from analysis they mostly could not reject the unit root hypothesis and hysteresis.

Recently, empirical studies have stressed on considering the possible cross-sectional dependence in the series. Lee (2010) applies the methodology of nonlinear panel unit root tests to test for the hysteresis of unemployment in 29 OECD countries,

and takes into account both nonlinearity and cross-sectional dependence. The data used are until 2008 and with different beginning dates due to the availability of data. A nonlinear panel unit root test developed by Ucar and Omay (2009) is employed for testing the hypotheses of nonlinearity and nonstationarity of the series. This study uses the bootstrap procedure proposed by Ucar and Omay (2009) to resolve the problem on the possible biased towards rejection of unit root null due to cross-sectional dependence. In addition, a sequential panel selection method suggested by Chortareas and Kapetanios (2009) is utilized to identify and separate the stationary series from the nonstationary series. The author points out that the major weakness of panel unit root tests is unit root is a joint hypothesis for all series in the panel. In which, the null hypothesis may be rejected even though only one series is stationary. The finding of this study is in favour of the natural rate of unemployment for 23 of 29 OECD countries. Evidence of hysteresis is found in Greece, Iceland, Ireland, Japan, Luxembourg, and Norway. This finding seems to be inconsistent with Chang (2002). The latter provides evidence of no hysteresis in 17 of 29 OECD. The countries associated with hysteresis are Australia, Czech Republic, France, Hungary, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Sweden, and the United Kingdom.

Ener and Arica (2011) examine the hysteresis hypothesis in 15 OECD countries over the period 1985-2004. They employ a panel unit root test that allows for cross-sectional dependency and a panel unit root test with structural breaks. The finding from the panel root test with cross-sectional dependency indicates that the unemployment rates in these OECD countries can be described as a non-stationary process. However, the finding from the test with structural break suggests that the unemployment time series can be seen as a stationary process.

Cuestas et al. (2011) examine mean reversion in the unemployment rates of European transition economies. A sophisticated econometric analysis carried out in the study has failed to reject the null hypothesis of a unit root. Ayala et al. (2012) use a unit root test with one structural break and a unit root test with two structural breaks to examine the unemployment hysteresis in 18 countries in Latin America for the period of 1980-2009. They point out that the unemployment rates in these countries can be described as stationary process when structural breaks are taken into account for analysis.

More recently, a few studies have demonstrated the usefulness of Fourier function to deal with the structural breaks in the series. Chang (2011) applies the stationary test with a Fourier function proposed by Becker et al. (2006) for testing the hysteresis hypothesis in 17 OECD countries. Data used are spanning from 1960 to 2009. This method is thought able to incorporate the structural breaks in the series while testing for the unit root null hypothesis. The results from traditional unit root tests, ADF, PP and KPSS do not reject the unit root process for these countries.

Distinctively, by using the method with Fourier function, the results reject the unit root process for six OECD countries including Australia, Canada, Finland, France, Sweden, and the United States.

Cheng et al. (2014) utilize a flexible Fourier unit root test proposed by Enders and Lee (2012) to examine the hysteresis hypothesis in unemployment for the PIIGS countries, namely Greece, Ireland, Italy, Portugal, and Spain over the period of 1960-2011. The Fourier unit root test is found to have greater power than the conventional unit root tests of ADF, PP and KPSS, when the series are stationary and nonlinear process with a unknown form of structural change. Results from ADF and PP do not reject the nonstationary null hypothesis for all these countries. By using KPSS, mixed results is produced. When a trend term is not used, the result does not reject the null of stationary for Ireland. When a trend term is used, the result does not reject stationary for Portugal. In sum, the traditional unit root tests find evidence of hysteresis for the PIIGS countries. Nevertheless, the method of Fourier unit root test confirms hysteresis only in Greece, Ireland, and Italy. This finding seems to be inconsistent with the belief that European countries tend to have a greater extent of unemployment hysteresis as a result of the role of specific market institution such as union.

Clearly, majority of the empirical inquiries focus on the developed countries in Western Europe and North America. Two notable exceptions are the studies by Lee et al. (2010) and Furuoka (2012) that examine the hysteresis in unemployment in the context of Asia-Pacific region. Lee et al. (2010) use the Lagrange Multiplier (LM) unit root test and the panel unit root test that takes account of structural breaks. The result fails to reject the null hypothesis of hysteresis even after incorporating the structural breaks in the series. Furthermore, Furuoka (2012) uses the MADF test and the SURADF test to analyze unemployment hysteresis in 12 Asia-Pacific countries. The empirical result confirms the presence of unemployment hysteresis, except for South Korea and New Zealand. The result of Furuoka's study also indicates that equilibrium rate of unemployment in Asia-Pacific region tends to be path-dependent and the cyclical fluctuations in these economies could have a permanent effect on the level of unemployment.

Indeed, there is only handful of past studies which have focused on the Asian countries. This study is motivated to add to the literature with new empirical evidence on these countries. Thus, the contribution of this study is empirically investigating the nature of 11 selected Asian countries' unemployment rates, by incorporating the most recent data and allowing for cross-section dependence among these countries.

Econometric Methodology

Panel Unit root tests with Cross-sectional dependence

Recently, Smith et al. (2004) have developed more powerful variants of some commonly used panel unit root tests, thereby allowing for general forms of cross-sectional dependence through bootstrap methods. The first two tests are the standard t -bar statistic (Ψ_t) and the Lagrange Multiplier (LM) panel statistic (Ψ_{LM}) of IPS. Smith et al. (2004) consider a panel specification of the form:

$$\Psi_{Min} = \frac{\sqrt{N}(Min_{NT} - E(Min_i))}{\sqrt{var(Min_i)}}$$

Where p_i is the required degree of lag augmentation to make the residuals white noise, α_i represents the country-specific fixed effects, and $i = 1, \dots, N$ and $t = 1, \dots, T$ stand for the number of panel members and time periods, respectively. To achieve the most parsimonious model compatible with white noise residuals, p_i is determined by the conventional step-down procedure.

The t -bar statistic is computed as an average of individual t -statistics from ADF specifications, i.e. $\bar{t}_{NT} = N^{-1} \sum_{i=1}^N t_i$. The standardized statistics is given as following:

$$\Psi_t = \frac{\sqrt{N}(\bar{t}_{NT} - E(t_i))}{\sqrt{var(t_i)}}$$

Where $E(t_i)$ and $var(t_i)$ are the expected value of the mean and variance, respectively. IPS also provided the Lagrange Multiplier (LM) test statistic, which after normalisation takes the following form:

$$\Psi_{LM} = \frac{\sqrt{N}(LM_{NT} - E(LM_i))}{\sqrt{var(LM_i)}}$$

Where LM_i is the individual LM test and $LM_{NT} = N^{-1} \sum_{i=1}^N LM_i$. Smith et al. (2004) also develop panel versions of some powerful modifications of univariate ADF t -statistics such as the Max test (Maxi) of Leybourne (1995) and the weighted symmetric (WS) test of Pantula et al. (1994). Leybourne (1995) proposes to obtain the ADF t -statistic from original data (DFf i), and from time-reversed data ($zit = y_i, T+1-t$) yielding DFri. The Max t -statistic for individual i is obtained as $Maxi = \text{Max}(DFf\ i, DFri)$. In a panel framework, the panel Max t -statistic takes the form:

$$\Psi_{Max} = \frac{\sqrt{N}(Max_{NT} - E(Max_i))}{\sqrt{\text{var}(Max_i)}}$$

Where $Max_{NT} = N^{-1}\sum_{i=1}^N Max_i$. Likewise, individual WS tests are computed as in Pantula et al. (1994), and the panel counterpart is given by:

$$\Psi_{WS} = \frac{\sqrt{N}(WS_{NT} - E(WS_i))}{\sqrt{\text{var}(WS_i)}}$$

Where $WS_{NT} = N^{-1}\sum_{i=1}^N WS_i$. Finally, Smith et al. (2004) present a more powerful variant of the Lagrange Multiplier (LM) statistic on the basis of forward and reverse ADF regressions which yield the univariate LM_{fi} and LM_{ri} . Since both statistics take a positive value, the minimum LM statistic is computed as $Min = Min(LM_{fi}, LM_{ri})$. The panel version of the test is as follows:

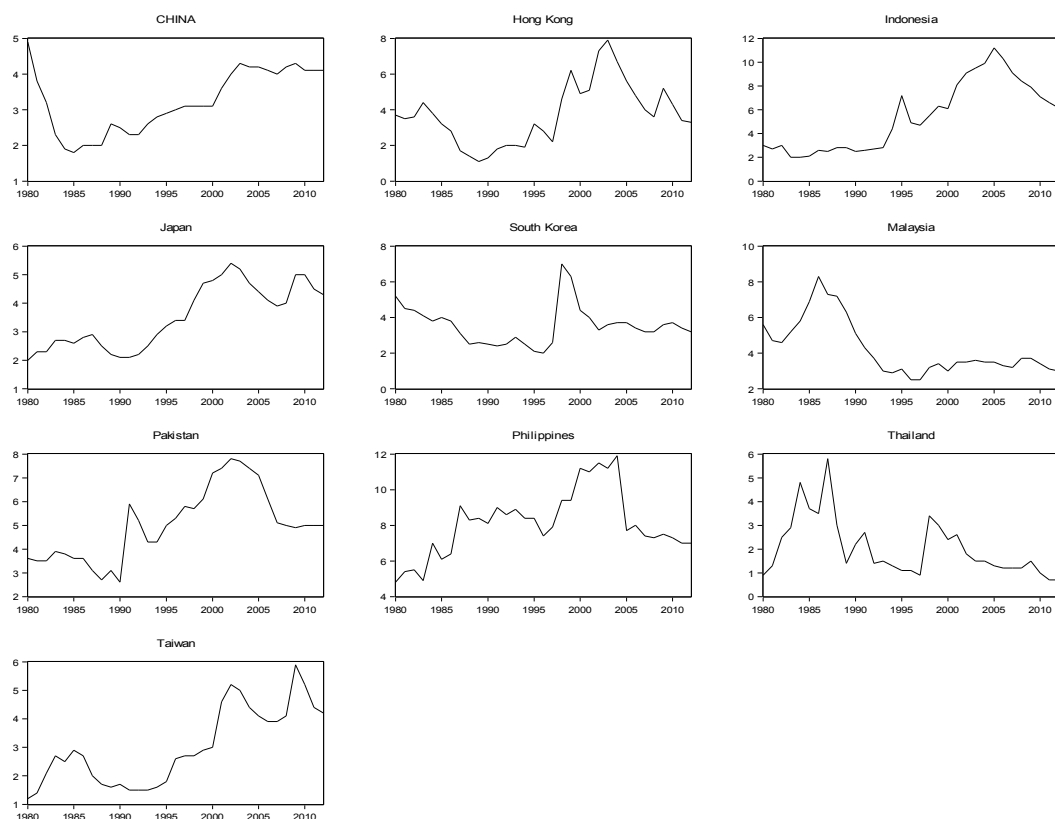
$$\Psi_{Min} = \frac{\sqrt{N}(Min_{NT} - E(Min_i))}{\sqrt{\text{var}(Min_i)}}$$

Where $Min_{NT} = N^{-1}\sum_{i=1}^N Min_i$. Given that these tests assume both cross-sectional independence and asymptotic normality, Smith et al. (2004) have developed a modified bootstrap procedure to compute p -values that are robust to small-sample bias and to general forms of cross-sectional dependencies across panel members¹.

Data and Empirical Results

To perform our tests, we employ the annual data on unemployment rates from 11 Asian countries over the period 1980-2012. The countries are China, Hong Kong, Indonesia, Japan, South Korea, Malaysia, Pakistan, Philippines, Singapore, Taiwan and Thailand. The remaining Asian countries are excluded from our sample because there is not enough unemployment data. Our dataset comes mainly from International Labour Organization (ILO), World Development Indicators (WDI), and various government statistics publications. Figure 1 depicts the historical trend of the unemployment rate of the selected Asian countries.

¹ See Smith et al. (2004, pp. 165–166) for details on the bootstrap procedure that generates bootstrap innovations through resampling using a block size of 30 and 20,000 replications.

Figure 1 Unemployment rate of the selected Asian countries

Conventional Univariate Tests

As a benchmark, we first apply several conventional unit root tests such as Dickey and Fuller (ADF, 1979), Phillips and Perron (PP, 1988) and Kwiatkowski et al. (KPSS, 1992) to examine the null hypothesis of a unit root in the unemployment rate of each country. Table 1 summarizes the results of hysteresis hypothesis testing based on conventional unit root tests. We include a time trend and intercept in the model and use the Schwartz Information Criterion to select the optimal lag length for ADF test. The bandwidth is selected automatically using the Newey and West (1994) method for PP and KPSS tests. Our main finding from ADF and PP (which tests the null hypothesis of non-stationarity) can be summarized as follows. We are able to reject the unit root null hypothesis only for China, South Korea and Thailand at the 5% or below level of significance. For the remaining countries in our sample, we are unable to reject the null hypothesis of unit root based on the ADF and PP tests. This implies that for 72% of the countries in our sample, the ADF and PP

tests suggest that unemployment series are non-stationary. Turning to the KPSS test, we are able to reject the null hypothesis of stationarity for China, Pakistan and Philippines at the 5% level of significance. However, for 8 countries, namely Hong Kong, Japan, South Korea, Malaysia, Pakistan, Singapore, Taiwan and Thailand we are unable to reject the null of stationarity.

Taken together, the results from the univariate unit root tests suggest that hysteresis in unemployment hypothesis is supported by 6 of 11 Asian countries under study. On the contrary, the hysteresis in unemployment hypothesis can be rejected for China, Korea, Pakistan, Philippines and Thailand. As rejection of the hypothesis implies evidence in favor of the natural rate hypothesis, this finding suggests that unemployment in these 5 Asian countries is flexible enough to easily revert to its long-run equilibrium determined by the domestic labour markets.

Table 1 Unit root tests without a break

	ADF t-stat	LL	PP t-stat	Band- width	KPSS LM-stat	Band- width
China	*-6.744	1	*-6.071	11	**0.147	3
Hong Kong	-2.219	3	-1.838	1	0.099	4
Indonesia	-1.218	0	-1.436	3	0.097	4
Japan	-2.265	1	-1.631	1	0.085	4
South Korea	** -3.591	1	-2.598	6	0.098	2
Malaysia	-2.222	4	-1.931	3	0.095	4
Pakistan	-1.549	0	-1.579	1	**0.147	4
Philippines	-1.873	0	-1.761	2	**0.152	3
Singapore	-2.231	0	-2.429	2	0.077	3
Taiwan	-2.536	1	-2.186	2	0.113	4
Thailand	** -3.587	0	** -3.592	2	0.058	3

Notes: LL denotes the lag length. The finite sample critical values for the ADF and PP test are -3.21, -3.581 and -4.273 at the 10%, 5% and 1% levels, respectively, and are extracted from MacKinnon (1996). The finite sample critical values for the KPSS test are 0.119, 0.146 and 0.216 at the 10%, 5% and 1% levels, respectively, and are extracted from Kwiatkowski *et al* (KPSS, 1992). * and ** denote statistical significance at the 1% and 5% levels, respectively.

First Generation Panel Unit Root Tests

It is well known that univariate unit root tests suffer from low power if the variable is a stationary but highly persistent time series. By contrast, panel unit root tests are aimed to increase power by exploiting cross-sectional information between units. Levin, Lin and Chu (LLC, 2002), Breitung (2002), Im, Pesaran and Shin (IPS, 2003), Maddala and Wu (1999) and Choi (2001), and Hadri (1999) have developed

the tests of panel data. The LLC (2002), Breitung (2000), IPS (2003), and Fisher-type (Maddala and Wu, 1999) and (Choi 2001) tests have the null hypothesis that all the panels contain a unit root. The Hadri (2000) test has the null hypothesis that all the panels are stationary. The authors have demonstrated that even relatively small panels offer large improvements with respect to power. Therefore, we proceed to test the hysteresis in unemployment rates by using the panel data tests.

It is observed from Table 2 that, after incorporating country-specific effects into account, the null hypothesis of unit root (implying existence of hysteresis in unemployment) can be rejected at the 10% significant level based on the LLC (2002), IPS (2003) and at the 5% level of significance based on the Breitung (2002) unit root test. It can be concluded, based on these three tests which by incorporating cross country variations, the unemployment series of all the 11 Asian economics are stationary. In other words, the unemployment rates of these countries as a whole is mean-reverting in the long-run and therefore there is no evidence of hysteresis in unemployment in these countries. However, from Table 2, this finding is changed when we apply the nonparametric Fisher test of Maddala and Wu (1999) and Choi (2001), which shows the evidence for the hysteresis in unemployment rates of the selected Asian countries. The null hypothesis cannot be rejected based on Maddala and Wu (1999) and Choi (2001) tests, providing the strong support the hysteresis hypothesis. This finding is cross-validated by the Hadri (2000) test. The results indicate that the null hypothesis that all of series in the panel are stationary is clearly rejected (the test statistic is 2.964; p-value 0.001). These contradicting results from the first generation panel unit root tests are due to negligence of accounting for cross-sectional dependence.

Table 2 The first generation panel unit root tests

	Test statistics	p-value
LLC (2002)	-1.506	***0.066
IPS (2003)	-1.599	***0.055
Breitung (2002)	-2.246	**0.012
Maddala and Wu (1999)	28.056	0.110
Choi (2001)	-0.798	0.212
Hadri Z-stat (2000)	2.964	*0.001

Notes: *, **, *** denotes rejection of null at the 1, 5 and 10% level.

Testing for Cross-Section Independence

So far, the presentation of the panel statistics has assumed that individuals are cross-section independent. However, this assumption might be restrictive in practice since the analysis of macroeconomic time series for different countries are affected by similar major events that might introduce dependence among individuals in

the panel data set. A number of panel unit root tests allowing for cross section dependence have been proposed in the literature. In this paper, we account for cross-section dependence by using Moon and Perron (2004), chang (2002), (Choi, 2006), and Pesaran (2007) panel unit root tests. Since traditional panel unit root tests which are derived under the assumption of cross-sectional independence are well known to be subjected to large size distortions (O’Connell 1999; Maddala and Wu 1999), we need to test whether this assumption holds in practice. In order to test the cross-section dependence among the individuals, we use the CD statistic of Pesaran (2004).

Pesaran (2004) presents a test statistic based on the average of pair-wise Pearson’s correlation coefficients $\hat{\rho}_j$, $j = 1, 2, \dots, n$, $n = N(N-1)/2$, of the residuals obtained from ADF-type regression equations. The CD statistic in Pesaran (2004) is given by:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \right)$$

Pesaran’s CD statistic tests the null hypothesis of cross-section independence against the alternative of dependence.

For each country we compute the residuals from ADF regressions whose optimal lag-order is determined using the general-to-specific procedure suggested by Ng and Perron (1995) with a maximum lag order of eight. Since the CD statistic takes on a value of 10.5, we are able to strongly reject the null hypothesis that output innovations are cross-sectionally independent at the 1% level. This result is plausible and reflects the high degree of cross-sectional dependence induced by trade links, international capital movements and common shocks hitting the sample of Asian countries under scrutiny.

Table 3 Cross-section independence test results

Average (Pi, j)	CD Statistics	P-value
0.444	10.5	0.000

Note: CD denotes Pesaran.s (2007) test statistic with the null hypothesis of cross-section independence

Second Generation Panel Unit Root Tests

We now proceed to report the results from the application of a battery of recently developed panel stationarity tests of Smith et al. (2004) which explicitly control for cross-sectional correlation. To account for cross-sectional dependence, we apply bootstrap methods to obtain the critical values of the panel statistics of Smith et

al. (2004). The first two tests are the standard t -bar statistic (Ψ_t) and the Lagrange Multiplier (LM) panel statistic (Ψ_{LM}) of IPS. They also develop panel versions of some powerful modifications of univariate ADF t -statistics such as the Max t -statistic and the Min LM-statistic, which are both based on forward and reverse ADF regressions, as well as the weighted symmetric (WS) test. These panel statistics are denoted by Ψ_{Max} , Ψ_{Min} and Ψ_{WS} . All the five tests take as null a unit root in all individuals versus the alternative of stationarity for at least one individual panel member. The p -values of the five tests are computed employing 20,000 bootstrap replications in order to control for general forms of cross-sectional dependence as well as for finite-sample bias. We define a block size equal to 30 and a maximum lag-order for whitening the residuals equal to eight.²

The results from the computation of these more powerful panel unit root tests are reported in Table 4 below. The evidence provided by the bootstrap version of the five panel unit root t -statistics do not support the presence of a unit root in unemployment rates of the selected Asian countries as they all reject the null of nonstationarity at the 10% or below significance level. This finding provides the evidence against the hysteresis hypothesis.

Taken together, contradicting to conventional panel unit root test, the results from second generation panel unit root tests suggest that the unemployment rates of these economies are stationary. This leads to the conclusion that the unemployment rates as a whole is mean-reverting in the long-run and therefore there is no evidence of hysteresis in unemployment for these countries.

Table 4 The 2nd generation panel unit root tests

Test	statistics	p-value
Ψ	-1.932	0.081
Ψ_{Max}	-1.514	0.036
Ψ_{LM}	7.444	0.015
Ψ_{Min}	3.133	0.054
Ψ_{WS}	-1.832	0.018

Notes: p-values for all panel unit root tests are computed employing 20000 bootstrap replications and defining a block size equal to 30. The maximum lag order is set at eight. A general-to-specific procedure has been used to select the optimal lag-length.

Overall, our empirical results provide significant support for unemployment rate stationarity among 11 Asian countries. The finding is in sharp contrast with those reported previously based on univariate and traditional panel unit root tests where the null is not rejected in all cases. The latter is such as Lee et al. (2010) in the

² The results remain unchanged for a block size equal to 100 and other maximum lag-orders different from eight.

context of Asia-Pacific region. Further, this highlights the importance of allowing for contemporaneous correlation in the panel setting demonstrating the gain in power after controlling for cross sectional dependence. By comparing our finding with those reported by other researchers for the Asian countries (i.e. Lee et al., 2010; Furuoka, 2012) we see that all these studies have led support to the contention that the unemployment hysteresis hypothesis is accepted which is in contrast with what the present study claims.

This study adds new evidence to the existing literature of the natural rate of unemployment which has been postulated by Song and Wu (1997) for 48 US states, Song and Wu (1998) for 11 EU countries, Song and Wu (1998) for 15 OECD countries, Lee et al. (2001) and Murray and Papell (2002) which both give strong evidences on 17 OECD countries under their studies, Chang (2002) for majority of 29 OECD countries, Camarero and Tamarit (2004) for majority of 19 OECD countries, Camarero et al. (2006) for majority of 19 OECD countries, Camarero et al. (2008) for selected transition economies, Lee (2010) for majority of 29 OECD countries, and Ayala et al. (2012) for 18 Latin America countries. In a contrast, this study's finding which is against the hysteresis hypothesis in unemployment is inconsistent with Chang et al. (2000) for majority of 10 European countries, León-Ledesma (2002) for 11 EU countries and 51 US states, Cuestas et al. (2011) for selected European transition economies, and Chang (2011) for majority of 17 OECD countries.

Conclusion

This paper analyses the empirical validity of the hysteresis hypothesis in unemployment rates for 11 Asian countries over the period 1980-2012. To this end, we have first applied univariate unit root test namely ADF, PP, and KPSS. The fact that conventional unit root tests normally lack power has led to the development of panel unit root tests which are more powerful than their univariate counterparts. However, More recently, it has also become well known the fact that panel tests that fail to allow for cross-sectional correlation are subject to severe size distortions. In order to test the cross-sectional dependence in the data, we have applied the CD statistic of Pesaran (2004) to unemployment innovations, rendering strong evidence of cross-sectional dependence in the error structure of our panel of countries. Lastly, we have accounted for this fact by employing a battery of panel unit root tests of Smith et al. (2004) that explicitly allow for cross-sectional dependence across countries. In contrast to the existing literature for Asian countries, we find support for the view that unemployment rates appear stationary in the long run after allowing for cross sectional dependencies. An implication of this finding is that it

provides support to the view that the unemployment rates exhibit mean reversion, and therefore appear consistent with the natural rate hypothesis.

Unemployment is a major source of concern among policymakers and society as a whole. Some important policy implications can be drawn from the findings of the present study. First of all, the empirical results suggest that higher-than-normal unemployment rates in Asian countries will automatically revert to a sustainable level. This indicates that policy makers in Asian countries need not to hammer out some special short-run policies to deal with the problem of high unemployment. Instead, as the findings suggest, the policy makers in Asian countries may focus on the long-run strategies that would aim at strengthening the fundamental of domestic labour markets. Among such strategies could be creating favorable conditions for and promoting Research and Development (R&D) activities by the multinational corporations (MNCs) in Asian countries.

Secondly, contractionary fiscal policies in Asian countries that would aim at achieving a low level of the budgetary deficit would not have produced a negative long-run impact on their unemployment rates due to its mean-reversion tendency. In other words, the policy makers of Asian countries for fiscal policy would have a wider choice of policy options to fulfill their policy targets.

Finally, restrictive monetary policies in Asian countries that would aim at controlling the inflation rate in order to achieve their target inflation rate also would not have a prolong negative effect on the unemployment rates because of unemployment rates' mean-reversion tendency. In this sense, the monetary authorities in Asian countries could have a wider range of options to regulate money supply in order to achieve the target inflation rate.

The present study examines the behavior of the unemployment rates in Asian countries using second generation panel unit root tests. Future studies may use longer periods of the time series data to examine the hysteresis in the region. More importantly, researchers may consider using the latest available statistical methods, such as nonlinear unit root test or fractional integration analysis, when examining the stationary process of the unemployment series data in the region. The findings of such studies would give much needed insights on the mean reversion in the unemployment in Asia.

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