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Abstract

With the increments of labor market institutions, the potential problem caused by labor market rigidity is emerging within the four Asian tigers, namely, Hong Kong, South Korea, Singapore and Taiwan. This study emphasizes the impact of labor market rigidity on economic performance in the four Asian tigers over the 1980-2010 period. Through the estimation of the aggregate production function, we find that labor market rigidity has a negative impact on output and economic growth. On the other hand, without imposing any labor market institutional adjustment that would lower the standard of labor conditions, the rises in country's competitiveness can serve as a balancing force to mitigate the negative impacts of labor market rigidity. A crucial insight for policymakers is to determine the most efficient method for giving labor effective protection without hurting economic performance.

JEL Codes: C33, J3, J58

Keywords: Labor market rigidity, output, economic growth, four Asian tigers, openness, international competitiveness.

1. Introduction

Over the past several decades, labor market institutions (the so-called regulations and, in some sense, rigidity), referring to unemployment insurance, employment protection, union and taxwedge, and their impacts on the labor market have constituted one of the most high-profile issues prevailing in both Europe and the United States. On the one hand, Europe has been through times in which labor market rigidity has worsened the unemployment problem as was the case in the 1970s that in turn stimulated the labor market reforms which started to take place in the 1990s. On the other hand, the United States has by contrast gone through a tradeoff between labor market flexibility (which enhances a relatively low unemployment rate) and a high degree of wage inequality (Mortensen and Pissarides, 1999; Hornstein and Krusell, 2005). Furthermore, Nickell and Layard (1999) indicate that the poorly designed labor market institutions (rigid labor market regulations) have become outdated and have not only led to a deterioration in the unemployment problem, but also to a fall in the economic growth rate. However, the economic growth-labor market rigidity nexus has yet been quantitative examined.

In this study, we argue that the same problem is emerging in the Asian market. Table 1 provides a brief glimpse of some of the suspicions raised. It shows the evolution of non-wage cost as a percentage of the total compensation cost (NWC% hereafter)[1] as well as the GDP per capita growth rate of the four Asian tigers over that period from 1980 to 2010, averaged over five-year intervals. NWC% rises from 3.3, 9.9 and 7.4 to 8.5, 17.7 and 14.1 in Hong Kong, South Korea and Taiwan, respectively. In the meantime, the growth of GDP per capita, with a few cyclical stages in some intervals, declines from 5.3, 6.5 and 5.3 to 3.8, 3.6 and 3.9 over the long term. A negative relationship between NWC% and growth is found to exist in

[1] The non-wage cost includes social insurance expenditures and labor-related taxes, which are the components associated with the so-called labor market institutions and rigidity.

some intervals in Hong Kong (the 1990s), South Korea (1985-1999) and Taiwan (1985-2004). Although the NWC% figures in Singapore are in cyclical decline and have remained at 13.9 in the latest years, they are still at a level that other countries have taken years to reach. The long-run GDP per capita has also declined in Singapore. However, we do not rule out the possibility that these incidents are shadowed or purely driven by macroeconomic shocks, and thus later in our empirical section we include macroeconomic variables to control the aggregate shocks and econometric techniques that will help clearly depict the relationship between labor market rigidity and productivity.

While studies that shed light on Asian labor markets are few, an increasing number are, however, gradually being published. For example, in India, states with labor market institutions that have been modified to be more pro-worker have experienced decreases in output, employment, investment and productivity in registered or formal manufacturing. In other words, labor market rigidity in India has been found to have a negative impact on economic performance because of the rising labor costs due to the rigidity and the decreases in foreseen future profit which results in reduction of investors' capital investment (Besley and Burgess, 2004). On the other hand, the increases in labor market rigidity in newly-industrializing economies (NIEs) in East Asia, namely, Hong Kong, Singapore, South Korea and Taiwan are also worth noting. Fields (1994) stresses that the rise in labor market institutions are the consequences led by the so-called Asian economic miracle that occurred over the period from the 1960s to the early 1990s, and during which the labor market institutions and conditions were substantially improved. Workers benefited from the economic growth during that period of time. However, with the constant increments of labor market institutions, we wonder if there are any potentially negative impacts on economic performance.

Given that there could be a negative impact of labor market rigidity, the direct modification of labor market institutions could sometimes be difficult to implement as it could shrink workers' benefits. We wonder if there are alternative solutions that would turn the negative effects around instead of the drastic changes in labor market institutions. This brings out the other main point of this paper where we argue that the increasing international competitiveness resulting from a higher degree of trade openness could undermine labor market rigidity and further ease the impact of labor market tightness. Nickell and Layard (1999) indicate that encouraging product market competition is a key solution to mitigating the negative effects of unions on economic performance. For example, unions, one of the so-called labor market institutions that cause labor market rigidity, can hold up firms' investments by resisting innovation in production, which leads to a reduction in productivity. International or external pressure, brought about for instance by challenges of product market competition or the introduction of technological workplace practices, could diminish union power and push unions to be more co-operative in terms of enhancing productivity. Furthermore, Hasan et al. (2007) and Rodrik (1997) suggest that trade liberalization can raise the elasticity of labor demand. Through the substitution and scale effects, the increase in openness leads to increases in imports of substitutes goods (for instance, semi-finished goods) for domestic labor, which in turn generates greater factor demand elasticity. Firms are thus able adjust labor costs by choosing favorable/beneficiary factors to offset the increasing labor cost from the rising domestic labor market rigidity. In other words, increasing openness to improve international competitiveness could to some extend undermine labor market rigidity and outweigh the negative impact that labor market rigidity could have on economic growth. We thus provide quantitative evidence in a later section regarding this viewpoint.

This study employs country-level data ranging from 1980 to 2010 for Hong Kong, South Korea, Singapore and Taiwan. Empirically, we observe how labor market rigidity affects productivity by examining the production function. Secondly, we take one- and five-year differences in regard to the productivity function to examine the influences of labor market rigidity on economic growth. Finally, we look at the interaction between labor market rigidity and openness to observe whether improving international competition by encouraging a degree of trade openness could offset the effect of labor market rigidity. Furthermore, our measurement of labor market rigidity is based on indirect payments (the non-wage portion) as a percentage of the total compensation cost (NWC% hereafter) collected from the key indicator of labor market dataset (KILM hereafter). The NWC refers to hourly social insurance expenditures and labor-related taxes[2], which are the main components of so-called labor market institutions (rigidity) that in studies usually include four dimensions, namely, unemployment insurance, a tax wedge, union density and employment legislation (Nickell 1997 and 1998; Nickell and Layard, 1999; Blanchard and Wolfers, 2000; Nickell, 2003; Nickell et al., 2005). Due to limitations on the access to complete individual institutional variables for the four Asian tigers and the difficulties associated with compiling a collective labor market index, NWC% is an alternative representation of the degree of labor market rigidity. The larger that NWC% is, the higher the labor market rigidity. On the other hand, we employ the degree of openness[3] in accordance with the literature to represent the degree of a country's international competitiveness. In addition, in order to avoid arbitrary setting we also employ the terms of trade as a proxy for the competitiveness as the robustness check.

[2] Specifically, they are employers' contributions to compulsory, contractual and private social security schemes, pension plans, casualty or life insurance schemes and benefit plans in respect of their employees.

[3] The international trade (import and export) share of GDP.

We believe that the contributions of this paper are threefold. First of all, by employing econometric methods, we examine the potential problem that lies behind the increasing labor market rigidity in the four Asian tigers. Secondly, in view of the lack of studies that employ data on East Asian countries to discuss the relationship between labor market rigidity and growth, this study is an attempt to fill the gap in the econometrics literature. Finally, we provide an important policy implication regarding how governments cope with the impact brought about by rising labor market rigidity. In addition to modifying labor market institutions directly, the alternative solution is to improve the competitiveness of countries by increasing the degree of trade openness.

Our empirical results also echo the findings of past studies. First, when controlling for specific countries, time effects and macroeconomic shocks, we find that NWC% has a negative impact on both output and the economic growth rate. This implies that the increased labor market rigidity hampers economic performance. Secondly, our time series results also suggest that the marginal effect of rigidity towards growth is more intense in Taiwan than in South Korea. It is shown that Taiwan labor market is more rigorous than that in South Korea so that when facing labor market institutional adjustment, the output in Taiwan is stroke more seriously. This is because the adjustment of the labor market regulation, based on negotiations between labor, firms and the government, in accordance with the economic environment is more efficient in South Korea. The evidence can be seen for in Fig 1, which shows that South Korea experienced a dramatic decline in NWC% after 1997, the financial crisis, in order to maintain its international competitiveness and productivity (a lower labor benefit to cope with the financial crisis), while in Taiwan NWC% on the contrary keeps increasing. Moreover, the empirical evidence is even more convincing in the sense that we include a very different country, Singapore,

within our sample. Singapore has an opposite tendency in terms of the evolution of NWC% within our sample, and the inclusion of Singapore reinforces our statement of the effects of labor market rigidity on economic performance. Finally, the interaction term of NWC% and the degree of openness exhibits a positive sign significantly. This suggests that the effect of enhancing a country's competitiveness could outweigh part of the impact of labor market rigidity that is imposed on economic growth.

2. Background and Related Literature

2.1 Background

In the case of Hong Kong, Fig.1 indicates that NWC% of the total labor cost is rising at a low level, from 4% to 5% before 2000 and followed by a substantial jump in the year 2000 to 8%. This is because that the labor legislation went through extensive modification in order to improve working conditions aimed at applying international labor standards between 1997 and 2001. As of 2001, Hong Kong was following 40 conventions (including social insurance, workers' benefits and so forth), which exceeded those for most of the countries in the same region. NWC% in Hong Kong has maintained an upward trend during our sample years.

Turning to Singapore, NWC% had its first downturn in 1985, which was related to its economic decline. It is said that one of the reasons for the decline was the high wage level[4]. Another downturn occurred around 1997 because of the Asian financial crisis. In order to minimize damage from the crisis, the government provided financial relief in terms of a reduction in the contribution from the employer to the government-run retirement benefits program (Kuruvilla et al., 2002). The macroeconomic shocks impacted economic growth and temporarily undermined payments to workers and employment benefits. NWC% in Singapore has exhibited a cyclical downward trend. Nevertheless, its level has been higher than that in Hong Kong or Taiwan.

On the other hand, NWC% in South Korea remained quite stable before 1988. After the democratization in 1987 and the reform of the system of industrial relations which relaxed the restrictions on collective bargaining (Fields, 1994; Kim and Topel,

[4] Before 1979, Singapore implemented wage repression in order to maintain its international competitiveness; however, the policy failed because it not only dragged down economic growth because of the excessive demand for labor but it also lowered living standards. In 1979, the government announced a "wage correction". (Fields, 1994) Wages had since experienced double-digit growth and stopped at 1985.

1995; Kuruvilla et al., 2002), trade union power upswings and usually successful wage bargaining, the nominal wage surges and non-wage cost percentage started to rise until 1997 (Betcherman and Islam, 2001). The financial crisis in 1997, accompanied by a record high unemployment rate of 8.4% in 1999, accelerated the restructuring of the labor market[5] to achieve flexibility in order to maintain international competition and therefore caused NWC% to plummet in 1999. However, NWC% is still at a relatively high level of around 16%.

Labor market rigidity in Taiwan has obviously risen with the times regardless of any financial crises. The Labor Standards Law was enacted in 1984 and provided unions with bargaining power over employment benefits. Further democratization (the lifting of Martial Law and democratic reforms) in 1987 gave unions greater freedom from central control. Union density rose from 28% to 50% in 1995 (Kuruvilla et al., 2002). During the democratic transition, political parties started to engage in the labor market reforms in order to seek election support. Amendments to the labor market legislation thus sprung up (Wang, 2010). In 1992, while still led by a political party, the Taiwan Labor Front was founded and advocated improving labor conditions. A number of legislative bills were proposed and passed during that time. Fig. 4 depicts the rise in the non-wage cost percentage beginning around 1993. A slight downturn that occurred around 2000 was related to the domestic information technology bubble.

2.2 Literature Review

Labor market institutions (rigidity) mainly refer to four dimensions, including

[5] Kuruvilla et al. (2002) indicated that a tripartite commission (with labor participation) was held and a social pact drawn up which was mainly based on decisions related to industrial relations. The social pact included the launching of an unemployment insurance fund, the extension of unemployment benefits in terms of duration and amount, and the freedom enjoyed by labor unions to be active politically. In addition, legal amendments that allow layoffs in firms and temporary contracts were permitted and the practice of paying full-time union leaders was outlawed.

unemployment insurance, the tax wedge, union density and employment protection legislation (Blanchard and Wolfers, 2000). Increments in unemployment insurance and the tax wedge generally reduce workers' incentives to join the labor market, while the rises in union density and employment protection legislation tend to drive up the wage rate and labor costs which in turn lower employers' incentives to create jobs. Studies employing these variables to analyze the effect of labor market institutions on the unemployment rate are numerous (Nickell 1997 and 1998; Nickell and Layard, 1999; Blanchard and Wolfers, 2000; Nickell, 2003; Nickell et al., 2005). Nevertheless, the literature regarding the quantitative measurement of the impact of these institutions on economic growth is quite limited, and this is particularly so when it comes to incorporating the data for East Asian countries.

Labor market institutions could influence the growth rate and output for a number of reasons. The first is the relative price effect (Besley and Burgess, 2004). The increase in labor regulations will consequently raise labor costs that will cause firms to substitute capital or any other labor-saving inputs for labor. The rising labor costs also lead to increases in the marginal costs of production and reduce the optimal output of firms. Second, when bargaining power (union density) increases, firms' anticipated returns on their investments may not be achieved because of the workers, which reduces firms' incentives to invest and leads to decreases in capital accumulation. Furthermore, the states in India with more manufacturing industries tend to pass pro-worker legislation (which increases the labor market rigidity) because of workers' vested interests in their own benefits that deter future investment and output. Nickell and Layard (1999) and Nickell et al. (2005) also indicate that unions can affect output by holding up firms' investments in various ways, for instance, in relation to R&D expenditure, and resist new technology introduced in working practices because maintaining old practices enables workers to provide less effort. It

is also observed that firms that adopt technological innovation will end up by paying more when unions are stronger. Unions have a negative impact on firms' investment (Nickell and Denny, 1992). From the aspect of endogenous growth (Barro et al., 1995; Crafts, 2006; Loayza et al., 2005), labor market regulations can also influence the accumulation of human and physical capital and form barriers that will slow down innovation (the introduction of new technology to replace old technology). In contrast to most of the literature that falls short when it comes to giving quantitative estimates of the impacts on the growth rate and mainly focuses on the European region, we provide econometric evidence and data for Asian countries in our empirical section. Given that the share of manufacturing in industry and union density work through labor market rigidity to influence output, in a later section we will also consider these two variables as instrumental variables to correct for the possible endogeneity problem associated with NWC%.

On the other hand, the existing literature indicates that increasing product market competition is a key solution to mitigate the negative impacts of unions (one dimension of forming labor market rigidity) on economic performance (Nickell and Layard, 1999; Nickell et al., 2005). By increasing external/international exposure, firms are able to access new technology, implement a standard competition policy and remove anti-competition product market regulations, which soften union power and more external pressure is exerted on unions (labor market rigidity is undermined) to adopt a more co-operative attitude toward improving productivity. It also suggests that unions are more cooperative in terms of productivity improvement when facing the threats of consequences (losing jobs or worse) from firms becoming less competitive in a more competitive environment. Furthermore, Hasan et al. (2007) and Rodrik (1997) suggest that trade liberalization can increase the elasticity of labor demand, by which firms are able to avoid impacts of the increasing labor market

rigidity (labor costs) through two channels. First, rise the degree of trade liberalization increases the degree in openness. Firms are able to import semi-finished or assembly goods that require less manpower, which serve as a substitute for domestic labor. By this way, firms could elastically adjust their labor demand and costs in accordance with the profit, which offset the increases in labor costs brought about by the greater labor market rigidity. Secondly, trade liberalization makes it easier for firms to access labor substitutions which would reduce the share of labor and fimrs become more capital-intensive. Consequently, this will lead to an accumulation of capital and further increase their output. Moreover, increases in the degree of openness could also increase output in countries that are more international trade-oriented. The rises in output and profit could cover the rising labor costs. All in all, the increases in the degree of openness to improve international competitiveness could undermine labor market rigidity and outweigh the negative impacts that labor market rigidity could bring to economic growth. We thus seek to provide quantitative evidence in the following sections.

3. Data and Methodology

The econometric analysis requires estimations of the production function. We thus follow the aggregate production function to examine the relationship between labor market rigidity and output in level and difference specifications. The panel data comprise four Asian countries, which are Hong Kong, South Korea, Singapore and Taiwan with the time period spanning from 1980 to 2010. Most of the data are collected from the Key Indicator of Labor Market dataset (KILM) and World Bank, except for the capital stock, which is obtained from the data market that indicates that the original data are from the World Bank and are based on constant 2000 US dollars. Data for Taiwan are obtained from National Statistics of the R.O.C., which is the Taiwan bureaucratic statistics website. The details of the data sources and descriptive statistics are provided in Appendix A1.

By following the production function in Barro and Sala-i-Martin (2004) that incorporates human capital into the textbook Solow model, our model follows the spirit of Bloom et al. (2004, 2010), and Narayan (2010) taking the form:

Production function:

$$Y = A.K^{\alpha}.H^{\beta}.e^{\delta_0 NWC\% + \delta_1\, openess + \delta_2\, government + \delta_3\, GDP\ deflator} \tag{1}$$

where Y is output, K denotes physical capital, and H is human capital which comprises L, the number of workers, multiplied by h, the typical worker. We classify other relevant variables as powers in exponential form. In the following, we take the log and per capita form for our estimation purposes:

Empirical specification of output:

$$\begin{aligned} \log y_{\mathrm{it}} = \alpha \ \ & \log k_{it} + \alpha_1 \log edu_{it} + \alpha_2 \log lifeexpec_{it} + \alpha_3 NWC\%_{it} \\ & + \alpha_4\, openess_{it} + \alpha_5 government_{it} \\ & + \ \alpha_6 GDP\ deflator_{it} + f_i + d_t + \epsilon_{it} \end{aligned} \tag{2}$$

where f_i denotes the specific-country fixed effect, and d_t is the time effect. y

represents GDP per capita for country *i* at time *t*., and *k* is the per capita capital stock. *h* splits into two components. In our model, we apply *edu,* education expenditure as a percentage of GDP, and introduce another variable that is often used as one of the components of human capital in terms of health, namely, *lifeexpec*, which denotes life expectations (Topel, 1999; Barro and Sala-i-Martin, 2004; Narayan, 2010). *NWC%* denotes the non-wage cost as a percentage of total compensation which represents labor market rigidity. The non-wage cost includes employers' contributions to compulsory, contractual and private social security schemes, pension plans, casualty or life insurance schemes and benefit plans in respect of their employees which are in line with the so-called labor market rigidity in the literature. Still remaining are the environmental variables (Barro and Sala-i-Martin, 2004; Bond et al., 2010), of which *openness* is the sum of imports and exports as a percentage of GDP, and evaluates the degree of international openness while also representing the country's external and international competitiveness. In addition, *government* is government consumption as a percentage of GDP mainly controls the affect of public institutions, and *GDP deflator* is a price index that is used to capture the influences of inflation combined with the effects of the fiscal and monetary policy. Table A1 in the appendix presents variable definitions and data sources along with basic statistics. Furthermore, with this specification we incorporate union density and the share of manufacturing in GDP (Besley and Burgess, 2004) as instrumental variables and the generalized method of moments (GMM) as the methodology used to correct for the possible endogeneity problem that is related to the omission of other labor market institutional variables or measurement errors. In addition, heteroskedasticity and autocorrelation are also considered.

In order to observe how labor market rigidity directly impacts economic growth, following the conventional setting, we take one- and five-year differences for the level

of the production function. Moreover, given that the log-differenced process transforms the specification into growth form, we follow past studies and growth theory to include a lagged term of GDP per capita (Barro and Sala-i-Martin, 2004; Caselli, 1996), which captures the convergence effect[6]:

Empirical specification of economic growth:

$$\begin{aligned}\Delta\log y_{\mathrm{it}} = {} & \beta_0 L.\log y_{\mathrm{it}} + \beta_1 \Delta\log k_{it} + \beta_2 \Delta\log edu_{it} + \beta_3 \Delta\log lifeexpec_{it} \\ & + \beta_4 \Delta NWC\%_{it} + \beta_5\, \Delta openess_{it} + \beta_6 \Delta government_{it} \\ & + \beta_7 \Delta GDP\ deflator_{it} + \varphi_i + \gamma_t + v_{it}\end{aligned} \tag{3}$$

Taking a long difference, usually a five- or ten-year difference, also reduces the possibility of measurement error in terms of a full adjustment in the variables through time (Hasan at el., 2007). Moreover, the growth specification, with a lag term of GDP per capita, which is correlated with the dependent variables, pertains the same problem with the dynamic panel model (a typical dynamic model has a lagged term for the dependent variable) and has an endogeneity problem. We then follow Arellano and Bover (1995) in the selection of instruments[7] and propose the generalized method of moments (GMM) procedure to obtain consistent estimates.

Specifications (2) and (3) will be examined with an additional term which is the interaction of *NWC%* and *openness* in order to demonstrate whether the effects of international openness could undermine the negative effect of labor market rigidity. To avoid an arbitrary setting of international competitiveness, we apply the terms of trade *TOT* (the export amount divided by the import amount) in addition to *openness* to represent the international competitiveness as a robustness check of the interaction term. The coefficient predictions are as follows. First, the effect of *NWC%* on GDP per capita is negative. This indicates that the increases in *NWC%*,

[6] Conditional convergence hypothesis: Poor economies grow faster in terms of their GDP per capita than richer economies once we control the determinants of the steady state, i.e., investment and population growth (Barro and Sala-i-Martin, 2004).

[7] Baltagi (2008) has details on p.155.

implying an increase in labor market rigidity, lead to a deterioration in output due to the rising labor costs. Second, the impact of *NWC%* on the growth of per capita GDP is also negative, meaning that the higher the labor market rigidity, the slower the economic growth. Finally, the interaction term of *NWC%* and *openness* is positive, which implies that encouraging openness balances the negative impact of labor market rigidity.

4. Empirical Analysis

As described earlier, an increase in labor market rigidity could result in a deterioration of output and the growth rate, on the one hand, and on the other hand an increase in the degree of openness could alleviate the negative impacts of labor market rigidity. We then examine these possibilities empirically in this section. The empirical strategies include the following. First, for comparison purposes, we employ time series data for individual countries to estimate specification (2) and obtain the individual countries' marginal effects of labor market rigidity towards output. However, our time-series data has their limitations in terms of a small sample size. Thus, the second strategy involves estimating the four countries collectively. In addition to ordinary fixed effect estimators, we also consider the possible endogeneity by adopting union density and the manufacturing share of GDP as instrument variables and applying GMM to obtain consistent estimates. Third, we evaluate (3) to obtain the relationship between rigidity and growth. Note that all variables, with the exception of log variables, are standardized to reduce the number of decimal places for each coefficient.

Table 2 represents the results for individual countries. These results suggest that the increases in labor market institutions have a negative impact on output both in South Korea and Taiwan. In Taiwan, a one standard deviation increase in *NWC%* significantly generates a 0.103 decline in GDP per capita. Taiwan has a larger marginal effect in relation to *NWC%* compared to South Korea, which implies that the variation in labor market rigidity has a greater impact on the output for Taiwan. This is not surprising when we look at the evolution of *NWC%*. In Fig 1, NWC% for South Korea falls dramatically in 1997 and declines steadily afterwards in accordance with the economic crisis (a lower labor benefit results in a decrease in the labor cost to maintain output and productivity) and this kind of adjustment can

not be achieved without efficient negotiations between labor, firms and the government. Thus, the labor market adjustment, and the negotiation mechanism between these three parties, is more efficient in South Korea than in Taiwan, which results in the output of South Korea being less affected by changes in labor market regulations. Furthermore, physical capital and human capital have the expected positive signs as the capital expenditure with GDP per capita. *Openness* is also positive in relation to GDP per capita. The inflation control variable, *GDP deflator*, is not significant. Government expenditure is negative since it is mainly related to taxation, which could burden output (Bleaney and Nishiyama, 2002). In addition, the effects of *NWC%* are insignificant in Hong Kong and Singapore compared to Taiwan and South Korea, which implies that labor market rigidity in manufacturing-intensive countries tends to affect output more in that stronger unions tend to seek stickier labor protection that will increase labor market rigidity and hamper output (Besley and Burgess, 2004). Although the coefficients in individual countries are in line with past studies and our argument, one might have doubts over whether the sample size could lead to inconsistent estimates. Therefore, we examine the four countries collectively to increase the credibility of the evidence.

Table 3 presents our main results regarding the relationship between labor market rigidity and output. Columns (1) and (2) present the estimates using ordinary least square estimators with consideration of individual fixed effects while columns (3) and (4) adjust for possible endogeneity, heteroskedasticity and autocorrelation. The possible endogeneity of *NWC%* is also corrected by including union density and manufacturing's share of GDP as instrument variables, because the two variables are highly correlated with *NWC%* (Besley and Burgess, 2004), but are not directly related to output. Weak instrument and over-identification tests are also provided.

A quick look at columns (1) and (2), despite all of the variables being

consistent with our argument, however, reveals that the two specifications almost reject the CRTS null hypothesis[8] at the 1% level of significance, which reminds us of the possibility of a few problems in terms of the OLS analysis. Given the limitations of OLS, we apply GMM and instrument variables to correct for the possible endogeneity problem and adjustments are also made for heteroskedasticity and autocorrelation. In column (3), *NWC%* is negatively correlated with output with a marginal effect of 0.13, which is in line with the literature (Crafts, 2006; Loayza et al., 2005) which argues that the labor market rigidity has a negative influence on output through a few different channels, including the increase in labor cost that lowers the optimal output, and the investors perceives future benefit cutback and consequently to hold back their investment. Physical capital is positively and significantly related to output, implying the accumulation of capital, which rises with GDP increments. The rise in *openness* also increases GDP as the four economies are by nature internationally trade-dependent. Therefore, the increases in international trade certainly result in higher output. The GDP deflator and government have the expected positive and negative signs that coincide with the findings of past studies. Furthermore, our estimates also show that the law of CRTS cannot be rejected, which eliminates the concern to apply the output function to country-level data. The over-identification and weak identification tests are passed, and an F-value greater than 10 proves the validity of the instrumental variables.

Column (4) includes an interaction term for *NWC%* and *openness* to observe how the effect of international competitiveness offsets the effect of labor market rigidity. A one standard deviation increase in *NWC%* reduces *GDP per capita* by 0.116(-0.117+0.068*0.005) while the rise in *openness* increases *GDP per capita* by 0.104(0.104+0.068*0.007). In addition, in column (5) we also include the terms of

[8] Null hypothesis $\alpha_0 + \alpha_1$=1.

trade (*TOT*) as an alternative proxy for international competitiveness. The sign of the interaction term for *TOT* and *NWC%* is positive which is again in line with our argument. Given that other variables have with same signs as in column (3), it is shown that the interplay of *openness* with *NWC%* has a positive effect on output, which implies that the negative effect of *NWC%* can to some extent be offset by the effect of *openness*.

As mentioned in the second section, the increases in *NWC%* and labor market rigidity mainly cause the increases in labor costs, as well as the increases marginal cost of production, reduction in the optimal output and the investments of firms. On the other hand, the increases in openness interact with labor market rigidity. The increase in the degree of trade openness, for example, allows firms to access substitutes for labor from imports and thus firms are able to adjust their labor demand (Hasan et al., 2007) and labor cost to outweigh the increased labor cost caused by the increases in labor market rigidity. Moreover, under certain degrees of openness, labor market rigidity could push firms to replace the labor share with capital and become more capital-intensive, which would further increase output. In addition, the increases of international exposure due to the greater international openness helps to introduce/invest in new technological work place practices/management which turn out to undermine union power (labor market rigidity) and cause unions to cooperate in enhancing output. To sum up, encouraging the degree of openness partially outweighs the negative impacts of *NWC%*, which again echoes the existing literature (Nickell and Layard, 1999).

Turning to economic growth, the estimates are shown in Table 4. The coefficients are similar to the results in Table 3 with the exception that the dependent variable is in growth form. Obviously, the increases in *NWC%* can lead to a deterioration in economic growth via a reduction in capital accumulation, i.e., an

upswing in labor market rigidity, which increases the labor cost, holds back firms' investment and affects capital accumulation (Besley and Burgess, 2004). Furthermore, this result is in line with the literature in that the key solution to the negative impacts of labor market rigidity is to improve international competition by increasing the degree of international trade openness, which is also proved again by the interaction term in columns (2) and (4).

Collectively, by employing econometric techniques for different types of specifications, consistent results have been obtained in that the labor market rigidity not only leads to a deterioration in output but also economic growth. This is because labor market rigidity can directly raise labor costs and reduce profit and output, and furthermore reduce the incentives of firms to invest and accumulate capital. Note that even though we include heterogeneity in our sample, i.e. Singapore, which has very a different evolution for *NWC%*, the same result remains. This makes our argument even more robust. On the other hand, we empirically prove that an improvement in competitiveness among countries by encouraging a greater degree of openness balances the negative impact due to labor market rigidity. The results have a crucial policy implication that either directly reduces the labor market rigidity or maintains the status quo in the labor market by encouraging a degree of openness that outweighs the impact due to rigidity.

5. Conclusion

In the past several decades, the labor market rigidity in Europe has been attributed to poorly designed labor market institutions and a deterioration in economic performance. In contrast to past studies, we shed light on the four Asian tigers. We argue that the improvement in labor market conditions, driven by the rapid economic growth from the 1960s to the 1990s, consequently resulted in an increase in the degree of labor market rigidity. More importantly, the adverse effect of the increased labor market rigidity was that it could conversely hinder output and economic growth, which would make it a potential problem in the future.

Labor market rigidity undermines output and growth through a number of channels. First, the increases in labor rigidity are equivalent to the rises in labor costs, which reduce profits and the optimal output. Second, when firms perceive that the firm could be deprived of its expected profits from investing by labor, they may then withdraw the investment. The reduction in investment hampers the capital accumulation and damages the economic growth. Finally, the increase in union bargaining could form a strong barrier against the introduction of new technologies in the work place, which undermines productivity. On the other hand, granted that the rigidity hampers economic performance, it is also suggested that the increased degree of openness to international trade to improve national competitiveness could interact and mitigate the negative impacts of labor market rigidity on output and growth. This is because increases in openness enable firms to find substitutes to counter their rising labor costs, give outward pressure to union (undermine labor market rigidity) for enhancing productivity, and the increasing openness could of itself also raise output and profits that would in turn reduce the share of labor costs. Moreover, the openness brings the possibility of access of foreign capital substitutes, which causes firms to replace labor with capital and become capital-intensive when

facing the increments of labor market rigidity. This may in turn enhance capital accumulation and economic growth.

By employing data from four Asian tigers, this study provides empirical evidence in support of the aforementioned arguments. We propose an econometric technique that obtains consistent results showing the rises in labor market rigidity to be negatively correlated with output and economic growth. By including the interaction term for NWC% and openness, we go further to show that the increases in openness can also balance the negative impacts from rigidity. This provides a critical insight into the policy implications for governments that attempt to mitigate the negative impacts of labor market rigidity: they could either directly reduce labor market rigidity or retain the current labor market institutions while at the same time nurturing an increasing degree of openness.

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Table 1 NWC% and GDP per capita growth five-year average

	HK		KOR		SGR		TW	
Year	NWC%	GDP per capita growth	NWC%	GDP per capita growth	NWC%	GDP per capita growth	NWC%	GDP per capita growth
1980-1984	3.3	5.3	9.9	6.5	26.1	5.5	7.4	5.3
1985-1989	3.9	6.1	10.1	8.1	19.0	5.0	7.5	7.1
1990-1994	4.6	4.3	15.5	6.8	20.1	5.8	7.7	6.3
1995-1999	5.2	-0.2	22.6	3.7	19.5	2.5	12.4	4.5
2000-2004	7.8	3.8	23.7	4.8	14.9	4.1	13.2	3.3
2005-2010	8.5	3.8	17.7	3.5	13.9	3.3	14.1	3.9

Figure 1 Non-Wage Cost as Percentage of Total Compensation Cost (NWC%) in Hong Kong, Korea, Singapore and Taiwan

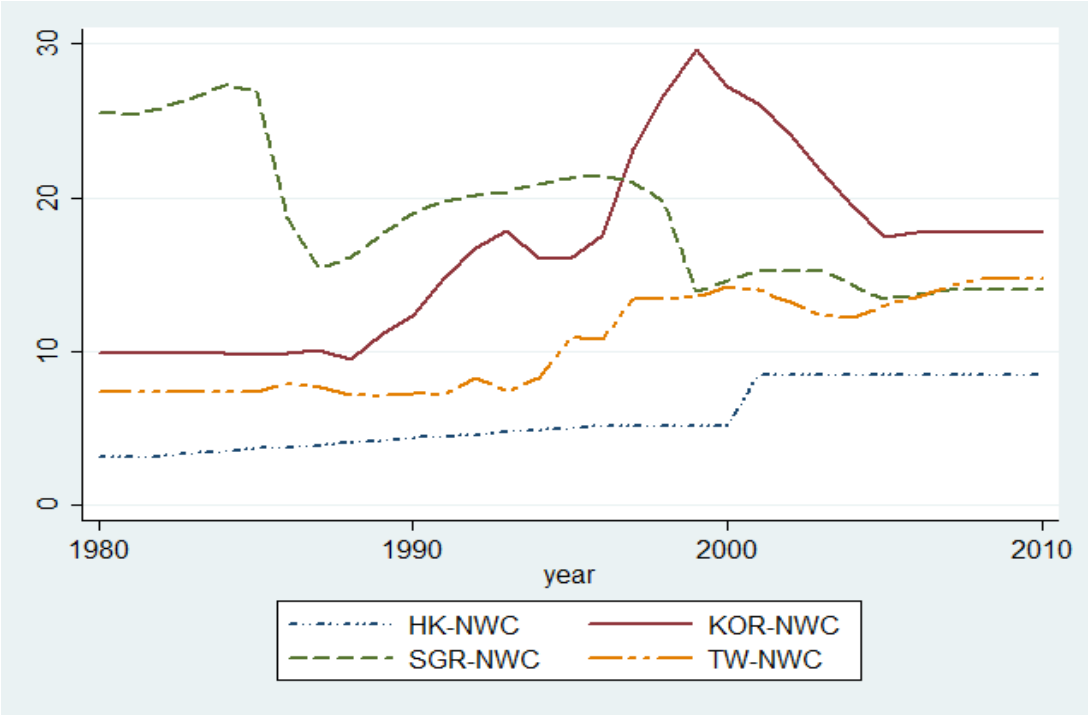

Table 2 Non-Wage Cost % and Output for Individual Countries

	HK	KOR	SGR	TW
	(1)	(2)	(3)	(4)
Dependent variable:	**log GDP per capita**			
NWC%	0.024	-0.067***	-0.006	-0.103*
	(0.079)	(0.01)	(0.012)	(0.05)
log k	0.670***	0.751***	0.504***	0.824***
	(0.182)	(0.097)	(0.093)	(0.096)
log lifeexpec	0.626	0.384*	0.983***	0.259
	(0.438)	(0.215)	(0.229)	(0.207)
log edu	-0.019	-0.054	0.002	0.14
	(0.057)	(0.038)	(0.026)	(0.14)
openness	0.107**	0.043	0.106***	0.279*
	(0.039)	(0.097)	(0.014)	(0.154)
GDP deflator	0.022	-0.00039	0.229***	-0.028
	(0.03)	(0.046)	(0.046)	(0.072)
government	-0.18***	-0.022	-0.04**	0.013
	(0.03)	(0.022)	(0.019)	(0.027)
p-value	0.000	0.000	0.000	0.000
Obs	31	31	31	30

** Significant at the 5% level; standard errors are reported in parentheses. The estimates are evaluated using the Newey method which adjusts possible autocorrelation and heteroskedasticity. Note that all variables, with the exception of log variables, are standardized to reduce the number of decimal places for the coefficients.

Table 3 Non-Wage Cost % and Output for the Aggregate Sample

	OLS		GMM		
	log GDP per capita		log GDP per capita		
Variables	(1)	(2)	(3)	(4)	(5)
NWC%	-0.036*	-0.038*	-0.126***	-0.117***	-0.107***
	(0.015)	(0.012)	(0.025)	(0.024)	(0.021)
log k	0.607**	0.742***	0.897***	1.023***	0.883***
	(0.119)	(0.104)	(0.103)	(0.117)	(0.102)
log lifeexpec	0.438	-0.082	-0.973	-0.874	-1.979**
	(0.557)	(0.378)	(0.725)	(0.708)	(0.715)
log edu	-0.091	-0.056	-0.059	-0.01	-0.061
	(0.052)	(0.029)	(0.041)	(0.035)	(0.038)
openness	0.043	0.034	0.144***	0.104***	0.145***
	(0.038)	(0.03)	(0.045)	(0.048)	(0.041)
GDP deflator	0.02	0.031	0.078***	0.062**	0.07**
	(0.026)	(0.025)	(0.026)	(0.025)	(0.022)
government	-0.064*	-0.067**	-0.084***	-0.085***	-0.069***
	(0.021)	(0.019)	(0.019)	(0.017)	(0.016)
openness*NWC%		0.059*		0.068***	
		(0.019)		(0.026)	
TOT*NWC%					0.025**
					(0.01)
Time effect	yes	yes	yes	yes	yes
Fixed effect	yes	yes	yes	yes	yes
Adjusted R-sq	0.9934	0.9944	0.9834	0.9864	0.9879
P-value	0.000	0.000	0.000	0.000	0.000
CRTS test	reject	reject	not reject	not reject	not reject
Weak identification test(F)			12.149	11.681	19.21
Overidentification test			not reject	not reject	not reject
Obs	123	123	108	108	108

** Significant at the 5% level; standard errors are reported in parentheses. The constant term is not reported. Columns (1) and (2) are the OLS estimates. Possible heteroskedasticity and autocorrelation, as well as the endogeneity problem (via GMM) have been corrected in columns (3) and (4). The time effect is included in the form of a time dummy in five-year intervals. The instrumental variables here are union density and the share of manufacturing in GDP which have all passed the weak instrument tests. (STATA code: xtreg2). Note that all variables, with the exception of the log variables, are standardized to reduce the number of decimal places for the coefficients.

Table 4 Non-Wage Cost % and Economic Growth for the Aggregate Sample

Dependent variable:	1 year Growth GDP per Capita		Dependent variable:	5 year Growth GDP per Capita	
	(1)	(2)		(3)	(4)
△ *NWC%*	-4.405**	-9.564***	△5 *NWC%*	-3.499***	-3.876***
	(1.802)	(3.434)		(1.706)	(1.209)
△*Log k*	1.054***	0.813***	△5 *Log k*	0.039	0.24*
	(0.247)	(0.13)		(0.128)	(0.13)
△*Log lifeexpect*	1.775**	1.858***	△5*Log lifeexpect*	-2.046	-3.107
	(0.823)	(0.711)		(2.376)	(2.191)
△*Log education*	-1.235	-1.193	△5*Log education*	0.061	0.01
	(0.817)	(0.862)		(0.107)	(0.059)
△ *openness*	7.932**	1.074	△5 *openness*	6.007**	2.526
	(3.38)	(2.942)		(2.911)	(2.515)
△ *GDP deflator*	7.746	-3.138	△5 *GDP deflator*	7.32	1.984
	(11.417)	(8.578)		(5.418)	(4.392)
△ *government*	-7.044***	-5.931**	△5 *government*	-5.463***	-5.171***
	(2.75)	(2.687)		(0.896)	(1.174)
△ *(openness*NWC%)*		15.539***	△5 *(openness*NWC%)*		9.923***
		(1.272)			(2.763)
L. *log y*	-5.912***	-2.615	**L5.** *log y*	-28.056***	-20.631***
	(2.116)	(2.045)		(6.43)	(3.992)
Time effect	yes	yes	**Time effect**	yes	yes
Fixed effect	yes	yes	**Fixed effect**	yes	yes
Overidentification test	not rejected	not rejected	**Overidentification test**	not rejected	not rejected
P-value	0.000	0.000	**P-value**	0.000	0.000
Obs	115	115	**Obs**	103	103

** Significant at the 5% level; standard errors are reported in parentheses. We apply the dynamic GMM of Arellano and Bond (1995) as the methodology (STATA code: xtabond2). The time effect is included in the form of a time dummy in five-year intervals. Note that all variables, with the exception of the log variables, are standardized to reduce the number of decimal places for the coefficients.

Appendix A1

Variable	Definition	#Observation	Mean	Std. Dev.	Min	Max	Data source
y	GDP per capita	123	16097	8077	3358	35537	KILM; National Statistics of R.O.C.
NWC%	Non-Wage Cost as % of Total wage cost	123	12.921	6.640	3.200	29.600	KILM
k	capital stock per capita	123	33449	16891	6549	68744	datamarket, (population as denominator, data from WDI and National Statistics of R.O.C.)
lifeexpec	life expectancy	123	76	4	66	83	WDI; National Statistics of R.O.C.
edu	education as % of gross national income	123	3.634	1.323	1.662	6.730	WDI; National Statistics of R.O.C.
openness	trade (exports and imports) as % of GDP	123	200.865	132.581	52.670	460.470	WDI; National Statistics of R.O.C.
GDP deflator	GDP deflator	123	82.968	23.043	26.779	129.450	WDI; National Statistics of R.O.C.
government	government consumption as % of GDP	123	11.339	2.811	5.620	17.600	WDI; National Statistics of R.O.C.
log y	log GDP per capita	123	9.544	0.565	8.119	10.478	KILM; National Statistics of R.O.C.
log k	log capital stock per capita	123	10.259	0.611	8.787	11.138	datamarket, (population as denominator, data from WDI and National Statistics of R.O.C.)
log lifeexpec	log life expectancy	123	4.331	0.050	4.187	4.417	WDI; National Statistics of R.O.C.
log edu	log education as % of gross national income	123	1.231	0.338	0.508	1.907	WDI; National Statistics of R.O.C.
standardized NWC%	standardized Non-Wage Cost as % of Total wage cost	123	0	1.001	-1.459	2.522	KILM
standardized openness	standardized export and import shares in GDP	123	0	1.002	-1.114	1.966	WDI; National Statistics of R.O.C.
standardized GDP deflator	standardized GDP deflator	123	0	0.948	-2.279	1.947	WDI; National Statistics of R.O.C.
standardized government	standardized government consumption as % of GDP	123	0	0.987	-2.013	2.195	WDI; National Statistics of R.O.C.