# Democratic Consolidation, Unionization, and Growth-Enhancing Structural Change*

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**Abstract**

Re-allocation of labor from less productive sectors to more productive sectors is essential in attaining economic growth. Because only some developing countries achieve productive labor re-allocation, it is important to address the determinant of productive labor re-allocation. Based on this motivation, this paper focuses on the role of unionization in structural change. First, using aggregated cross-country data from 31 countries, I find that a country with higher national labor union density has smaller growth-enhancing structural change if the country has a democratic political regime. Furthermore, I provide detailed dynamics by constructing an index for the degree of unionization for each sector in each region of South Korea and Taiwan. Consistent with cross-country evidence, the magnitude of growth-enhancing structural change was lowered when a sector in a region had a higher degree of unionization. In addition, this heterogeneous magnitude of structural change across the different degrees of unionization became more explicit after the legalization of democratic labor union confederations. These findings suggest that the institutional properties represented by unionization can affect the dynamics and growth implication of structural change.

**Keywords:** structural change, productivity, growth, labor union, democratization, democratic consolidation, South Korea, Taiwan
**JEL Codes:** D72, F16, J61

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# 1 Introduction

The fundamental challenge in achieving rapid and sustained economic growth is ensuring that labor flows rapidly from sectors with lower productivity levels to sectors with higher productivity levels. Rodrik et al. (2017) termed this challenge as a 'structural transformation challenge'. Some countries have succeeded in overcoming this structural transformation challenge during their development period. However, many other countries have not been successful in attaining productive re-allocation of labor. Understanding what decides the success and the failure is very important because it can explain this cross-country heterogeneity. This paper suggests that labor unionization is related to the speed and magnitude of productive labor re-allocation.

Increased bargaining power of labor unions affects the rigidity of the labor market through multiple channels, including wage level, wage dispersion, and employment level. As the section 3 discusses, there have been ample theoretical elaborations and empirical clarifications which support the relationship between unionization and labor market outcomes. Despite the significance of unionization, it has received limited attention from the existing empirical literature on structural change. Among many possible reasons, two main difficulties have been blocking economists from attaining it. First, for most countries, information on sector-specific rigidity, such as sector-level union density or collective bargaining coverage, is often not available. Second, most measures are from recent periods for fully developed countries, and they have limited variation in union density and collective bargaining coverage across different periods and sectors.

This paper overcomes the above empirical difficulties by quantifying the degree of unionization for each sector in each region of two East Asian new democracies. I focus on the Republic of Korea (South Korea) and the Republic of China (Taiwan), whose democratization was followed by a significant increase in the bargaining power of labor. In particular, labor unions had both quantitative and qualitative growth in the two countries during the democratic consolidation process. Labor unions gradually attained more bargaining power in

representing workers since the political democratization in two nations. In addition to time-series variation in unionization, there were also both sectoral and geographical variations in the degree of unionization during the democratic consolidation process. These bountiful variations of unionization in multiple dimensions allow me to identify the marginal effect of unionization clearly. To exploit this variation in labor rigidity and bargaining power, I construct sector- and region-specific indexes for the degree of unionization in both countries. I use the variation in these indexes to empirically examine the dynamics of structural change by following the analytic framework suggested by McMillan and Rodrik (2011) and Rodrik et al. (2017). If a sector with higher productivity attracted a greater employment share, then we can say that the economy went through the growth-enhancing structural change. On the other hand, if a sector with lower productivity attracted a greater employment share, it can be termed growth-reducing structural change. I find that labor rigidity, represented by the degree of unionization, can explain the heterogeneous magnitude of growth-enhancing structural change.

Specifically, I consider 7 sectors in 17 regions of South Korea and 10 sectors in 25 regions of Taiwan. My analysis covers all geographic provinces of South Korea and Taiwan. Data for South Korea start in 1989, while those for Taiwan start in 1992, both right after democratization in each country, respectively. My sample for South Korea ends in 2019, and that for Taiwan ends in 2018. Government reports used for constructing my unionization index are published by the Ministry of Employment and Labor of South Korea and the Ministry of Labor of Taiwan. For Taiwan, the regional distribution of labor union members is tracked by each local government. Sectoral value-added and employment in each region are used in measuring productivity, which varies across both sectors and regions, where productivity is defined by the real value-added per worker. Both countries' official national accounts and sectoral surveys are primary sources of my data on value-added and employment. As Taiwan's official statistics are not annually announced, I interpolate annual variation using the Economic Transformation Database (De Vries et al. (2021)) constructed by the Uni-

versity of Groningen. My cross-country evidence from 31 countries is estimated using the 10-sector Database (Timmer et al. (2015)) from the University of Groningen. Cross-country labor union density is from the database of the Organisation for Economic Co-operation and Development (OECD), International Labour Organization (ILO), and Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS).

Using my geographically disaggregated sectoral data from two East Asian new democracies, I test two key hypotheses. First, I test whether South Korea and Taiwan went through growth-enhancing structural change. McMillan and Rodrik (2011) and Rodrik et al. (2017) have suggested some stylized facts on country-specific experience related to growth-enhancing and growth-reducing structural change. However, while they provided an overall conceptual framework and presented aggregated trends using cross-country data, they did not fully explore the dynamic nature and path dependence. Therefore, in order to provide much more robust empirical findings, I use geographically disaggregated sectoral data and implement dynamic panel data estimation in testing this first key hypothesis. The second key hypothesis is whether the degree of unionization explains the heterogeneous magnitude and speed of structural change. This is a novel contribution to the paper. To be specific, using dynamic panel data estimators, I estimate that the magnitude of growth-enhancing structural change varies with different degrees of unionization.

I find that both South Korea and Taiwan experienced growth-enhancing structural change during the sample period. In other words, a sector with higher productivity attracted more labor share in both nations. This finding from my first hypothesis is consistent with the stylized fact about the economic growth of South Korea and Taiwan suggested by Rodrik et al. (2017). Efficient re-allocation of labor allowed South Korea and Taiwan to sustain the rapid economic growth until recently. However, the size of growth-enhancing structural change was smaller for sectors with higher unionization. In other words, the increase in the employment share coming from the productivity premium became smaller if a sector in a region encountered higher bargaining power of labor. Higher labor rigidity caused by the

stronger bargaining power of labor decelerated the growth-enhancing structural change in South Korea and Taiwan. In addition, this heterogeneous size of growth-enhancing structural change became more explicit after the legalization of the democratic confederation of labor unions in both countries. According to these findings from my second hypothesis, the institutional characteristics of the labor market represented by the degree of unionization can affect the speed and magnitude of productive re-allocation of labor. I show that empirical findings from South Korea and Taiwan have considerable external validity by deriving similar implications from cross-country data of 31 nations.

One of the main implications provided by the above findings is that, after the fundamental regime change in the bargaining power of labor attained by political democratization, the two countries no longer enjoyed quick and immediate labor re-allocation according to productivity. Given the fact that their authoritarian regimes tried to maintain the high flexibility of labor until democratization, my findings suggest that the lower rigidity of labor can be recognized as one of the critical determinants of rapid economic growth during authoritarian periods in two countries. In addition, because the quick labor re-allocation according to the growth-enhancing structural change became slower after the democratization, it was natural for those new democracies to focus more on within-sector growth rather than structural growth. This transition to the more significant share of within-sector growth is supported by productivity growth decomposition using the sample from South Korea.

The paper is organized as follows. In the next section, I discuss the related literature. I clarify the relationship between unionization and labor rigidity because it provides vital mechanisms in interpreting my empirical findings. I introduce background on the labor unions and labor movements in South Korea and Taiwan. I focus on how labor unions evolved along with the democratic transition in these two countries. Subsequent sections introduce my data and econometric specification, respectively. Then I interpret my estimation results and robustness checks. I conclude after I discuss extensions of my analysis to labor productivity growth decomposition.

# 2 Related Literature

This section links this paper to the existing related research. As the title of this paper implies, I can categorize related literature into several topics. The growth experience of South Korea and Taiwan has been receiving steady focus from social scientists. As the outset of the growth is settled mainly by their authoritarian regimes, the political economy approach has linked industrial policies of these two countries with the incentive of political agents. Along with this literature that focuses on country-specific cases, there are also cross-country studies about the impacts of institutional evolution on economic growth. The conceptual framework for comprehensive analysis on structural change and growth within an economy started getting exclusive focus in recent years when sector-level national accounts became widely available. The consequent accumulation of cross-country and within-country evidence is broadening our understanding of structural change and related issues in economic growth. As theoretical prediction and empirical studies about the impact of unionization on the labor market provide the key mechanism of my empirical analysis, I have an independent section (Section 3) on them.

The concept of the 'development state' (or the developmental state) has been widely used in explaining the economic success of two East Asian countries during the late 20th century. A development state is a regime that could sacrifice many other aspects within a country to guarantee economic growth. Political freedom or civil society used to be sacrificed for economic development. In addition, sacrificing a specific sector in terms of resource allocation also happened in order to boost another particular sector. Manufacturing sectors enjoyed abundant resources, including both labor and capital, because the key mechanism in their growth strategies was promoting export in the manufacturing sector (Wade (1990) and Haggard (1990)). It was taken for granted that the manufacturing sectors got the most attention from authoritarian politicians in both countries. Thanks to rapid economic growth coming from successful implementations of this development strategy, authoritarian politicians were able to justify their rules for decades. Amsden (1989) and Woo and Woo-

Cummings (1991) elaborated more on the experience from South Korea. Woo and Woo-Cummings (1991) revisited the role of financial intervention made by the Korean government that allowed manufacturing sectors to get a stable capital allocation. Wade (1990) provided a Taiwan-specific understanding which focused on the synergy between public administration and market.[1]

In addition to the above political economy approaches, macroeconomists also contributed in understanding country-specific cases of East Asia. Lucas (1988, 1993) emphasized the importance of human capital accumulation through learning by doing. The channel of learning by doing in both countries was highly correlated with their industrial policies. In the beginning of their industrialization, if it were not for the government's intervention, the manufacturing sector was not able to attract enough economic factors of production. Both countries had a fragile foundation for manufacturing after the independence. Therefore, the considerable reliance on the agricultural sector was the underlying feature until they started industrialization. Even though it was evident that the two countries' comparative advantages did not lie in the manufacturing sector, governments decided to specialize in manufacturing to attain comparative advantage in manufacturing within a few decades. Even though workers in the manufacturing sector were not productive enough initially, learning by doing, which became feasible due to government intervention, made them improve productivity. In the end, by the early 1980s, they finally arrived at attaining comparative advantage in heavy manufacturing industries within the world economy.

The overall relationship between institutional properties and the economic outcome has been widely studied by both theoretical approach and empirical approach. Among them, the role of democracy (or democratization) on economic outcome became a testable topic since the methodological developments on longitudinal panel data. Barro (1996, 1997), and

[1]Even though it is hard to classify Japanese governments during their rapid economic growth as authoritarian regimes, Japan's experience is also in a similar line with the experience of its neighbors. Johnson (1982) suggests that Japanese economic growth can be largely explained by Japan's efficient utilization of the Ministry of International Trade and Industry (MITI). MITI yielded strong influence on the financial sector to mandate resource allocation according to their industrial policy.

Tavares and Wacziarg (2001) pointed out the possible negative relationship between democracy and economic growth. This negative relationship echoes around the experience of South Korea and Taiwan because their rapid growth is mostly attained during non-democratic rules. Furthermore, we are still witnessing the rapid economic growth of China under its authoritarian rule. Recent empirical findings are more accumulated on the positive relationship between democracy and economic development. Preworski and Limongi (1997), Rodrik and Wacziarg (2005), Persson and Tabellini (2007), Papaioannou and Siourounis (2008), and Acemoglu et al. (2019) focused on economic growth as the left-hand-side variable. They all estimated the positive relationship between the two, which can be considered as empirical supports to Lipset (1960)'s discussion on the modernization theory. Acemoglu et al. (2019) went further to the causal relationship by implementing both dynamic panel estimation and causal inference.

However, these findings in the previous paragraph should be understood as an overall static pattern across different continents and different periods, which can be different from the country-specific dynamic trend. The concept of democratization and democracy in existing cross-country panel data findings does not successfully imply the dynamics of democracy. In new democracies, even though political democratization is attained, it takes several decades or more for them to make the democracy consolidated. For example, in the case of labor representation which this paper focuses on, the legalization of democratic labor union confederation was attained 12 years after the democratization in South Korea, and it was 9 years after the democratization in Taiwan. In line with this, Samuel Huntington's democratic consolidation criteria point out the second power shift as the critical point of democratic consolidation because new democracies gradually make progress towards well-functioning democracy throughout at least several decades[2]. Therefore, when and how the democratic political process is consolidated after the democratization deserve enough consid-

[2]It is often called as the two turn-over test for democratic consolidation (Huntington (1991)). Preworski (1991) defined that a democratic system is consolidated when the democratic political process is considered as the unique, accessible process for taking political power.

eration if an economist wants to have a detailed analysis of the impact of democratization. Some new democracies consolidate democratic institutions sooner while others do not[3]. In addition, depending on the degree of consolidation, new democracies can have very different freedom and transparency across different countries and periods. My paper incorporates this aspect by considering the dynamic process of structural change after democratization. Because the development of labor unions was one of the important aspects of the democratic consolidation in two nations, identifying how the role of unionization changed after the legalization of non-authoritarian union confederation will suggest some implications which have not been discussed in detail yet.

The structural change I study in this paper is a change in employment share across different sectors within an economy. The conceptual framework of structural change analysis and its implication on economic growth are suggested in McMillan and Rodrik (2011), McMillan et al. (2014), and Rodrik et al. (2017). A structural change is defined as growth-enhancing structural change if the relative productivity of a sector is positively correlated with the change in employment share. In other words, if a sector with higher productivity attracted more employment share, then an economy went through the growth-enhancing structural change. Symmetrically, a structural change is defined as growth-reducing structural change if the relative productivity of a sector is negatively correlated with the change in employment share. Based on this definition, McMillan and Rodrik (2011) and Rodrik et al. (2017) classified country-specific cases. They focused on the growth-enhancing structural change of Hong Kong, Thailand, and India. The growth-reducing structural changes that happened in Argentina, Brazil, Nigeria, and Zambia are also discussed. If a growth-enhancing structural change happens during economic growth, it means that the labor force re-allocation is consistent with the sectoral distribution of productivity. By having more employment share, a sector with more productivity is able to accelerate its expansion to contribute more to the national economic growth. McMillan and Rodrik (2011) found that, in South Korea and

[3]It is also true that we can see some reversals of new democracies towards the non-democratic regime. Acemoglu et al. (2019)'s dichotomous democracy measure contains both democratization and its reversal.

Singapore, the structural change was not growth-enhancing during 1990 - 2005. However, they suggested that the very rapid 'within' productivity growth was big enough to offset the negative role of structural change in making economic growth. My geographically decomposed analysis with the data on labor unionization suggests one of the possible mechanisms behind it here. It will be discussed in detail in the section 9.

De Vries et al. (2015) applied this framework of structural change on the cross-country evidence of African nations. Ahsan and Mitra (2017) studied determinants of sectoral change in employment share in Indian provinces. Mcaig and Pavcnik (2017) and Firpo and Pieri (2017) discussed the overall trend in structural change and its growth implication in Vietnam and Brazil, respectively. Mueller et al. (2019) and Atta-Ankomah and Osei (2021) focused on the evidence from Ghana. Relatively, an exclusive focus on East Asian countries has not been made in the literature. As stylized facts on countries in different continents suggested by McMillan and Rodrik (2011) and Rodrik et al. (2017) are based on highly aggregated information on limited information, detailed analysis with disaggregated panel data from South Korea and Taiwan will provide a further dimension of understanding.

# 3 Unionization and Labor Rigidity

The labor movement in both countries went through drastic environmental change after political democratization. Specifically, the legalization of autonomous and democratic labor union confederations after the political democratization fundamentally changed the power of labor movement and labor unions. The next section will clarify and elaborate on the institutional backgrounds in two new East Asian democracies. Before diving into country-specific detail, I review the literature on channels between the labor union and labor rigidity in this section. Unionization affects wage level, change in employment, and wage dispersion. Consequent labor market outcomes coming from unionization can determine the acceleration or deceleration of structural change.

The seminal theoretical predictions are made in the literature on the collective bargaining of labor unions. Nickell and Andrews (1983) considered a labor union that represents all workers in the labor pool. Union maximizes the expected utility of its members, and firm maximizes profits. Wage is determined through the negotiation between the union and the firm. Both the union's objective function and the firm's objective function are functions of the negotiated wage. The bargaining power of labor unions affects the equilibrium level of wage and employment in the Nash solution. Nickell and Andrews (1983) suggest a contract curve whose wage is an increasing function of bargaining power of labor while the employment level decreases when the bargaining power increases. Because the wage is the only agenda in contract bargaining between the labor union and firm in Nickell and Andrews (1983), possible extensions on contents in the contract can be considered as more realistic analyses. McDonald and Solow (1981) derived equilibrium where wage and employment are decided simultaneously. Booth (1995a) expanded discussions toward a broader contract, which includes wage and unemployment benefits. In both McDonald and Solow (1981) and Booth (1995a), authors predicted that the wage would be increased whenever the bargaining power of labor is strengthened. However, the impacts on employment will be different to Nickell and Andrews (1983). McDonald and Solow (1981) clarified that the employment level increases when the bargaining power of unions increases, while Booth (1995a) expected that the employment level would not be affected by the bargaining power of labor unions.

The insider-outsider approach relaxes the assumption on labor unions' representation so that it can accommodate more realistic circumstances. As unemployed workers are usually excluded from the bargaining process, it assumes that the union only represents the utility of employed workers. Building upon this assumption, Lindbeck and Snower (1988) consider the bargaining between union and firm. The bargaining occurs on a contract that includes the wage of union members (insiders) and the wage of future entrants (outsiders). Key construction in the insider-outsider approach is that the wage of outsiders has almost no weight in the objective function of insiders and their labor union. As the profit of the

firm will be a negative function of future entrants' wages regardless of their weights in insiders' utility, negotiated wage level of future entrants will be set at the lowest possible level according to the Nash criterion[4].

Among implications from the insider-outsider approach, I focus on the fact that the lower wage for future entrants implies increased rigidity of employment through both insiders and outsiders. First, outsiders who are not employed in the firm when the negotiation occurs will not be attracted to join the firm if they are aware of the existence of a wage premium for the insider. Especially when an outsider candidate is a qualified candidate in terms of productivity, systematically lower wages for an outsider will push the candidate away from the firm instead of attracting the candidate. Also, insiders will be willing to remain in the current firm because they are clearly aware of the existence of wage premiums for insiders. Furthermore, if insiders expect that other firms may also implement similar contracts due to their labor unions' exclusive representation of employed workers, they will be discouraged from moving to other firms because they will encounter lower wages than current insiders in the alternative job. Consequently, labor re-allocation according to productivity is no longer active due to institutional factors caused by labor unions' exclusive representation.

Along with the above theoretical elaboration on the effect of unionization to wage and employment, empirical approaches have been making related stylized facts. Large groups of empirical studies support the wage premium of unionized workers predicted by theoretical literature. Unionized workers enjoy statistically significant wage premium in the United States, according to Lewis (1963, 1986), Card (1996), Hirsch (2004), and Sojourner et al. (2012). Booth (1995b) identified union wage premium in the United Kingdom. Dell'Aringa and Lucifora (1994) and Lemieux (1998) found a positive impact of unionization on wages in Italy and Canada, respectively. Blanchflower and Freeman (1992) and Blanchflower and

[4]Insider-outsider approach also accommodates the case when the median voter in a democratic union is a worker with relatively high seniority. The preference of senior workers is likely to be different from that of newly hired workers with less seniority, especially in terms of attitudes towards additional hiring. Newly hired workers can actually be regarded as outsiders when the union's median voter has considerable seniority. Therefore, the interests of newly hired workers will not be able to be reflected in the negotiated contract.

Bryson (2003) studied the cross-country evidence of union wage premium. Blanchflower and Bryson (2003) found that the union wage premium is around 12 percent on average in 17 countries. Recent development in the regression discontinuity allowed DiNardo and Lee (2004), Sojourner et al. (2012), Freandsen (2012) to quantify the causal impact of unionization. Even though narrowly elected labor unions do not always have a significant impact on wages according to regression discontinuity analysis, stronger unions with broader support still have an explicit impact on wages.

Similar to the fact that theories expected mixed directions of changes in employment level after unionization, empirical evidence also provides mixed impact on employment. The negative relationship between unionization and employment has been identified in Brown and Ashenfelter (1986), Card (1986, 1990), Abowd and Kramarz (1993), Kahn (2000), Sojourner et al. (2012), and Frandsen (2012). However, a positive relationship between unionization and employment level is found by Abowd (1989) and Maloney (1994). Nickell and Wadhwani (1990), Boal and Pencavel (1994), and DiNardo and Lee (2004) did not find any systematic pattern between unionization and employment level. Along with these findings on wage and employment level, a notable pattern is, the wage variance within a sector decreases when the sector has higher unionization. This is often interpreted as reduced wage inequalities coming from unionization. Freeman and Medoff (1984), Blau and Kahn (1999), Frandsen (2012) all identified that unions compress the wage distribution in the United States. Rowthorn (1992), Blau and Kahn (1996), and Kahn (1998, 2000) found that wage inequalities are negatively correlated to the labor union density using cross-country data of OECD.

If I briefly summarize the above findings, both theoretical approaches and empirical studies support that more unionized workers earn more wages. Empirical findings suggest that wage dispersion within a sector is decreased when workers are more unionized. Contrary to the explicit prediction on wage, both theoretical prediction and empirical research have not reached a consensus on whether more unionized firms will invite more workers or lose workers. Explicit impacts on wages mean that when workers are more unionized, firms

encounter a higher barrier in hiring more workers because of the existence of the union wage premium. In addition, firms no longer feel free to discriminate against workers by suggesting different levels of wages. Consequently, immediate expansion in hiring coming from higher business profitability is less likely to happen when the bargaining power of labor unions improves with higher unionization.

In the next section, I add the country-specific surroundings of labor unions in South Korea and Taiwan. By doing so, I convince why the increased bargaining power of labor unions after the democratization can be interpreted as increased rigidity of labor in two countries. Along with the two countries' institutional backgrounds, detailed descriptive statistics such as labor union density and labor-management dispute cases will be suggested. Most importantly, how the power of labor unions evolved during the democratic consolidation process provides the key motivation of this paper along with the above discussions on change in wage and employment caused by unionization.

# 4 Democratization and Labor Union in South Korea and Taiwan

This section summarizes how the business-labor and government-labor relationships evolved as the democratic consolidation occurred in South Korea and Taiwan. Two countries went through democratization after they started rapid economic growth. The average annual economic growth rate in the 1970s of South Korea is 10.5 percent. During the same period, Taiwan's average annual economic growth rate was 18.7 percent. If we consider the first direct and democratic election for the presidency (or general election in parliamentary government system) as the critical point of democratization, South Korea was democratized in 1987, and Taiwan was democratized in 1996. But many researchers consider earlier years (mostly 1991 or 1994) as Taiwan's critical point of democratization. This is mainly because Taiwan's transition towards a democratic political system was relatively gradual compared

to the case of South Korea. Even though it is still unclear whether the increased income level was the direct cause of democratic transition, the authoritarian regime became no longer sustainable in the 1980s for both countries with accumulated wealth and human capital. Even though South Korea and Taiwan share similar periods for their economic growth and democratization, the actual process and properties of democratization are considerably different between these two countries. Within this different process of democratic transition, the role of a labor union was also different across the two countries[5].

Protests toward labor rights and the labor movement were the key impetus throughout the democratization and its consolidation in both countries. Labor unions were under the direct control of the government during the authoritarian regimes in South Korea and Taiwan. There were many trials to establish autonomous and non-authoritarian labor union confederations during the rule of dictators. However, it was not attained until democratization. Even after the democratization, the most prominent representative and autonomous labor union confederations were not legalized during the earlier years of democratic governments. The legalization of those confederations is finally accomplished in 1999 in South Korea and 2000 in Taiwan, and these years are critical years for the liberalization of the labor movement in two countries.

During the authoritarian regime, the labor movement in South Korea was much more militant and radical than that of Taiwan. This is linked with the fact that the dictatorial regime of Taiwan was much more responsive and strategically sophisticated so that the ruling power could control the demand of citizens flexibly. Dictators in South Korea kept oppressive attitudes towards democratization camps and labor unions during most of their authoritarian periods. Below subsections clarify details and elaborate the link between democratic transition and the labor union movement the two in East Asian new democracies.

[5]Among recent reviews on East Asian democratization, Yap (2011) and Slater and Wong (2013) provide a comprehensive comparison between South Korean case and Taiwanese case.

## 4.1 Labor Union and its Development in South Korea

During the South Korean authoritarian period until 1987, there was only one representative and comprehensive federation of labor unions in the nation. Federation of Korean Trade Unions (KFTU) was the unique labor union confederation that was legally identified by the South Korean authoritarian regime. Even though it served as the channel between employees and employers in Korea during that period, it is evidently true that the KFTU can be understood as a government-organized labor union confederation. Therefore, during this authoritarian period, the labor movements through KFTU were considerably far from those in fully democratized nations. It was natural for many activists and motivated workers to request an independent labor union confederation which is supposed to be free from authoritarian regime's control. Even though the labor movement outside of the KFTU channel is regarded as illegal activity, efforts towards independent labor union confederation were broadly supported by many citizens and workers. These efforts towards independent and democratic union federation are often called as 'Democratic Union Movement', and it was finally institutionalized in 1988 after the political democratization is attained[6].

The newly-organized democratic confederation of the labor union, the Korean Confederation of Trade Unions (KCTU), was first organized in 1988 as a representative confederation of democratic labor unions[7]. KCTU became the new center for radical and progressive labor movements even though it was not legally accepted when it was first organized. KCTU was recognized by the labor union law in 1999, and it gained equal status with KFTU. After the political democratization had been attained, KFTU also went through considerable change and reforms in their movement and transparency. Even though it is still true that KFTU was not that radical compared to KCTU, it is clear that KFTU became democratic and independent from the government pressure when its counterpart, KCTU, was consolidated.

[6]South Korea joined the International Labour Organization (ILO) in 1991.

[7]It started from the different name (National Committee for Camps in Labor Union Movement) in 1988 and changed its name in 1990 (National Committee for Labor Union Movement). The current name, KCTU, became the official name in 1995, and it is used until current days.

In 2019, KFTU accounted for 40 percent of labor union members in South Korea, while KCTU had 41 percent of labor union members.

The legitimation of KCTU allowed the progressive labor movement in South Korea to be liberalized and protected by law since 1999. Official statistics on labor-management dispute cases reflect that the legalization had considerable impacts on workers' claims towards employers. The 3-year annual average of labor-management dispute cases right before the legalization of KCTU (1996 - 1998) is 97. However, the 3-year annual average of labor-management dispute cases right after the legalization (1999 - 2001) is 227. Employees had to take the risk of joining illegal confederations for progressive movements before the legalization. Incorporating KCTU in the legal system removed the risk, and employees began actively pursuing basic and fundamental rights as workers in 1999.

## 4.2 Labor Union and its Development in Taiwan

Similar to the case of South Korea, in Taiwan, only one umbrella confederation of labor union monopolized legal status during the authoritarian regime. The Chinese Federation of Labor (CFL) served as the unique legitimate confederation which aggregates county-level (or city-level) federation of unions. Even though the CFL did not have a direct impact on industrial and occupational unions within a county-level federation of unions (Huang (2002)), regional-level federations had very close ties to the ruling party (Kuo Min Tang, KMT) during the authoritarian regime[8]. Therefore, the formation and legalization of a new labor union confederation was the main goal of labor movement activists during this period. One of the main strategies of this 'new labor confederation movement' which turned out to be efficient in Taiwan, was having a close connection with politicians of opposing party (Democratic Progressive Party (DPP), for example). This enabled them to be active in regions where DPP had broader supports than KMT. And also, this made main politicians of DPP, such as Shui-bian Chen, promise the legalization of a new independent and legal

[8]Elected union officials usually belonged to occupational unions whose leaders tended to be members of (or have close ties with) the KMT. See Huang (2002) for more details

labor union confederation. Shui-bian Chen finally became the winner of the presidential election after the democratization in 2000 and implemented the new trade union law in 2000.

Following the new trade union law, since 2000, there have been three labor union umbrella confederations. Along with CFL, there are the Taiwan Confederation of Trade Unions (TCTU) and the National Federation of Labor (NFL). TCTU was established in 1999, and it explicitly opposed the former trade union law. Compared to CFL's close tie to the former authoritarian party KMT, TCTU has a close tie to DPP. This autonomous and independent confederation which was free from KMT rule was recognized by the new trade union law in 2000. The NFL was also organized in 2000. CFL's pro-KMT activists left CFL after they lost power in CFL and then organized NFL. Based on these dynamics and the evolution of Taiwanese labor confederations, we can say that Taiwanese labor unions after 2000 can do a lot more than those before 2000. The 3-year annual average of labor-management dispute cases right before the legalization of TCTU (1997 - 1999) is 4214. However, the 3-year annual average of labor-management dispute cases right after the legalization (2000 - 2002) is 10999. The more active and liberal labor movement has become available since 2000 because members of TCTU were no longer under legal constraints after its legalization.

## 4.3 Variation in the Unionization

Even though Taiwan was able to attain political democratization a little bit later than South Korea, the two countries share almost the same year (1999 and 2000 for South Korea and Taiwan, respectively) as the critical point of labor union liberalization. Since the rapid economic growth of the two countries, Taiwan has been keeping a considerably higher union density rate than South Korea. For example, in 1990, which is near the beginning point of my sample of baseline analysis, South Korea's overall labor union density rate was 17.4 percent while that of Taiwan was 43.3 percent. In 2000 and 2015, South Korean density rates were 11.4 percent and 10 percent, respectively, which are still similar to that of 1990. South

Korean labor union density was steeply increased right after the democratization in 1987, but it decreased again during the economic reform caused by its economic crisis in 1997. On the other hand, Taiwanese overall labor union density rate in 2000 was 38.5 percent, and it was 33.4 in 2015. Even though Taiwan's labor union density also went through a considerable decrease after 1990, the gap between those two countries kept relatively constant until recent years.

Even though the density rate may indicate that Taiwan has been managing more motivated and active labor unions compared to South Korea, we cannot directly compare the labor union density between these two countries. Even with Taiwan's higher aggregate labor union density rate, it is well known that the labor union movements in South Korea have been very militant and well-organized compared to those in Taiwan. Since the early 1980s, the Taiwanese government significantly relaxed the process of licensing newly established occupational unions. And, many Taiwanese citizens, working or not, joined an occupational union to acquire health insurance because unions acted as the main platform for health insurance. For these reasons, the comparatively higher density rate of Taiwan may not be the best measure for cross-country comparisons. Researchers cannot say that the labor movement of Taiwan has stronger organizational power than other democracies based on a higher density rate. This is the main reason for my separate estimations for the Korean sample and Taiwanese sample. Implementing two samples together in a single estimation will contain the systematic differences in unionization rate between two countries, leading researchers to get misleading variation.

However, within a nation, labor union density does represent heterogeneity in unionization. There are two sources of heterogeneous unionization in South Korea and Taiwan. First, spatial heterogeneity exists across different provinces and regions in both countries. In South Korea, labor movements have been keeping close ties with left-wing political parties. Regions with broader support towards left-wing parties have been making systematically higher participation in labor unions. Given the fact that South Korea has deep-rooted

regionalism in politics, labor unions in left-wing dominant regions accumulated their organizational foundation even since the authoritarian regimes. Similarly, in Taiwan, regions with more left-wing support had higher participation in labor movements and consequent higher union density. Southern regions centered by the Kaohsiung area started to be the hub of left-wing activities since the late 1970s. It was natural for activists to gather together in the southern area and work together under the goal of the democratic labor union confederation. The southern area's broader support towards the anti-authoritarian party, DPP, helped the labor movement thrive faster in the region than in other parts of the nation. Second, sectoral heterogeneity is explicit within each country. Different sectors have different circumstances for the labor movement. Especially in the formation of the labor union, some sectors have more favorable conditions while others do not. Sectors whose workers work together within an indoor workplace, such as the manufacturing sector, are likely to have a faster and broader formation of unions. As both countries experienced a rapid expansion of the economy through the manufacturing giant firms with huge production complexes, manufacturing sectors led the unionization. On the other hand, agricultural sectors and service sectors have systematically less density rate compared to that of the manufacturing sector. My unionization index successfully catches these natures of heterogeneity, and they will be introduced in the section for the data.

# 5 Data

This section describes data sources and variables that I use in the empirical analysis. The first subsection describes how I construct the index for the degree of unionization, which varies across different regions and sectors. The second subsection includes information on the spatial and sectoral distribution of workers. Value-added for deriving productivity is also handled in the second subsection. The third subsection discusses descriptive statistics.

## 5.1 Degree of Unionization

The degree of unionization is one of the key variables which allows this paper to study the consequence of democratic consolidation in labor institutions. Throughout the empirical analysis of this paper, the degree of unionization explains the structural change measured by the change in employment share. The best measure without any measurement error can be constructed by the population list of every labor union in a nation with its magnitude, location, and sectoral affiliation. However, most developed countries are not sharing the population list mainly due to the related privacy laws. Instead, South Korea and Taiwan are providing an annual report with sector-level aggregates of labor unions (both number of members and number of unions). Yearly reports of South Korea further contain the geographical distribution of the number of labor union members. In the case of Taiwan, local governments share their total number of unions and members so that I can construct the geographical distribution of labor union members. The publisher of this annual report is the Ministry of Employment and Labor in South Korea. For Taiwan, the Ministry of Labor and each local government provide related information.

Using the above publicly available information, I consider the degree of unionization, $Unionize_{ijt}$, for each industry $i$ in the region $j$ in year $t$ as below.

$$Unionize_{ijt} = \left\{ \frac{L^u_{jt}}{L^u_t} \times L^u_{it} \right\} \Big/ L_{ijt} \tag{1}$$

where $L^u$ stands for the number of members in the labor union. $L^u_{jt}/L^u_t$ quantifies the region $j$'s share of labor union members among the total number of labor union members in year $t$. $L^u_{it}$ is the sectoral level of labor union members. It is aggregated based on the number of members in industrial labor union confederations of South Korea and Taiwan. Industrial labor union confederations are umbrella confederations according to each industry which is more disaggregated than the concept of the sector. For example, there are confederations for the textile industry and car production industry which will be classified as the manufacturing

sector. By multiplying $L^u_{jt}/L^u_t$ and $L^u_{it}$ each other, $Unionize_{ijt}$ can reflect both sector-level variation and geographical variation of the degree of unionization. Dividing by $L_{ijt}$, the total number of employees in each sector of the region, leads us to get $Unionize_{ijt}$ which is a normalized proxy for the degree of unionization.

The $Unionize_{ijt}$ in equation (1) can be also understood as the penetration or permeation of the industrial labor union in region $j$. In $Unionize_{ijt}$, the aggregated sector-level distribution of union members ($L^u_{it}$) is distributed according to the region $j$'s share of labor union members ($L^u_{jt}/L^u_t$). This means that, in constructing $Unionize_{ijt}$, I'm not making further adjustments based on region $j$'s industrial structure. The national industrial structure reflected in the $L^u_{it}$ is equally distributed based on the region $j$'s share of labor union members in my index for the degree of unionization.

While it will not be exactly equal to the labor union density of each sector in each region[9], $Unionize_{ijt}$ successfully measures the within-country variation in the degree of unionization due to following reason. Note that the $L^u_{it}$ is the sector-level aggregates of industrial labor union members, as I clarified in the previous paragraph. Industrial labor unions are forms of labor unions organized within an industrial affiliation so that their members can react efficiently to the industry-specific labor conflicts. Therefore, the quantitative and qualitative growth of industrial labor unions will be a positive shock to the welfare of every worker in the specific industry throughout all regions of a nation. As the industrial labor union targets the welfare increase of all employees within the industry, simply weighting $L^u_{it}$ with the overall regional unionization ($L^u_{jt}/L^u_t$) will be able to measure how the labor movement of industrial unions permeated in the region $j$. I implement various alternative measures to guarantee robustness. Those alternative measures for the degree of unionization are discussed in section 8.

In classifying 10 sectors $i$, I follow 10 sectors in Table 1. However, due to the sectoral classifications in regional value-added information in South Korea, the actual number of

[9]Under the assumption of $(L^u_{jt}/L^u_t) = (L^u_{ijt}/L^u_{it})$, equation (1) will be exactly equal to the actual labor union density $(L^u_{ijt}/L_{ijt})$.

sectors used in the estimation for the sample from South Korea will be 7 sectors (Table 2). For the same reason, the first 12 years of Taiwanese data will also use 9 sectors in the empirical analysis while later years since 2004 fully utilize all information in 10 sectors. $Unionize_{ijt}$ is available in Korea[10] since 1980 while it is available since 1992 in Taiwan[11].

## 5.2 Value Added and Employment

When I attain the productivity of each sector $i$ in all regions $j$, the data on the value-added and employment should be decomposed into each sector-region pair. Statistics Korea, the statistics bureau funded by the government of South Korea, provides yearly decomposition. Korean Statistical Information Service (KOSIS) manages a data series[12] which includes the yearly sector-region decomposition of the real value-added. KOSIS also provides the Economically Active Population Survey that contains the annual number of employees in each sector of each province. Using these two data sources, I can obtain the panel time series of value-added and employment of 7 sectors in 17 regions from 1989 to 2019. 17 regions cover every geographical location of South Korea. The classification of sectors that I am using for Korean data is clarified in Table 1 and Table 2.

Taiwan makes sector-region decomposition of value-added and employment in every 5-year. All sectors except the agricultural sector are covered by the Industry and Service Census of National Statistics of the Republic of China. Industry and Service Census includes the geo-sectoral distribution of both value-added and employment. During my period of analysis when $Unionize_{ijt}$ is available, the first Industry and Service Census was conducted in 1996. In the case of agricultural sectors, Agriculture, Forestry, Fishery and Animal Hus-

[10]South Korean 17 regions used in my estimations are Seoul, Taejeon, Taegu, Busan, Gwangju, Incheon, Ulsan, Kyeonggi, Kangwon, Chungbuk, Chungnam, Sejong, Jeonbuk, Jeonnam, Kyeongbuk, Kyeongnam, and Jeju. These regions form unbalanced panel data.

[11]Taiwanese 25 regions used in my estimations are Changhua county, Chiayi city, Chiayi county, Hsinchu country, Hualien county, Kaohsiung city, Kaohsiung county, Keelung city, Miaoli county, Nantou county, New Taipei city (Taipei county), Penghu county, Pingtung county, Taichung city, Taichung county, Tainan city, Tainan county, Taipei city, Taitung county, Taoyuan city, Yilan county, Yunlin county, Kinmen county, and Lienchiang county. These regions form unbalanced panel data.

[12]Regional Income

bandry Census (AFFA census) contains the region-level employment. AFFA census is also conducted every 5-year and the first census within my period of analysis was conducted in 1995. As the AFFA census does not share the distribution of value-added, I use the distribution of cultivated land area in retrieving the geo-sectoral share of value-added.

Because the sector-region decomposition is only feasible every 5-year, proper interpolation is needed using attainable time-varying information. The Economic Transformation Database published by the University of Groningen suggests the yearly sum of sectoral real value-added and employment. As sector-level real value-added and employment vary across the year, multiplying with the sector-region share in national surveys allows me to get the sector-region level decomposition. The share of each census is implemented to four neighboring years so that I can fully interpolate. For example, the sector-region share of 2011's Industry and Service Census is utilized in interpolating for 2009, 2010, 2012, and 2013. The agricultural sector goes through the same interpolation process using the AFFA census.

## 5.3 Descriptive Statistics

The consequent descriptive statistics are suggested in Table 3. In order to correctly represent sample of my empirical estimation, observations in Table 3 is restricted to those used in the baseline estimation (Table 6 and Table 8). The estimated sample will cover from 1989 to 2019 of the South Korean economy and from 1992 to 2018 of the Taiwanese economy. The $Unionize_{ijt}$ of South Korea has 7.9 percent as the sample average while that of Taiwan has 44.4 percent as the sample mean. According to the International Labour Organization (ILO), the average labor union density of South Korea during 2000 - 2015 was 10.36 percent. And Taiwan had 39.78 percent as average union density during the period when ILO covered Taiwanese information during 2004 - 2010. Based on these population means provided by ILO, we can see that the $Unionize_{ijt}$ is successful in reflecting the overall degree of unionization in both countries.

As I clarified in the equation (1), $Unionize_{ijt}$ is not exactly equal to the actual labor union

density. It can be exactly equal to the actual labor union density only when the assumption $(L^u_{jt}/L^u_t) = (L^u_{ijt}/L^u_{it})$ holds. Due to the restrictions on the feasibility of data, I construct $Unionize_{ijt}$ by utilizing proxies which can cause $Unionize_{ijt} > 1$. The regional distribution of total labor union members is multiplied with national aggregates of industrial labor union members in order to measure the degree of penetration of industrial labor unions in each region. Higher values of $Unionize_{ijt}$ can be understood as descriptions of the higher impact of industrial unions in sector $i$ and region $j$ in year $t$. In the case of the sample for South Korea, less than 1 percent of observations have $Unionize_{ijt}$ which are bigger than one. On the other hand, in the Taiwanese ample, around 11 percents of observations have $Unionize_{ijt}$ which are bigger than one. As I also introduced in section 4, this stems from the fact that Taiwan has systematically higher union density due to the link with health insurance. Members of labor unions in Taiwan include unemployed workers because they still need union membership for their health insurance benefits. This fundamental factor causes me to have quite big values of $Unionize_{ijt}$ for around 11 percent of Taiwanese observations. Even though $Unionize_{ijt}$ is still successfully measuring the within-country variation in unionization, I implement various alternative ways to fix these higher values of $Unionize_{ijt}$ in Taiwan. They are introduced in my section for robustness checks.

The variation of $Unionize_{ijt}$ within a nation is consistent with the geographical and political properties of the two nations, which I introduced in section 4. Gwangju has been the center of left-wing activities with continuous and steady support from citizens and voters. In 1996, for example, Gwangju's manufacturing sector had 0.21 as the value of $Unionize_{ijt}$. However, other major cities have significantly smaller values, such as 0.10 in Seoul and 0.08 in Taegu. Sectoral heterogeneity is also considerable. Trade services sector (WRT according to Table 1 and Table 2) in Gwangju had 0.003 for the value of $Unionize_{ijt}$ in 1996, and government or personal services sector (PUBO according to Table 1 and Table 2) in Gwangju had 0.06 in the same year. Compared to the manufacturing sector's value (0.21), these two sectors have a significantly lower degree of unionization. Similar patterns are observed across

other sectors and other regions in South Korea. Likewise, $Unionize_{ijt}$ reflects geographical and sectoral variation within Taiwan. Kaohsiung county has a systematically higher value of $Unionize_{ijt}$ compared to other regions such as New Taipei City. The manufacturing sector in Taiwan tends to have a higher degree of unionization measured by $Unionize_{ijt}$ compared to other sectors such as the trade services sector (WRT).

Notations in Table 3 will appear in all consequent sections of this paper. $\theta_{ijt}$ is the employment share of sector $i$ of region $j$ in year $t$ ($\theta_{ijt} = L_{ijt}/L_{jt}$). The consequent first-difference ($\theta_{ijt} - \theta_{ijt-1}$) is denoted as $\Delta\theta_{ijt}$. $p_{ijt}$ is the annual productivity measure of each sector-region pair $ij$. I simply quantify $p_{ijt}$ by having $p_{ijt} = V_{ijt}/L_{ijt}$ where $V_{ijt}$ stands for the real value added. $V_{ijt}$ is represented by local currency unit in millions[13]. $L_{ijt}$ is the total number of employees in each sector-region pair as in equation (1). Therefore, $p_{ijt}$ can be called as the real value added per worker of the sector $i$ in region $j$ in year $t$. I construct relative productivity using the overall productivity of region $j$, $P_{jt}$. Symmetrically, it can be expressed as $P_{jt} = V_{jt}/L_{jt}$. The relative productivity of sector-region pair, $p_{ijt}/P_{jt}$, indicates how each sector $i$ in region $j$ is relatively productive compared to the overall aggregated productivity of region $j$. In both South Korea in Taiwan, the sample avearge of $p_{ijt}/P_{jt}$ is slightly bigger than 1 according to Table 3. The relative productivity can have negative value because the value added is sometimes measured as negative. The minimum value of $p_{ijt}/P_{jt}$ is negative in Taiwan while it is positive in South Korea.

# 6 Econometric Specification

Based on the institutional backgrounds of the democratic consolidation and unionization of two countries, I suggest a dynamic panel data model which can test some key hypotheses. Two of them are the main interests of this paper. First, based on the conceptual framework suggested by Rodrik et al. (2017), I test whether structural changes in South Korea and Taiwan were growth-enhancing structural change or growth-reducing structural change. If

[13]Won in South Korea and Taiwan Dollar in Taiwan.

the relative productivity has a positive marginal effect on the change in employment share, we can say that we can observe growth-enhancing structural change. On the other hand, if the marginal effect is negative, it can be interpreted as the growth-reducing structural change during the sample period. The second hypothesis, which gives us the political-economic implication, is about the role of the degree of unionization in explaining the structural change. Unionization can accelerate the overall direction of the structural change while it can decelerate the speed of structural change. The interaction term between relative productivity and the unionization index allows me to test whether the unionization decelerates growth-enhancing structural change. Given these motivations, I consider following dynamic panel estimation.

$$\begin{aligned}\Delta\theta_{ijt} = \beta_0 + \sum_{a=1}^{d}\beta_{1a}\Delta\theta_{ijt-a} + \beta_2\frac{p_{ijt-b}}{P_{jt-b}} + \beta_3 Unionize_{ijt} \\ +\beta_4\frac{p_{ijt-b}}{P_{jt-b}}\times Unionize_{ijt} + \mu_{ij} + \lambda_t + \nu_{ijt}\end{aligned} \tag{2}$$

where all of the key notations follow those of the previous section 5. Individual heterogeneity across sector-region pair $ij$ is addressed by the fixed effect $\mu_{ij}$. The time-specific effect is represented by $\lambda_t$ while $\nu_{ijt}$ accounts for the remaining stochastic term.

The change in employment share in each sector $i$ in region $j$, $\Delta\theta_{ijt}$, is explained by its lagged variables $\sum_{a=1}^{d}\beta_{1a}\Delta\theta_{ijt-a}$ in this framework. I sequentially add further lagged dependent variables based on the validity of instrumental variables for GMM where $1{\leq}a{\leq}4$. The key test statistics for model specification will be AR$(a+1)$ test so that I can make sure that Arellano and Bond (1991)'s instrumental variables for the endogeneity coming from $\sum_{a=1}^{d}\beta_{1a}\Delta\theta_{ijt-a}$ are valid instruments. If the AR$(a+1)$ test gives us satisfactory confidence on the validity of instrument, I implement $\Delta\theta_{ijt-a-1}$ and its further lags as instrumental variables. The smaller order AR tests such as AR(1) should reject their null hypotheses in order to justify the dynamic panel specification. Because adding further lags as an instrumental variable in Arellano and Bond (1991) allows us to have an over-identification test, I

follow Hansen-type robust test statistics.

By having a set of lagged dependent variables on the right-hand side of the equation (2), I test the path dependence of structural change measured by the change in employment share. Also, unobserved determinants of $\Delta\theta_{ijt}$ will be able to be controlled by both lagged dependent variables and fixed effects. By following the transformation suggested by Arellano and Bond (1991), the first-difference method handles the heterogeneities of each sector-region pair. For the sample of South Korea, according to AR test statistics, the preferred value of $d$ in equation (2) is $d = 1$ while it is $d = 4$ in the Taiwanese sample. As I discussed in the previous section for introducing data, every information of Korea and Taiwan varies across every year and every $ij$ pair. However, in the case of Taiwan, the multiplied geographical shares for industry-level distribution of value-added and employment vary every 5-year. Therefore, in estimating the Taiwanese sample, having $d = 4$ as the preferred level of $d$ is consistent with the nature of the Taiwanese sample. By having $d = 4$, instrumental variables are clearly satisfying the exogeneity requirement. It is supported by AR test statistics as well as the properties of the sample. The fifth-year lag of the dependent variable and set of its further lags will be used as instrumental variables in the estimation for the sample from Taiwan. In case of the estimation for South Korea's experience, the second year lag and its further lags will be utilized. Other types of dynamic panel estimators, including Anderson and Hsiao (1982)'s first-difference estimator, two-step GMM estimator, and system GMM estimator are handled in the section for the robustness checks.

The relative productivity is added as a lagged variable in the equation (2). This is mainly due to the fact that the $\Delta\theta_{ijt}$ and $p_{ijt}/P_{jt}$ may share simultaneity issue. The current relative productivity might be affected by the contemporary change in employment share because productivity can evolve based on the shifts in the employment magnitude of the labor force. In order to avoid issues related to simultaneity, I implement lagged relative productivity where $3 \leq b \leq 5$. Because the first or second year lag ($b = 1$ or $b = 2$) will not be enough to guarantee exogeneity, I start from the third year lag of the relative productivity. The current

change in employment share in year $t$ is less likely to be the key determinant of the relative productivity in year $t-b$ if $3 \leq b \leq 5$.

Along with the linear term of the degree of unionization, the interaction term between relative productivity and unionization is implemented in equation (2). Based on this specification, we can test whether the magnitude of growth-enhancing structural change in both countries can be explained by the degree of unionization. The marginal effect of relative productivity will determine the direction of structural change between growth-enhancing and growth-reducing[14]. As the relative productivity appears in two terms, the partial derivative with the Delta Method standard error can test the null hypothesis of zero marginal effect. If the marginal effect of the relative productivity is positive ($\frac{\partial \Delta\theta_{ijt}}{\partial(p_{ijt}/P_{jt})} > 0$), the $\beta_4 > 0$ means that the degree of unionization accelerated the growth-enhancing structural change. On the other hand, when the marginal effect of the relative productivity is positive ($\frac{\partial \Delta\theta_{ijt}}{\partial(p_{ijt}/P_{jt})} > 0$), $\beta_4 < 0$ indicates that the unionization decelerated the growth-enhancing structural change[15]. McMillan and Rodrik (2011) and Rodrik et al. (2017) classified country-specific stylized facts without considering dynamic nature. They did not cover the possible heterogeneity which can be caused by variation in labor rigidity. I provide a more rigorous test on it with disaggregated dynamic estimation using the empirical partial derivative in terms of $p_{ijt}/P_{jt}$. I go further by identifying whether the institutional variation can accelerate or delay the growth-enhancing structural change. The partial derivative in terms of $Unionize_{ijt}$ will also be handled by the Delta Method so that I can see the overall role of unionization in the dynamics of employment share.

[14]Growth-reducing structural change can also be called as the negative growth-enhancing structural change.

[15]Symmetrically, when $\frac{\partial \Delta\theta_{ijt}}{\partial(p_{ijt}/P_{jt})} < 0$, $\beta_4 < 0$ means that the unionization accelerated the growth-reducing structural change. On the other hand, $\beta_4 > 0$ means that the unionization decelerated the growth-reducing structural change when $\frac{\partial \Delta\theta_{ijt}}{\partial(p_{ijt}/P_{jt})} < 0$.

# 7 Estimation Results

This section suggests empirical evidence on how unionization links structural change to the variation in labor productivity. The main focus is on whether the unionization explains the heterogeneous size of the magnitude of growth-enhancing structural change. As I introduced in the previous section with backgrounds of labor unions in both countries, the gap in unionization density between the two countries does not reflect the actual organizational ability of the two countries' labor unions. Therefore, putting two countries as a united sample might be misleading in interpreting the role of the labor union. In the following subsections, I sequentially cover South Korea and Taiwan and see whether they share any qualitative similarities or country-specific distinctive features. Before I start suggesting country-specific results, I describe cross-country patterns coming from the sample of 31 countries.

## 7.1 The Global Pattern

The baseline results that I show in this paper focuses on East Asian new democracies, South Korea and Taiwan. They can be considered as valid and proper cases for testing my hypothesis on the role of unionization because they have enough variation during the sample period in both productivity and unionization, which are attained by rapid economic growth and political democratization. In this subsection, I consider cross-country evidence across 31 countries[16] before I dive into the analysis on South Korea and Taiwan. The sample period is from 1964 to 2012. This cross-country analysis will enhance the robustness of my results. It is due to the fact that I can guarantee external validity of my findings from the samples of South Korea and Taiwan if the cross-country evidence is consistent with them. The cross-country evidence will clarify whether the unionization can explain the heterogeneous magnitude and direction of growth-enhancing structural change across different continents. Also, I will discuss the difference between democratic regimes and nondemocratic regimes in

[16] Argentina, Brazil, Chile, China, Colombia, Costa Rica, Denmark, Spain, Ethiopia, France, UK, Ghana, Hong Kong, Indonesia, India, Italy, Japan, South Korea, Mexico, Mauritius, Malaysia, Netherlands, Peru, Philippines, Singapore, Sweden, Thailand, Taiwan, Tanzania, USA, South Africa

understanding the cross-country role of unionization. It will be the symmetric counterpart to my estimations for South Korea and Taiwan because I suggest a sub-sample analysis on those two East Asian countries using the legalization of democratic labor union confederation.

Equation (3) below is an extension of equation (2) for analyzing cross-country sample. Subscript $c$ which stands for country is now replacing equation (2)'s subscript $j$ for region.

$$\begin{aligned}\Delta\theta_{ict} = \beta_0 + \sum_{a=1}^{d}\beta_{1a}\Delta\theta_{ict-a} + \beta_2\frac{p_{ict-b}}{P_{ct-b}} + \beta_3 Unionize_{ct} \\ +\beta_4\frac{p_{ict-b}}{P_{ct-b}}\times Unionize_{ct} + \mu_{ic} + \lambda_t + \nu_{ict}\end{aligned} \tag{3}$$

10-sector decomposition of 31 countries is coming from the 10-sector Database from Groningen University[17]. In this cross-country analysis of equation (3), I use $Unionize_{ct}$ instead of $Unionize_{ict}$. This means that the annual unionization level in equation (3) varies across country $c$ only (not varies across industry $i$). It is true that the sector-specific unionization data is not easily accessible for longitudinal analysis in most countries. Therefore, for cross-country analysis in equation (3), the feasible proxy for $Unionize_{ict}$ is the country-level annual labor union density $Unionize_{ct}$[18]. $Unionize_{ct}$ is retrieved from the union density level data of OECD, ILO, and ICTWSS[19]. Even though the density rate across different countries will have different implications depending on the institutional backgrounds of each nation, we can still get the overall global trend from equation (3) to see whether my main analysis for South Korea and Taiwan has external validity.

The sub-sampling is implemented based on the dichotomous dummy variable of Acemoglu et al. (2019). Their dichotomous dummy variable for democracy, $D_{ct}$, is equal to 1 if the country $c$ can be classified as a democratic country in year $t$. Otherwise, $D_{ct} = 0$. In each column of Table 4, equation (3) is estimated using whole sample, sample with observations under democratic regimes, and sample with those under non-democratic regimes. The list

[17]Because the 10-sector Database suggests the real value-added in local currency units, I use the exchange rate to US Dollars in order to unify the currency.

[18]$Unionize_{ct} = L^u_{ct}/L_{ct}$

[19]Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts

of countries reduces to 28 countries, and the sample period reduces to 1964 - 2010 when I utilize the democracy dummy variable of Acemolgu et al. (2019)[20]. The reduced list of 28 counties still includes South Korea and Taiwan, which are my main focus in this paper.

Table 4 includes estimation results when $b = 3$. This means that the third-year lag of relative productivity is used to avoid possible endogeneity with the dependent variable. Table 4 suggests in its column (1) that, with the overall sample, the role of unionization does not explain the heterogeneous magnitude of growth-enhancing structural change. Relative productivity, country-level union density, and their interaction term are not suggesting any statistically significant coefficients. In the bottom panel of Table 4, empirical marginal effects of the relative productivity and $Unionize_{ct}$ are suggested. None of them reject the null hypotheses of zero marginal effect in column (1). One thing that we have to notice is that the path dependence represented by the lagged dependent variable shows explicit statistical significance. The gain in employment share in year $t$ is explained considerably by the gain of the last year, $t-1$. Key test statistics, including AR tests and over-identification tests, supports the implementation of Arellano and Bond (1991)'s dynamic estimation.

However, in column (2), when I restrict the sample only to democratic observations with $D_{ct} = 1$, consequent findings and implications are different. The marginal effect of relative productivity is positive and statistically significant in the 90-percent confidence interval. This means that a sector with more productivity attracted more employment share in countries under a democratic regime. The growth-enhancing structural change occurred during the sample period for these countries. The important point is, the interaction term between the relative productivity and $Unionize_{ct}$ is exhibiting a negative and significant estimated coefficient. This suggests that a sector in a country with higher unionization had smaller growth-enhancing structural changes. Even though democratic countries went through the growth-enhancing structural change during the sample period, the magnitude of growth-enhancing structural change is heterogeneous across the degree of unionization.

[20]Hong Kong, Tanzania, and South Africa are not considered in Acemolgu et al. (2019). And Acemoglu et al. (2019) did not cover years after 2010.

Increased unionization decelerated the speed of growth-enhancing structural change. The lagged dependent variable is still a statistically significant determinant. AR tests and over-identification test supports the implementation of the GMM estimator. In columns (3) and (4), however, both marginal effects of relative productivity and interaction term are not successfully explaining the dependent variable. Column (3) focuses on the non-democratic sample and column (4) estimates equation (3) by controlling $D_{ct}$. Test statistics in columns (3) and (4) indicate that the GMM estimation is properly implemented.

If I summarize cross-country results in Table 4, unionization decelerates the growth-enhancing structural change only in democratic regimes, while this pattern cannot be identified in the non-democratic regime. As I reviewed in the section 3, increased unionization can be regarded as increased labor rigidity. The channel can be wage level, wage dispersion, and employment level. In democratic countries, a sector with higher unionization encounters slower re-allocation according to the variation of productivity because of the increased rigidity of labor. However, higher unionization does not display this role in non-democratic countries. Table 5 further implement $Left_{ct}$ as control variable. $Left_{ct}$ is a dummy variable where $Left_{ct} = 1$ if the chief executive party can be classified as a left-wing party according to its economic policy orientation. $Left_{ct} = 0$ if the incumbent chief executive party cannot be classified as a left-wing party. It is constructed from the Database of Political Institutions (DPI). It covers possible ties between the sectoral union and its country's left-wing support. It is possible that the rigidity of labor is not mainly coming from the unionization of labor. If a country's overall policy orientation is progressive, controlling for it allows us to better identify the role of unionization. If a country has very strong left-wing supports from voters, workers within the region may attain their job security without joining the labor movement such as unions. The left-wing party with broad supports can already represent the interest of labor efficiently. Table 5 handles this issue, and it makes qualitatively the same results with Table 4. This means that, even after incorporating the political orientation of a country, the main finding on the role of unionization in explaining the heterogeneous growth-enhancing

structural change is kept robust.

Even though this finding based on cross-country data is already informative, there are some shortcomings. First, current $Unionize_{ct}$ is not varying across different sector $i$. Second, pooling the union density from different countries into a single estimation can be problematic because there can be a systematic gap in density ratio between a pair of the country, which does not reflect the actual gap in unionization. For example, as I described in the section 4, Taiwan has a systematically higher density ratio compared to South Korea due to the role of unions as the platform of health insurance. But it does not mean that the labor movement in Taiwan has more bargaining power than that of South Korea. To overcome these issues, I digitize the government reports about labor unions in South Korea and Taiwan, which went through big variations in unionization and productivity growth. By digitizing them, I constructed $Unionize_{ijt}$ which varies across different sectors and regions within a nation. Based on this $Unionize_{ijt}$, I implement separate estimations for each East Asian new democracies.

## 7.2 South Korea

Table 6 includes the estimation results of equation (2) with the whole sample on South Korea. As I clarified in the previous section for econometric specification, putting a single lag of the dependent variable satisfies the AR restrictions. As p-values of AR(1) and AR(2) tests reveal, the instrumental variables of Arellano and Bond (1991), which start from the second-year lag of the dependent variable, can be considered as valid instrumental variables. Also, Hansen's over-identification test after the heteroskedasticity and autocorrelation robust estimation supports its validity in all three columns. As we can expect, the path dependence of the change in employment share, $\Delta\theta_{ijt}$, exists with considerable magnitude. In all three columns, the estimated coefficients of the lagged dependent variable are positive and statistically significant. This means that a sector in a region is likely to attract more employment share in year $t$ when it experienced an increase in employment share in year $t-1$. This reveals the

importance of implementing dynamic nature in analyzing the structural change with panel data.

The first column of Table 6 is using relative productivity in year $t-3$, $p_{ijt-3}/P_{jt-3}$. And the second and the third columns are using $p_{ijt-4}/P_{jt-4}$ and $p_{ijt-5}/P_{jt-5}$, respectively. By using lagged variables of relative productivity, I can test the existence of growth-enhancing or growth-reducing structural change without endogeneity concern. As the relative productivity is interacted with the index of the degree of unionization, the marginal effect of relative productivity is supposed to be different from its estimated coefficient of the linear term. Therefore, I suggest empirical marginal effect with the Delta Method standard error in the bottom part of Table 6. Suggested empirical marginal effect is calculated at the sample mean of observation. Symmetrically, as the degree of unionization, $Unionize_{ijt}$ also has both linear and interaction terms, I also suggest the empirical marginal effect at the mean of sample observation with the Delta Method standard error.

The marginal effect of relative productivity is positive and statistically significant in all three columns in Table 6. This elaborates that we can observe the growth-enhancing structural change in South Korea during the sample period. In other words, a sector in a region with higher lagged relative productivity is likely to gain more employment share. Growth-enhancing labor re-allocation occurred according to sectoral productivity during this period in South Korea. At the same time, the marginal effect of $Unionize_{ijt}$ is not rejecting the null hypothesis of being zero in all three columns in Table 6.

Even though the overall marginal effect of $Unionize_{ijt}$ is statistically not different to zero, $Unionize_{ijt}$ does suggest an important aspect in understanding the structural change. We can see that, in each column of Table 6, the interaction term between $Unionize_{ijt}$ and lag of relative productivity has a negative coefficient with statistical significance. This means that, during the growth-enhancing structural change in South Korea, a sector in a region with a higher degree of unionization had smaller growth-enhancing structural change. This is consistent with both theoretical and empirical predictions of labor economic literature

on labor rigidity. As the increased degree of unionization will bring about the decreased flexibility in pulling new workers, sectors will be expected to have slower re-allocation than the optimal speed of adjustment.

Based on the fact that the labor movement was liberalized by the legalization of democratic labor union confederation in 1999 in South Korea, Table 7 analyzes sub-sample of before and after legalization. The left panel accounts for the period from 1989 and 1999 when KCTU is not recognized by related labor union laws. The right panel of Table 7 covers years after 1999. In all six columns, Hansen's over-identification test supports the validity of the set of instrumental variables suggested by Arellano and Bond (1991). The serial correlation tests of the first-differenced errors are satisfied only except the first column. We can see that the lagged dependent variable is only significant in the right panel of Table 7. In addition, the overall marginal effect of the relative productivity is positive and statistically significant in all three columns in the right panel of Table 7. Marginal effects of the relative productivity term in the right panel are consistent with the finding that I elaborated in the previous paragraph about Table 6. In the left panel, even though the statistical significance is diminished compared to that of the right panel, we can still see the evidence of growth-enhancing structural change in the third column. In the first two columns, even though they are not rejecting the null hypothesis of zero marginal effect, estimated marginal effects are still positive. The empirical partial derivative in terms of $Unionize_{ijt}$ is not making statistically significant in all columns as we also saw in Table 6.

The key difference between the left and right panels in Table 7 is disparities in the estimated coefficients of the interaction term. In the left panel of Table 7, the interaction term's coefficient rejects its null hypothesis of being zero only in its third column. However, in the right panel, columns (5) and (6) have statistically significant estimation results. This means that from 1989 to 1999, even though it is the period after democratization is attained, the role of unionization is less explicit than after the legitimation of KCTU, which happened in 1999. The growth-enhancing structural change had heterogeneous magnitude according

to the unionization during 2000 - 2019, while this pattern was less explicit until 1999. Even in column (4), even though the test statistics of $\hat{\beta}_4$ are not bigger than the critical values of rejection, the gap between the test statistics and its critical value is marginal. In other words, in the right panel of Table 7, the unionization's role as a significant factor is robust regardless of the implementation of lagged relative productivity. However, in the left panel, which represents the period before the labor union liberalization, the implication coming from the interaction term is sensitive to the implementation of lagged relative productivity. Furthermore, the distances between the test statistics and critical values are bigger compared to those in the right panel. I interpret this disparity by focusing on the qualitative difference in labor unions between the two periods. As KFTU used to be under the direct and indirect control of authoritarian power until democratization, KCTU served as the center of the radical and active labor movement. However, as it was not legalized until 1999, it was not easy for KCTU to attract motivated members and pursue popular agenda. As soon as it is officially recognized by the labor union law of South Korea, thanks to KCTU's updated legal status, many members became able to join its movement without fear of getting scrutinized by law enforcement. It became easier for KCTU to attract more members and organize bigger movements since its legalization. Overall bargaining power of labor is fundamentally increased after 1999, as I elaborated in the previous section 4. Based on these historical surroundings, the more explicit role of unionization in structural change after 1999 can be attributed to the essential improvement in the bargaining power of labor after the legalization of the democratic confederation, KCTU.

## 7.3 Taiwan

Symmetric to the previous subsection for South Korea, I also cover the estimation with a whole sample of Taiwanese sector-region pairs (Table 8) and estimation with sub-samples divided according to the legalization of TCTU (Table 9).

Table 8 is the counterpart of Table 6 in the sense that it covers the whole sample of

Taiwan. It covers from 1992, which is slightly after the democratic transition of Taiwan. The difference between Table 8 and Table 6 is the number of lagged dependent variables on the right-hand side and consequent instrumental variables. It is mainly due to the characteristics of Taiwanese data, which is clarified in previous sections for introducing data and econometric specifications. Even though all observations vary across every year and every pair $ij$, each sector's geographical distribution is interpolated between census years (every 5-year). Therefore, in order to guarantee fully exogenous instruments for lagged dependent variables, fifth-year, and further lags are utilized. Correlation within interpolated years is controlled by adding four lagged dependent variables linearly on the right-hand side of the equation (2). The serial correlation tests using the first-differenced errors of equation (2) support that the fifth-year lagged variable is a valid instrument. P-values for AR(5) tests are all bigger than critical values in all three columns, while lower-order AR tests reject the null hypothesis. Hansen's over-identification test after heteroskedasticity and autocorrelation robust estimation is also telling us that Arellano and Bond (1991)'s approach on my Taiwanese data is the proper treatment.

In each column of Table 8, every lagged dependent variable has negative and statistically significant estimated coefficients. This clearly indicates that skipping the dynamic nature might be misleading in understanding the structural change in the Taiwanese economy. The overall marginal effect of relative productivity rejects the null hypothesis of being zero only in the second column. In column (2), it is positive and statistically significant when we have a confidence interval of 90-percent. We can see that, similar to the case of South Korea, the structural change in the Taiwanese economy is also growth-enhancing. However, it is less statistically explicit compared to the case of South Korea. On the other hand, the overall marginal effect of $Unionize_{ijt}$ is very explicit. In all three columns, we can see that the empirical marginal effects in the sample mean of observation with Delta Method standard errors are negative and statistically significant. A sector in a Taiwanese region with higher unionization is expected to have a negative gain in employment share. At the

same time, in addition to the overall marginal effects' being salient, the interaction term between relative productivity and unionization suggests that unionization can explain the heterogeneous magnitude of growth-enhancing structural change. In columns (2) and (3), estimated coefficients of interaction terms reject the null hypothesis of being zero. This means that a sector in a region with higher unionization will have smaller growth-enhancing structural change. Increased rigidity in labor allocation is causing an economy to have slower adjustment according to sectoral productivity.

Table 9 implements the sub-sample estimation based on the revision of trade union laws. As I introduced in previous sections, autonomous confederation TCTU was legalized in 2000 thanks to the election of Shui-bian Chen and consequent revision on trade union laws. The labor movement in the democratic confederation was finally recognized by the law since the revision. Therefore, workers became liberalized in pursuing progressive labor union activities. The left panel in Table 9 covers years until 2000, while the right panel is based on the period after TCTU legitimation. As the sample length for the left panel is not long enough for implementing four lagged dependent variables, I suggest results with a single lagged dependent variable. For the right panel, as the panel length is long enough, I'm keeping the specification of Table 8. In the left panel, serial correlation tests based on the first-difference errors support that Arellano and Bond (1991)'s instrumental variables are valid. However, the over-identification test is not adding the credibility of instrumental variables because the null hypotheses are all rejected in columns (1), (2), and (3). The estimated coefficients of the interaction term, which is my key interest, are not showing statistical significance in the left panel. However, in the right panel with years after the trade union law revision, estimated coefficients of interaction terms are negative with statistical significance. In all columns (4), (5), and (6), the magnitude of test statistics for the interaction terms are big enough to reject the null hypothesis of zero at a rigorous significance level. AR tests and Hansen's robust over-identification tests support the implementation of the GMM approach. We can see that the findings in Table 8 become much more explicit when we focus on the period after the

labor union liberalization. Increased bargaining power of labor unions caused Taiwan to have a heterogeneous size of growth-enhancing structural change across the degree of unionization. Whenever a sector is more unionized, the speed of growth-enhancing structural change is decelerated. But, in the period until 2000, we cannot find a similar pattern. This again emphasizes that, as I elaborated in the subsection for South Korea, the qualitative change in labor union movement after the trade union law revision can be the source of these disparities between two panels within Table 9.

# 8 Robustness Checks

This section suggests some robustness checks in estimating equation (2). Even though Arellano and Bond (1991) is regarded as one of the most widely used frameworks for dynamic panel data analysis, there have been many alternative estimators for the linear dynamic model. Therefore, the first subsection suggests that my main findings using Arellano and Bond (1991)'s estimator are still maintained in a robust manner with alternative estimators. The second subsection considers alternative measures for $Unionize_{ijt}$. $Unionize_{ijt}$ is successful in measuring the permeation of labor union movement across different sectors and different regions within each of the two nations. However, especially in the sample of Taiwan, around eleven percent of observations had $Unionize_{ijt} > 1$, and some of those values are extreme. Even though we can still interpret those extreme values as being highly unionized, I suggest alternative measures for unionization, which are free from related issues caused by outlier observations.

## 8.1 Alternative Dynamic Estimators

Dynamic panel data estimation with proper coverage on the endogeneity from the lagged dependent variable has been actively developed since the early 1980s. The systematic bias, which is often called the Nickell bias (Nickell (1981)), will be explicit if we do not handle

the endogeneity from the lagged dependent variable. Anderson and Hsiao (1981) suggested the first-difference estimation so that researchers can wipe out the individual fixed effects. Both lagged level and lagged difference of endogenous variables have been implemented as exogenous instrumental variables under proper conditions such as serial correlation criteria. Arellano (1989) pointed out that the estimation using instruments in levels is recommended due to its non-singularities and smaller variances.

I'm using Arellano and Bond (1991)'s estimator as my main estimator in section 6 and 7. Suggested results in previous sections with Arellano and Bond (1991)'s estimator are based on the one-step GMM estimation. The two-step GMM estimation can be derived by updating weight with the differenced residuals. Even though the one-step and two-step estimators are asymptotically equivalent when the error follows i.i.d. assumption, comparing this paper's main results with those from the two-step estimator will check the robustness of my estimation.

Along with Arellano and Bond (1991)'s GMM estimator, system GMM estimators have been widely used so that researchers can attain robust results under different assumptions. Arellano and Bover (1995) and Blundell and Bond (1998) showed that the Arellano and Bond (1991)'s lagged level as instrumental variables might be invalid instruments, especially when the dependent variable follows the random walk process. By using the lagged difference along with lagged level, Arellano and Bover (1995) and Blundell and Bond (1998) minimize the system of equations so that they can get more efficient estimators. Ahn and Schmidt (1995)'s estimator further uses additional moment conditions which have not been considered in Arellano and Bond (1991). Under the usual settings of the linear dynamic panel data approach, Ahn and Schmidt (1995) suggest that there can be $T-2$ more moment conditions where $T$ is the length of the panel data sample. These $T-2$ additional moment conditions are nonlinear moment conditions, and they allow researchers to make further efficiency gains.

Based on the above understanding, I implement listed alternative dynamic panel data estimators to the sample of South Korea and Taiwan. It makes sure that my main findings

are robust to the different estimators. I find that this paper's main findings on the role of unionization between productivity and structural change stay robust regardless of the type of estimators. In other words, a sector in a region with more unionization has a smaller size of growth-enhancing structural change in two East Asian new democracies. To be specific, in system GMM estimators, the statistical significance of interaction terms between productivity and unionization index became more explicit in both countries. When I implement Anderson and Hsiao (1982)'s first-difference estimator, the reduced number of exogenous variables compared to Arellano and Bond (1991) affects the significance level. However, the estimated signs of key variables are kept robust. Two-step estimators of Arellano and Bond (1991) also give us qualitatively same implications with section 7.

## 8.2 Robustness of $Unionize_{ijt}$

The definition of $Unionize_{ijt}$ is exactly equal to the actual labor union density for each sector $i$ in region $j$ when the assumption of $(L^u_{jt}/L^u_t) = (L^u_{ijt}/L^u_{it})$ holds. In other words, if this assumption holds, $Unionize_{ijt}$ should be between 0 and 1. It is true that the assumption of $(L^u_{jt}/L^u_t) = (L^u_{ijt}/L^u_{it})$ is strong premise because it is considering uniform geographical distribution of union members across different sectors. Because government documents on labor unions that I digitize do not include the population list of labor unions which is required to construct actual density $(L^u_{ijt}/L_{ijt})$ for each sector-region pair $ij$, my $Unionize_{ijt}$ may have measurement error in expressing the actual disaggregated density $L^u_{ijt}/L_{ijt}$. Even though constructing $Unionize_{ijt}$ as in the equation (1) is very successful in reflecting the within-nation heterogeneity in unionization, some extreme values are too large, especially in the Taiwanese sample. Around 11-percent of observations in the Taiwanese sample have $Unionize_{ijt} > 1$ while it happens in less than 1 percent of observations in South Korea. Estimating equation (2) by excluding observations with $Unionize_{ijt} > 1$ does not make any qualitative change in the South Korean sample, while the significance level is largely affected in the Taiwanese sample. It can be mainly because eliminating observations with

$Unionize_{ijt} > 1$ in the Taiwanese sample is truncating more than 10-percent of observations whose degree of unionization are high. The less variation across the remaining sample is not enough for identifying the heterogeneous size of growth-enhancing structural change.

In order to handle possible concerns coming from the measurement error of $Unionize_{ijt}$ in the equation (1), I suggest alternative indices for the degree of unionization. Regardless of the specification of the index, the key findings of this paper remain robust. The first alternative index is $Unionize^*_{ijt}$ below.

$$Unionize^*_{ijt} = \left\{ \frac{L_{jt}}{L_t} \times L^u_{it} \right\} \Big/ L_{ijt} \tag{4}$$

where all notations are consistent to those in previous sections. The difference between $Unionize_{ijt}$ and $Unionize^*_{ijt}$ is that the employment share of region $j$ ($\frac{L_{jt}}{L_t}$) is used in constructing $Unionize^*_{ijt}$ instead of the union member share of region $j$ ($\frac{L^u_{jt}}{L^u_t}$). $Unionize^*_{ijt}$ distributes sector-level industrial labor union members, $L^u_{it}$, according to the regional distribution of total employee while $Unionize_{ijt}$ distributes it according to the regional distribution of union members. Shifting $Unionize_{ijt}$ to $Unionize^*_{ijt}$ improves the tail distribution in the Taiwanese sample. Around 7-percent of Taiwanese observations have $Unionize^*_{ijt} > 1$ while 11-percent of them had $Unionize_{ijt} > 1$. South Korean sample is almost not affected by shifting to $Unionize^*_{ijt}$ in terms of the tail distribution in the degree of unionization.

Table 10 replicates Table 7 by substituting $Unionize_{ijt} > 1$ with $Unionize^*_{ijt}$. We can see that the main finding of Table 7 is maintained in Table 10. Especially in the right panel, which covers years after the legalization of KCTU, growth-enhancing structural change is identified while its magnitude is heterogeneous across the unionization. In a sector with more unionization, growth-enhancing structural change is decelerated. Table 11 also estimates the equation (2) again by replacing $Unionize_{ijt} > 1$ to $Unionize^*_{ijt}$ using Taiwanese sample. Table 11 replicates Table 9. The Hansen's over-identification test does not support the instrumental variables suggested by Arellano and Bond (1991) in the left panel of Table 11.

However, both the AR test and over-identification test support the right panel, which covers the period after the legalization of TCTU in 2000. The right panel of Table 11 is also making the same implication with that of Table 9.

Both $Unionize_{ijt}$ and $Unionize^{*}_{ijt}$ may have some potential sources of measurement error because it transforms sectoral distribution of union members ($L^{u}_{it}$) and regional distribution of union members ($L^{u}_{jt}$) to get an index for the degree of unionization which varies across each sector-region pair $ij$. If I use $L^{u}_{it}$ and $L^{u}_{jt}$ directly without transformation, those sources of measurement error can be avoided even though we no longer have an index varying across $ij$. Still, by implementing $L^{u}_{it}$ and $L^{u}_{jt}$ together, the estimation can reflect variation across $i$ and $j$.

$$\begin{aligned}\Delta\theta_{ijt} = \beta_0 + \sum_{a=1}^{d}\beta_{1a}\Delta\theta_{ijt-a} + \beta_2\frac{p_{ijt-b}}{P_{jt-b}} + \beta_3\frac{L^{u}_{it}}{L_{it}} + \beta_4\frac{L^{u}_{jt}}{L_{jt}} \\ +\beta_5\frac{p_{ijt-b}}{P_{jt-b}}\times\frac{L^{u}_{it}}{L_{it}} + \beta_6\frac{p_{ijt-b}}{P_{jt-b}}\times\frac{L^{u}_{jt}}{L_{jt}} + \mu_{ij} + \lambda_t + \nu_{ijt}\end{aligned} \tag{5}$$

In the equation (5) above, instead of implementing $Unionize_{ijt}$ in the equation (2), I deploy sectoral density ($\frac{L^{u}_{it}}{L_{it}}$) and regional density ($\frac{L^{u}_{jt}}{L_{jt}}$) together linearly along with interaction terms. $\frac{L^{u}_{it}}{L_{it}}$ is between 0 and 1 in every observation of both countries. $\frac{L^{u}_{jt}}{L_{jt}}$ is also between 0 and 1 in both countries only except in the observations from Keelung city in Taiwan. Keelung city has $\frac{L^{u}_{jt}}{L_{jt}} > 1$ in nine years where its maximum is 1.17. Therefore, we can see that the concerns from extreme values are relieved considerably when we estimate equation (5).

Using above equation (5), I derive symmetric counterparts of Table 6, 7, 8, and 9. Consequent replication of Table 6 is Table 12. All test statistics in Table 12 including the AR test and over-identification test, implies that the dynamic GMM estimation with instrumental variables suggested by Arellano and Bond (1991) can be properly implemented in columns (2) and (3). The marginal effect of relative productivity identifies that South Korea went through the growth-enhancing structural change during the sample period. In line with Table 6, the magnitude of growth-enhancing structural change is heterogeneous across the degree of unionization. However, in Table 12, the degree of unionization is represented by

two different measures, $\frac{L^u_{jt}}{L_{jt}}$ and $\frac{L^u_{it}}{L_{it}}$. The overall marginal effect of $\frac{L^u_{jt}}{L_{jt}}$ is not statistically significant while that of $\frac{L^u_{it}}{L_{it}}$ is positive and strongly significant. The interaction terms with $\frac{L^u_{jt}}{L_{jt}}$ is not rejecting the null hypotheses of having zero coefficients while interaction terms with $\frac{L^u_{it}}{L_{it}}$ have negative and significant coefficients. This means that the heterogeneity of the magnitude of growth-enhancing structural change is mainly explained by sectoral unionization. However, regional unionization was not able to explain it. A sector with higher unionization had a slower growth-enhancing structural change in South Korea. The sub-sampling results following Table 7 also yield the same implication. When I implement the sub-sampling, the AR requirements are satisfied only for the sample after the legalization in 1999.

Estimating equation (5) with Taiwanese sample will make replication of Table 8 and 9 with two different unionization measures, $\frac{L^u_{jt}}{L_{jt}}$ and $\frac{L^u_{it}}{L_{it}}$. The deceleration of structural change caused by the unionization is not observed when equation (5) is estimated with whole Taiwanese sample. However, sub-sample analysis on equation (5) still finds the statistically significant role of unionization in Taiwan. Table 13 includes the consequent estimation results. In the left panel, which is for the period before the legalization of TCTU, the over-identification test is not supporting my GMM specification. Therefore, suggested results in the left panel cannot be regarded as robust empirical results. However, all three columns in the right panel of the Table satisfy AR conditions and over-identification tests. The regional unionization ($\frac{L^u_{jt}}{L_{jt}}$) explains the heterogeneous size of growth-enhancing structural change in column (4). Even though the statistical significance is decreased compared to Table 9, overall estimated signs and consequent implications are maintained in Table 13.

I further try the arithmetic mean of $\frac{L^u_{it}}{L_{it}}$ and $\frac{L^u_{jt}}{L_{jt}}$ to substitute $Unionize_{ijt}$. Geometric mean and the average of arithmetic mean and geometric mean are also implemented. In other words, $Unionize^{AM}_{ijt} = \left(\frac{L^u_{it}}{L_{it}} + \frac{L^u_{jt}}{L_{jt}}\right) \Big/ 2$ and $Unionize^{GM}_{ijt} = \sqrt{\frac{L^u_{it}}{L_{it}} \times \frac{L^u_{jt}}{L_{jt}}}$ can be considered as the arithmetic mean and geometric mean, respectively. $\{(Unionize^{AM}_{ijt} + Unionize^{GM}_{ijt})/2\}$ can take advantage of both arithmetic mean and geometric mean. All three types of alternative $Unionize_{ijt}$ yields qualitatively same estimation results for South Korea and Taiwan.

The statistical significance is maintained with robustness in South Korea while the it is weakened in Taiwan. However, the estimated signs and consequent implications are still robust in estimations for both countries.

# 9 Discussion

The main implication of this paper suggests that the increased bargaining power of labor attained by democratic consolidation decelerates growth-enhancing structural change. Based on this finding, it is very natural for economists to think about the next question: If the increased bargaining power of labor affected growth-enhancing structural change, did it also affect the paradigm of economic growth? This paper is not providing a comprehensive answer for this further question. However, I suggest one of the possible explanations based on my analysis of South Korea and Taiwan. Equation (6) is the growth decomposition suggested by McMillan and Rodrik (2011) and Rodrik et al. (2017).

$$\Delta P_t = \sum_i^I \theta_{i,t-1} \Delta p_{i,t} + \sum_i^I p_{i,t} \Delta \theta_{i,t} \tag{6}$$

where notations are consistent with earlier sections of this paper. McMillan and Rodrik (2011) and Rodrik et al. (2017) considered decomposition with general year gap in measuring the sectoral change in employment share ($\theta_{i,t-k}$). This section focuses on the annual decomposition with $\theta_{i,t-1}$ in order to be able to link annual change in employment share with annual variation of unionization. $P_t$ and $p_{i,t}$ refer to economywide and sectoral labor productivity levels, respectively. The left-hand-side, $\Delta P_t$ measures the overall labor productivity growth of an economy between two adjacent years $t$ and $t-1$. The total labor productivity growth of an economy can be decomposed into two terms. The first term of right-hand-side ($\sum_i^I \theta_{i,t-1} \Delta p_{i,t}$) is called as within-sector component of labor productivity growth (within growth). The second term ($\sum_i^I p_{i,t} \Delta \theta_{i,t}$) is called as structural change component of labor productivity growth (structural growth). The within-sector component captures how much

of overall labor productivity growth can be attributed to changes within sectors. The structural change component quantifies how much of overall labor productivity growth can be attributed to movements of workers across sectors.

Figure 1 describes the decomposition results of the South Korean economy from 1965 to 2018. The bar stands for the share of within growth among total growth, while the line indicates that of structural growth. It is evident that structural growth used to dominate within growth until the end of the 1980s. However, as the 1990s started, within growth dominated structural growth in most of the years. Figure 2 clarifies it more explicitly by considering the difference between two shares. The vertical axis of Figure 2 is the difference between the share of within growth and the share of structural growth. Therefore, if the vertical axis has a positive value, it means that within growth dominates structural growth in that year. Three vertical lines indicate reference years. They are democratization, the first power shift[21], and the second power shift[22], respectively. Before democratization, the vertical axis used to have negative values for many years, while it barely happened after the democratization. Furthermore, after the second power shift, which is the critical event according to Huntington (1991)'s consolidation test, within growth is dominating the structural growth in all years. Figure 3 and Figure 4 are symmetric counterparts of Figure 1 and Figure 2 coming from the Taiwanese economy. The dominance of within growth has been stable in Taiwan. However, Table Figure 3 still suggests that, in recent years, the share of structural growth became considerably smaller compared to earlier years before 2000.

Motivated by these pattern in labor productivity growth decomposition in South Korea and Taiwan, I can test whether the increased bargaining power can explain this pattern of reduced share of structural growth. I go through above growth decomposition of each region in South Korea and Taiwan. After implementing the region subscript $j$, the decomposition equation will be $\Delta P_{jt} = \sum_i^I \theta_{ij,t-1} \Delta p_{ij,t} + \sum_i^I p_{ij,t} \Delta \theta_{ij,t}$ for each sector-region pair $ij$. Estimation equation below estimates whether a unionization of each region ($\frac{L_{jt}^u}{L_{jt}}$) can explain

[21] 1997 presidential election (power shift from the right-wing to the left-wing.).
[22] 2007 presidential election (power shift from the left-wing to the right-wing.).

each region's structural growth term.

$$StructG_{jt} = \alpha_0 + \alpha_1 \frac{L^u_{jt-b}}{L_{jt-b}} + \mu_j + \lambda_t + \nu_{jt} \tag{7}$$

where $StructG_{jt}$ is the structural growth term ($\sum_i^I p_{ij,t}\Delta\theta_{ij,t}$) of regional growth decomposition. $\mu_j$ and $\lambda_t$ represent the region-specific and year-specific effects, respectively. In order to relieve the possible endogeneity issue, the regional level unionization is lagged with enough gaps ($4 \leq b \leq 6$). In addition, if we replace $StructG_{jt}$ with $WithinG_{jt}$ which stands for the within growth term $\sum_i^I \theta_{ij,t-1}\Delta p_{ij,t}$, we have symmetric equation below.

$$WithinG_{jt} = \alpha_0 + \alpha_1 \frac{L^u_{jt-b}}{L_{jt-b}} + \mu_j + \lambda_t + \nu_{jt} \tag{8}$$

Table 14 and 15 include consequent estimation results from the South Korean economy and the Taiwanese economy, respectively. Left three columns of Table 14 and 15 are estimation results from equation (7). The right three columns of them are estimation results from equation (8). The difference of magnitudes in estimated coefficients between Table 14 and 15 comes from the local currency of each nation. The real value-added for retrieving the productivity is represented by the local currency in millions (Won in South Korea and Taiwan Dollar in Taiwan). We can clearly see that, in Table 14, regional lagged unionization is negatively correlated with the magnitude of structural growth in South Korea. The inverse relationship is found between the within growth and regional unionization. However, according to Table 15, there is not any statistically significant relationship between decomposed growth and regional unionization in Taiwan. McMillan and Rodrik (2011) used the labor rigidity index from World Development Indicators of World Bank to see its cross-country[23] relationship with structural growth. They found a negative relationship between the labor rigidity index and structural growth term. My geographically decomposed sectoral analysis partially supports the finding of McMillan and Rodrik (2011). Results from South Korea in

[23] 38 countries

Table 14 are consistent with the aggregated pattern in McMillan and Rodrik (2011), while those in Table 15 are not.

Even though results in Table 14 and 15 cannot be understood as complete analysis in suggesting comprehensive interaction, they give us some important points for future research. Aggregated analysis in McMillan and Rodrik (2011) indicated that, in South Korea and Singapore, the structural change was not growth-enhancing during 1990 - 2005. However, at the same time, they found that the very rapid 'within' productivity growth was big enough to offset the negative role of structural change in making economic growth. One of the background mechanisms can be identified in Table 14. The increase in unionization caused smaller structural growth during my sample period. On the other hand, the increase in unionization caused higher within growth, whose increased magnitude is bigger than the decreased magnitude of the structural growth. At least through the channel of labor rigidity, unionization can explain the changing shares of the contribution made by structural growth and within growth.

In South Korea, the decelerated growth-enhancing structural change caused by unionization is transmitted to the smaller magnitude of structural growth. However, in Taiwan, the lowered growth-enhancing structural change coming from unionization was not reflected in the magnitude of structural growth. It means that the two countries adjusted their economic development differently to the evolution of labor institutions and labor rigidity. South Korean economy reacted to the change in unionization by attaining more growth through the within-sector channel. On the other hand, my analysis in this section cannot find any related growth pattern in the Taiwanese economy. This can suggest that the two nations had different economic reactions to the increased bargaining power of labor even though the two nations have shared many similarities such as similar geographical location, similar colonial origin, a similar period of industrialization and democratization, and similar industrial policies. The dynamics of the labor union movement is one of the feasible mechanisms in the political economy of structural growth. Further research should be done for attaining better

clarification as well as more detailed elaboration on the heterogeneity in labor productivity growth.

# 10 Conclusions

This paper finds that the magnitude of the growth-enhancing structural change in South Korea and Taiwan exhibits heterogeneity across sectoral unionization. Disaggregated data on 7 sectors in 17 regions in South Korea and 10 sectors in 25 regions in Taiwan during their democratic regimes (since 1989 and since 1992 for South Korea and Taiwan, respectively) is analyzed. In both countries, growth-enhancing structural change is observed throughout my sample period. The productive sector was able to attract more employment share within a region. However, when a sector has higher unionization, the magnitude of growth-enhancing structural change decreases with statistical significance. In addition, this heterogeneity became much more explicit after the legalization of democratic labor confederations. A similar finding can also be estimated in a cross-country sample with 10 sectors of 31 countries. In democratic countries, a higher union density is related to the smaller growth-enhancing structural change. However, in non-democratic countries, I was not able to find this pattern. This result is robust even after controlling for the incumbency of the left-wing party.

I link these findings from both detailed analysis on East Asian new democracies and aggregated analysis on 31 countries with stylized facts in labor economics. As higher unionization is related to higher rigidity in labor input through multiple channels such as wage level, wage dispersion, and employment level, labor rigidity can be the main mechanism between unionization and structural change. To be specific, when the bargaining power of labor increases, an economy no longer enjoys quick and immediate re-allocation of labor input. As both South Korea and Taiwan experienced a considerable increase in the bargaining power of labor after the political democratization, the impacts of unionization were strong enough to be observed in my dynamic estimation.

Even though my study suggests a new interpretation of the economic development of new democracies, we have to be careful when we consider the overall impact of democratization. What I found here elaborates that the increased bargaining power of labor can delay the productive re-allocation of labor. However, I'm not quantifying other aspects of increased bargaining power of labor, such as increased welfare of workers, improved safety of workers, and the consequent impact on the wellness of the labor force. Given the fact that a labor employee is likely to be the median voter of these two countries, the increased wellness of workers coming from the stronger union is clearly the positive aspect that economists should consider.

Also, my findings on growth-enhancing structural change do not go further towards predicting the overall growth of the economy. What I'm suggesting is that the structural change was consistent with the distribution of sectoral productivity in South Korea and Taiwan, while the magnitude of the growth-enhancing structural change was heterogeneous across unionization. This does not imply that two nations' structural change actually stimulated productivity growth. This will require independent estimation with the careful specification. Also, my extensions to the structural productivity growth are not fully endogenizing other important aspects such as international trade. Implementing a more comprehensive framework of analysis will allow economists to evaluate related issues with deeper understandings.

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# Tables

Table 1: 10-Sector classification

| Sectors | Sector Name | ISIC Rev. 3.1 Code | ISIC Rev. 3.1 Description |
|---|---|---|---|
| AGR | Agriculture | AtB | Agriculture, Hunting and Forestry, Fishing |
| MIN | Mining | C | Mining and Quarrying |
| MAN | Manufacturing | D | Manufacturing |
| WRT | Trade services | G+H | Wholesale and Retail trade; repair of motor vehicles, motorcycles and personal and household goods, Hotels and Restaurants |
| CON | Construction | F | Construction |
| PU | Utilities | E | Electricity, Gas, and Water Supply |
| TRA | Transport services | I | Transport, Storage and Communications |
| FIRE | Business services | J+K | Financial Intermediation, Renting and Business Activities (excluding owner occupied rents) |
| PUB | Government services | L, M, N | Public Administration and Defense, Education, Health and Social work |
| OTH | Personal services | O, P | Other Community, Social and Personal service activities, Activities of Private Households |

Table 2: Sectors in South Korea and Taiwan

| Sectors | Korea 1989 - 2019 | Taiwan 1992 - 2003 | Taiwan 2004 2012 |
|---|---|---|---|
| AGR | AGR | AGR | AGR |
| MIN | MIN | MIN | MIN |
| MAN | MAN | MAN | MAN |
| WRT | WRT | WRT | WRT |
| CON | CON | CON | CON |
| PU | PTF | PU | PU |
| TRA | | TRA | TRA |
| FIRE | | FIRE | FIRE |
| PUB | PUBO | PUBO | PUB |
| OTH | | | OTH |

Table 3: Descriptive statistics

| **Variable** | **Mean** | **Std. Dev.** | **Min.** | **Max.** | **N** |
|---|---|---|---|---|---|
| | | South Korea | | | |
| $\theta_{ijt}$ | 0.158 | 0.105 | 0 | 0.479 | 2640 |
| $\Delta\theta_{ijt}$ | 3.44e-06 | 0.01 | -0.047 | 0.055 | 2640 |
| $p_{ijt}/P_{jt}$ | 1.233 | 1.167 | 0.042 | 11.636 | 2640 |
| $unionize_{ijt}$ | 0.079 | 0.16 | 0 | 2.411 | 2640 |
| | | Taiwan | | | |
| $\theta_{ijt}$ | 0.109 | 0.11 | 0 | 0.551 | 2865 |
| $\Delta\theta_{ijt}$ | -0.0002014 | 0.009 | -0.086 | 0.103 | 2865 |
| $p_{ijt}/P_{jt}$ | 1.049 | 1.001 | -1.53 | 18.952 | 2865 |
| $unionize_{ijt}$ | 0.444 | 1.129 | 0.001 | 19.915 | 2865 |

Table 4: Cross-country evidence using national union density.
31 countries, 1964 - 2012

| | (1) $\Delta\theta_{ict}$ | (2) $\Delta\theta_{ict}$ | (3) $\Delta\theta_{ict}$ | (4) $\Delta\theta_{ict}$ |
|---|---|---|---|---|
| | All Sample | Samples of $D_{ct}=1$ | Samples of $D_{ct}=0$ | Control $D_{ct}$ |
| $\Delta\theta_{ict-1}$ | 0.138** | 0.205*** | 0.0826 | 0.161** |
| | (0.0658) | (0.0761) | (0.0583) | (0.0669) |
| $p_{ict-3}/P_{ct-3}$ | -3.53e-08 | 0.0000947* | 0.00000801 | 0.00000826 |
| | (0.0000670) | (0.0000531) | (0.0000627) | (0.0000681) |
| $Unionize_{ct}$ | -0.000118 | 0.000362** | -0.000137 | -0.0000619 |
| | (0.000302) | (0.000157) | (0.000316) | (0.000302) |
| $(p_{ict-3}/P_{ct-3})\times Unionize_{ct}$ | 0.0000492 | -0.000123* | 0.000103 | 0.0000346 |
| | (0.000125) | (0.0000742) | (0.000209) | (0.000125) |
| $D_{ct}$ | | | | 0.0000131* |
| | | | | (0.00000759) |
| Observations | 6688 | 5203 | 1166 | 6369 |
| Fixed Effects | Yes | Yes | Yes | Yes |
| M.E of $p/P$ | 0.000015 | 0.000052* | 0.000035 | 0.000019 |
| (Delta Method) | (0.000030) | (0.000028) | (0.000069) | (0.00003) |
| M.E of $Unionize_{ct}$ | -0.000017 | 0.000113 | 0.000094 | 9.29e-06 |
| (Delta Method) | (0.000062) | (0.000074) | (0.000170) | (0.00006) |
| AR(1) p-value | 0.000 | 0.000 | 0.001 | 0.000 |
| AR(2) p-value | 0.984 | 0.059 | 0.206 | 0.720 |
| Hansen's oid p-value | 1.000 | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Cross-country evidence using national union density.
Chief executive party's economic policy orientation as a control variable.

| | (1) $\Delta\theta_{ict}$ | (2) $\Delta\theta_{ict}$ | (3) $\Delta\theta_{ict}$ | (4) $\Delta\theta_{ict}$ |
|---|---|---|---|---|
| | All Sample | Samples of $D_{ct}=1$ | Samples of $D_{ct}=0$ | Control $D_{ct}$ |
| $\Delta\theta_{ict-1}$ | 0.294*** | 0.271*** | 0.199 | 0.294*** |
| | (0.0783) | (0.0670) | (0.150) | (0.0783) |
| $p_{ict-3}/P_{ct-3}$ | 0.0000624 | 0.000101* | -0.0000676 | 0.0000624 |
| | (0.0000568) | (0.0000525) | (0.000221) | (0.0000568) |
| $Unionize_{ct}$ | 0.000180 | 0.000297* | 0.0000510 | 0.000173 |
| | (0.000185) | (0.000169) | (0.000330) | (0.000187) |
| $(p_{ict-3}/P_{ct-3})\times Unionize_{ct}$ | -0.0000858 | -0.000140* | 0.0000187 | -0.0000857 |
| | (0.0000887) | (0.0000746) | (0.000343) | (0.0000887) |
| $Left_{ct}$ | -0.000000705 | -0.00000147 | | -0.000000690 |
| | (0.00000424) | (0.00000494) | | (0.00000426) |
| $D_{ct}$ | | | | 0.00000452 |
| | | | | (0.00000710) |
| Observations | 4498 | 3995 | 503 | 4498 |
| Fixed Effects | Yes | Yes | Yes | Yes |
| M.E of $p/P$ | 0.000033 | 0.000054* | -0.000060 | 0.000033 |
| (Delta Method) | (0.000027) | (0.000027) | (0.000094) | (0.000027) |
| M.E of $Unionize_{ct}$ | -2.79e-06 | 2.83e-07 | 0.000091 | -9.60e-06 |
| (Delta Method) | (0.000031) | (0.000068) | (0.000428) | (0.000029) |
| AR(1) p-value | 0.000 | 0.000 | 0.019 | 0.000 |
| AR(2) p-value | 0.097 | 0.304 | 0.045 | 0.097 |
| Hansen's oid p-value | 1.000 | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p<0.10$, ** $p<0.05$, *** $p<0.01$

Table 6: South Korea's 7 sectors in 17 regions. (1989 - 2019)
Arellano-Bond estimator using unbalanced panel.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ |
|---|---|---|---|
| $\Delta\theta_{ijt-1}$ | 0.112*** | 0.121*** | 0.121*** |
| | (0.0237) | (0.0253) | (0.0276) |
| $p_{ijt-3}/P_{jt-3}$ | 0.00236*** | | |
| | (0.000747) | | |
| $p_{ijt-4}/P_{jt-4}$ | | 0.00166*** | |
| | | (0.000521) | |
| $p_{ijt-5}/P_{jt-5}$ | | | 0.00130*** |
| | | | (0.000410) |
| $Unionize_{ijt}$ | 0.00229 | 0.00348* | 0.00239 |
| | (0.00159) | (0.00196) | (0.00159) |
| $(p_{ijt-3}/P_{jt-3})\times Unionize_{ijt}$ | -0.00233*** | | |
| | (0.000813) | | |
| $(p_{ijt-4}/P_{jt-4})\times Unionize_{ijt}$ | | -0.00214** | |
| | | (0.000874) | |
| $(p_{ijt-5}/P_{jt-5})\times Unionize_{ijt}$ | | | -0.00134*** |
| | | | (0.000480) |
| Observations | 2640 | 2528 | 2416 |
| Fixed Effects | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00217*** | 0.00149*** | 0.00119*** |
| (Delta Method) | (0.00069) | (0.00047) | (0.00038) |
| M.E of $Unionize_{ijt}$ | -0.00057 | 0.00083 | 0.00072 |
| (Delta Method) | (0.00125) | (0.00143) | (0.00121) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 |
| AR(2) p-value | 0.189 | 0.646 | 0.913 |
| Hansen's oid p-value | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: South Korea's 7 sectors in 17 regions. Before and after the legalization of KCTU. Arellano-Bond estimator using unbalanced panel.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ | (4) $\Delta\theta_{ijt}$ | (5) $\Delta\theta_{ijt}$ | (6) $\Delta\theta_{ijt}$ |
|---|---|---|---|---|---|---|
| | 1989 - 1999 | | | 2000 - 2019 | | |
| $\Delta\theta_{ijt-1}$ | 0.0483 | 0.0733 | 0.0615 | 0.0798** | 0.0809** | 0.0838** |
| | (0.0433) | (0.0522) | (0.0664) | (0.0324) | (0.0323) | (0.0330) |
| $p_{ijt-3}/P_{jt-3}$ | 0.00175 | | | 0.00198*** | | |
| | (0.00125) | | | (0.000686) | | |
| $p_{ijt-4}/P_{jt-4}$ | | 0.000815 | | | 0.00157*** | |
| | | (0.000628) | | | (0.000529) | |
| $p_{ijt-5}/P_{jt-5}$ | | | 0.00155* | | | 0.00103*** |
| | | | (0.000887) | | | (0.000378) |
| $Unionize_{ijt}$ | -0.00119 | 0.00137 | 0.000887 | 0.00292 | 0.00269 | 0.00150 |
| | (0.00286) | (0.00209) | (0.00181) | (0.00274) | (0.00220) | (0.00151) |
| $(p_{ijt-3}/P_{jt-3})\times Unionize_{ijt}$ | -0.00145 | | | -0.00254 | | |
| | (0.00114) | | | (0.00205) | | |
| $(p_{ijt-4}/P_{jt-4})\times Unionize_{ijt}$ | | -0.00130 | | | -0.00225* | |
| | | (0.000889) | | | (0.00125) | |
| $(p_{ijt-5}/P_{jt-5})\times Unionize_{ijt}$ | | | -0.00146* | | | -0.000987** |
| | | | (0.000848) | | | (0.000398) |
| Observations | 682 | 580 | 481 | 1958 | 1948 | 1935 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00157 | 0.00066 | 0.00138* | 0.00181*** | 0.00142*** | 0.00096*** |
| (Delta Method) | (0.00113) | (0.00055) | (0.00080) | (0.00065) | (0.00048) | (0.00035) |
| M.E of $Unionize_{ijt}$ | -0.00309 | -0.00031 | -0.00098 | -0.00011 | -0.00005 | 0.00028 |
| (Delta Method) | (0.00265) | (0.00194) | (0.00189) | (0.00157) | (0.00148) | (0.00126) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) p-value | 0.015 | 0.161 | 0.606 | 0.651 | 0.733 | 0.790 |
| Hansen's oid p-value | 0.998 | 0.963 | 0.577 | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Taiwan's 10 sectors in 25 regions. (1992 - 2018)
Arellano-Bond estimator using unbalanced panel.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ |
|---|---|---|---|
| $\Delta\theta_{ijt-1}$ | -0.143*** | -0.141*** | -0.152*** |
| | (0.0179) | (0.0173) | (0.0185) |
| $\Delta\theta_{ijt-2}$ | -0.174*** | -0.168*** | -0.169*** |
| | (0.0290) | (0.0287) | (0.0292) |
| $\Delta\theta_{ijt-3}$ | -0.120*** | -0.116*** | -0.117*** |
| | (0.0149) | (0.0151) | (0.0158) |
| $\Delta\theta_{ijt-4}$ | -0.0783*** | -0.0773*** | -0.0753*** |
| | (0.0126) | (0.0121) | (0.0156) |
| $p_{ijt-3}/P_{jt-3}$ | 0.000207 | | |
| | (0.000142) | | |
| $p_{ijt-4}/P_{jt-4}$ | | 0.000374** | |
| | | (0.000171) | |
| $p_{ijt-5}/P_{jt-5}$ | | | 0.000317 |
| | | | (0.000205) |
| $Unionize_{ijt}$ | -0.000668** | -0.000553** | -0.000689** |
| | (0.000300) | (0.000254) | (0.000326) |
| $(p_{ijt-3}/P_{jt-3})\times Unionize_{ijt}$ | -0.0000148 | | |
| | (0.000164) | | |
| $(p_{ijt-4}/P_{jt-4})\times Unionize_{ijt}$ | | -0.000177** | |
| | | (0.0000896) | |
| $(p_{ijt-5}/P_{jt-5})\times Unionize_{ijt}$ | | | -0.000226* |
| | | | (0.000126) |
| Observations | 2865 | 2850 | 2841 |
| Fixed Effects | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00020 | 0.00029* | 0.00022 |
| (Delta Method) | (0.00012) | (0.00015) | (0.00018) |
| M.E of $Unionize_{ijt}$ | -0.00068*** | -0.00075*** | -0.00094*** |
| (Delta Method) | (0.00022) | (0.00021) | (0.00023) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 |
| AR(5) p-value | 0.288 | 0.287 | 0.305 |
| Hansen's oid p-value | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Taiwan's 10 sectors in 25 regions. Before and after the legalization of TCTU in 2000. Arellano-Bond estimator using unbalanced panel.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ | (4) $\Delta\theta_{ijt}$ | (5) $\Delta\theta_{ijt}$ | (6) $\Delta\theta_{ijt}$ |
|---|---|---|---|---|---|---|
| | 1992 - 2000 | | | 2001 - 2018 | | |
| $\Delta\theta_{ijt-1}$ | -0.269*** | -0.330*** | -0.351*** | -0.0903*** | -0.0909*** | -0.101*** |
| | (0.0249) | (0.0267) | (0.0312) | (0.0157) | (0.0155) | (0.0170) |
| $\Delta\theta_{ijt-2}$ | | | | -0.101*** | -0.101*** | -0.110*** |
| | | | | (0.0119) | (0.0120) | (0.0139) |
| $\Delta\theta_{ijt-3}$ | | | | -0.0679*** | -0.0680*** | -0.0755*** |
| | | | | (0.0139) | (0.0146) | (0.0152) |
| $\Delta\theta_{ijt-4}$ | | | | -0.0138** | -0.0137** | -0.0597*** |
| | | | | (0.00582) | (0.00583) | (0.0166) |
| $p_{ijt-3}/P_{jt-3}$ | 0.00375* | | | 0.000396*** | | |
| | (0.00227) | | | (0.000134) | | |
| $p_{ijt-4}/P_{jt-4}$ | | 0.00590 | | | 0.000433*** | |
| | | (0.00397) | | | (0.000152) | |
| $p_{ijt-5}/P_{jt-5}$ | | | -0.00840** | | | 0.000404** |
| | | | (0.00357) | | | (0.000197) |
| $Unionize_{ijt}$ | -0.00240 | -0.00245 | -0.00397 | -0.000199 | -0.000194* | -0.000272** |
| | (0.00178) | (0.00178) | (0.00281) | (0.000128) | (0.000107) | (0.000131) |
| $(p_{ijt-3}/P_{jt-3})\times Unionize_{ijt}$ | -0.000484 | | | -0.000160** | | |
| | (0.000869) | | | (0.0000656) | | |
| $(p_{ijt-4}/P_{jt-4})\times Unionize_{ijt}$ | | -0.001000 | | | -0.000207*** | |
| | | (0.00161) | | | (0.0000555) | |
| $(p_{ijt-5}/P_{jt-5})\times Unionize_{ijt}$ | | | 0.000714 | | | -0.000253*** |
| | | | (0.00152) | | | (0.0000941) |
| Observations | 630 | 515 | 391 | 2548 | 2533 | 2522 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00353 | 0.00541 | -0.00799** | 0.00032*** | 0.00034 | 0.00030 |
| (Delta Method) | (0.00226) | (0.00397) | (0.00342) | (0.00012) | (0.00310) | (0.01028) |
| M.E of $Unionize_{ijt}$ | -0.00304* | -0.00380 | -0.00299 | -0.00037*** | -0.00042 | -0.00055 |
| (Delta Method) | (0.00166) | (0.00268) | (0.00322) | (0.00011) | (0.00201) | (0.00790) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) p-value | 0.050 | 0.066 | 0.729 | | | |
| AR(5) p-value | | | | 0.577 | 0.579 | 0.672 |
| Hansen's oid p-value | 0.001 | 0.000 | 0.000 | 1.000 | 1.000 | 0.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: South Korea's 7 sectors in 17 regions. Before and after the legalization of KCTU. Arellano-Bond estimator using unbalanced panel with $Unionize^*_{ijt}$.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ | (4) $\Delta\theta_{ijt}$ | (5) $\Delta\theta_{ijt}$ | (6) $\Delta\theta_{ijt}$ |
|---|---|---|---|---|---|---|
| | 1989 - 1999 | | | 2000 - 2019 | | |
| $\Delta\theta_{ijt-1}$ | 0.0460 | 0.0702 | 0.0502 | 0.0708** | 0.0762** | 0.0821** |
| | (0.0424) | (0.0521) | (0.0690) | (0.0324) | (0.0326) | (0.0331) |
| $p_{ijt-3}/P_{jt-3}$ | 0.00231 | | | 0.00321*** | | |
| | (0.00145) | | | (0.00118) | | |
| $p_{ijt-4}/P_{jt-4}$ | | 0.000857 | | | 0.00215*** | |
| | | (0.000725) | | | (0.000784) | |
| $p_{ijt-5}/P_{jt-5}$ | | | 0.00134 | | | 0.00111** |
| | | | (0.000902) | | | (0.000433) |
| $Unionize_{ijt^*}$ | -0.00114 | -0.00107 | -0.00141 | 0.00819* | 0.00521 | -0.000837 |
| | (0.00263) | (0.00242) | (0.00301) | (0.00475) | (0.00333) | (0.00274) |
| $(p_{ijt-3}/P_{jt-3})\times Unionize^*_{ijt}$ | -0.00151 | | | -0.00839** | | |
| | (0.00107) | | | (0.00332) | | |
| $(p_{ijt-4}/P_{jt-4})\times Unionize^*_{ijt}$ | | -0.000521 | | | -0.00487** | |
| | | (0.000750) | | | (0.00221) | |
| $(p_{ijt-5}/P_{jt-5})\times Unionize^*_{ijt}$ | | | -0.000841 | | | -0.00119* |
| | | | (0.000656) | | | (0.000715) |
| Observations | 682 | 580 | 481 | 1958 | 1948 | 1935 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00210 | 0.00078 | 0.00123 | 0.00248*** | 0.00172*** | 0.00100*** |
| (Delta Method) | (0.00132) | (0.00064) | (0.00082) | (0.00091) | (0.00061) | (0.00038) |
| M.E of $Unionize^*_{ijt}$ | -0.00311 | -0.00174 | -0.00248 | -0.00187 | -0.00073 | -0.00230 |
| (Delta Method) | (0.00297) | (0.00239) | (0.00283) | (0.00344) | (0.00297) | (0.00251) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) p-value | 0.013 | 0.161 | 0.591 | 0.543 | 0.677 | 0.779 |
| Hansen's oid p-value | 0.998 | 0.941 | 0.439 | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Taiwan's 10 sectors in 25 regions. Before and after the legalization of TCTU in 2000. Arellano-Bond estimator using unbalanced panel with $Unionize^*_{ijt}$.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ | (4) $\Delta\theta_{ijt}$ | (5) $\Delta\theta_{ijt}$ | (6) $\Delta\theta_{ijt}$ |
|---|---|---|---|---|---|---|
| | 1992 - 2000 | | | 2001 - 2018 | | |
| $\Delta\theta_{ijt-1}$ | -0.285*** | -0.366*** | -0.278*** | -0.0280** | -0.0266** | -0.0281** |
| | (0.0240) | (0.0308) | (0.0272) | (0.0125) | (0.0125) | (0.0127) |
| $\Delta\theta_{ijt-2}$ | | | | -0.0632*** | -0.0621*** | -0.0630*** |
| | | | | (0.0106) | (0.0107) | (0.0102) |
| $\Delta\theta_{ijt-3}$ | | | | -0.0356*** | -0.0341*** | -0.0326*** |
| | | | | (0.0109) | (0.0111) | (0.0114) |
| $\Delta\theta_{ijt-4}$ | | | | -0.0401*** | -0.0409*** | -0.0367*** |
| | | | | (0.00897) | (0.00891) | (0.0125) |
| $p_{ijt-3}/P_{jt-3}$ | 0.00242 | | | 0.000291** | | |
| | (0.00163) | | | (0.000120) | | |
| $p_{ijt-4}/P_{jt-4}$ | | 0.00469 | | | 0.000237** | |
| | | (0.00326) | | | (0.0000955) | |
| $p_{ijt-5}/P_{jt-5}$ | | | -0.00636*** | | | 0.000138 |
| | | | (0.00216) | | | (0.0000879) |
| $Unionize^*_{ijt}$ | -0.00455*** | -0.00382*** | -0.00370*** | -0.000204 | -0.000283 | -0.000419* |
| | (0.00142) | (0.00144) | (0.00139) | (0.000191) | (0.000176) | (0.000215) |
| $(p_{ijt-3}/P_{jt-3})\times Unionize^*_{ijt}$ | 0.000758 | | | -0.000270*** | | |
| | (0.00149) | | | (0.0000785) | | |
| $(p_{ijt-4}/P_{jt-4})\times Unionize^*_{ijt}$ | | -0.00132 | | | -0.000311*** | |
| | | (0.00253) | | | (0.0000860) | |
| $(p_{ijt-5}/P_{jt-5})\times Unionize^*_{ijt}$ | | | -0.000563 | | | -0.000286*** |
| | | | (0.00247) | | | (0.000106) |
| Observations | 968 | 774 | 580 | 3180 | 3165 | 3156 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00259* | 0.00435 | -0.00652*** | 0.00021** | 0.00015* | 0.00006 |
| (Delta Method) | (0.00158) | (0.00314) | (0.00198) | (0.00010) | (0.00008) | (0.00006) |
| M.E of $Unionize^*_{ijt}$ | -0.00350* | -0.00566* | -0.00448 | -0.00051*** | -0.00064*** | -.00075*** |
| (Delta Method) | (0.00186) | (0.00297) | (0.00286) | (0.00017) | (0.00018) | (0.00022) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) p-value | 0.017 | 0.023 | 0.599 | | | |
| AR(5) p-value | | | | 0.951 | 0.947 | 0.930 |
| Hansen's oid p-value | 0.000 | 0.000 | 0.000 | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: South Korea's 7 sectors in 17 regions. (1989 - 2019)
Arellano-Bond estimator using unbalanced panel with $\frac{L^u_{it}}{L_{it}}$ and $\frac{L^u_{jt}}{L_{jt}}$.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ |
|---|---|---|---|
| $\Delta\theta_{ijt-1}$ | 0.0378 | 0.0702** | 0.0779*** |
| | (0.0267) | (0.0285) | (0.0302) |
| $p_{ijt-3}/P_{jt-3}$ | 0.00506*** | | |
| | (0.00122) | | |
| $p_{ijt-4}/P_{jt-4}$ | | 0.00398*** | |
| | | (0.000934) | |
| $p_{ijt-5}/P_{jt-5}$ | | | 0.00317*** |
| | | | (0.000852) |
| $\frac{L^u_{jt}}{L_{jt}}$ | 0.000678 | 0.000910 | -0.00245 |
| | (0.0111) | (0.0108) | (0.0104) |
| $\frac{L^u_{it}}{L_{it}}$ | 0.0349*** | 0.0367*** | 0.0366*** |
| | (0.00957) | (0.00871) | (0.00944) |
| $(p_{ijt-3}/P_{jt-3})\times\frac{L^u_{jt}}{L_{jt}}$ | 0.00318 | | |
| | (0.00648) | | |
| $(p_{ijt-3}/P_{jt-3})\times\frac{L^u_{it}}{L_{it}}$ | -0.0130*** | | |
| | (0.00322) | | |
| $(p_{ijt-4}/P_{jt-4})\times\frac{L^u_{jt}}{L_{jt}}$ | | 0.00161 | |
| | | (0.00596) | |
| $(p_{ijt-4}/P_{jt-4})\times\frac{L^u_{it}}{L_{it}}$ | | -0.0111*** | |
| | | (0.00266) | |
| $(p_{ijt-5}/P_{jt-5})\times\frac{L^u_{jt}}{L_{jt}}$ | | | 0.00374 |
| | | | (0.00522) |
| $(p_{ijt-5}/P_{jt-5})\times\frac{L^u_{it}}{L_{it}}$ | | | -0.00965*** |
| | | | (0.00252) |
| Observations | 2406 | 2299 | 2192 |
| Fixed Effects | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00410*** | 0.00312*** | 0.00254*** |
| (Delta Method) | (0.00093) | (0.00068) | (0.00062) |
| M.E of $\frac{L^u_{jt}}{L_{jt}}$ | 0.00461 | 0.00292 | 0.00225 |
| (Delta Method) | (0.00745) | (0.00732) | (0.00725) |
| M.E of $\frac{L^u_{it}}{L_{it}}$ | 0.01882*** | 0.02282*** | 0.02442*** |
| (Delta Method) | (0.00692) | (0.00649) | (0.00719) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 |
| AR(2) p-value | 0.024 | 0.380 | 0.463 |
| Hansen's oid p-value | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Taiwan's 10 sectors in 25 regions. Before and after the legalization of TCTU in 2000.
Arellano-Bond estimator using unbalanced panel with $\frac{L^u_{it}}{L_{it}}$ and $\frac{L^u_{jt}}{L_{jt}}$.

| | (1) $\Delta\theta_{ijt}$ | (2) $\Delta\theta_{ijt}$ | (3) $\Delta\theta_{ijt}$ | (4) $\Delta\theta_{ijt}$ | (5) $\Delta\theta_{ijt}$ | (6) $\Delta\theta_{ijt}$ |
|---|---|---|---|---|---|---|
| | 1992 - 2000 | | | 2001 - 2018 | | |
| $\Delta\theta_{ijt-1}$ | -0.245*** | -0.288*** | -0.305*** | -0.0782*** | -0.0800*** | -0.0813*** |
| | (0.0256) | (0.0335) | (0.0293) | (0.0164) | (0.0163) | (0.0163) |
| $\Delta\theta_{ijt-2}$ | | | | -0.0910*** | -0.0935*** | -0.0940*** |
| | | | | (0.0126) | (0.0128) | (0.0127) |
| $\Delta\theta_{ijt-3}$ | | | | -0.0636*** | -0.0683*** | -0.0700*** |
| | | | | (0.0122) | (0.0133) | (0.0136) |
| $\Delta\theta_{ijt-4}$ | | | | -0.0597*** | -0.0614*** | -0.0628*** |
| | | | | (0.0109) | (0.0102) | (0.0107) |
| $p_{ijt-3}/P_{jt-3}$ | 0.00339 | | | 0.000850* | | |
| | (0.00328) | | | (0.000453) | | |
| $p_{ijt-4}/P_{jt-4}$ | | -0.00556 | | | 0.000840* | |
| | | (0.00651) | | | (0.000464) | |
| $p_{ijt-5}/P_{jt-5}$ | | | -0.00870 | | | 0.000544 |
| | | | (0.00807) | | | (0.000440) |
| $\frac{L^u_{jt}}{L_{jt}}$ | -0.0565 | -0.0687 | -0.0673 | 0.00128 | 0.00152 | 0.00208 |
| | (0.0528) | (0.0573) | (0.0614) | (0.00488) | (0.00498) | (0.00541) |
| $\frac{L^u_{it}}{L_{it}}$ | 0.0667 | 0.0921 | 0.174** | -0.00393*** | -0.00343** | -0.00521*** |
| | (0.0655) | (0.0674) | (0.0702) | (0.00138) | (0.00147) | (0.00187) |
| $(p_{ijt-3}/P_{jt-3})\times\frac{L^u_{jt}}{L_{jt}}$ | 0.0188 | | | -0.00163* | | |
| | (0.0147) | | | (0.000894) | | |
| $(p_{ijt-3}/P_{jt-3})\times\frac{L^u_{it}}{L_{it}}$ | -0.0581*** | | | 0.000171 | | |
| | (0.0205) | | | (0.000442) | | |
| $(p_{ijt-4}/P_{jt-4})\times\frac{L^u_{jt}}{L_{jt}}$ | | 0.0230 | | | -0.00160 | |
| | | (0.0172) | | | (0.000978) | |
| $(p_{ijt-4}/P_{jt-4})\times\frac{L^u_{it}}{L_{it}}$ | | -0.0714*** | | | -0.000140 | |
| | | (0.0248) | | | (0.000503) | |
| $(p_{ijt-5}/P_{jt-5})\times\frac{L^u_{jt}}{L_{jt}}$ | | | 0.0183 | | | -0.00166 |
| | | | (0.0195) | | | (0.00107) |
| $(p_{ijt-5}/P_{jt-5})\times\frac{L^u_{it}}{L_{it}}$ | | | -0.0929*** | | | 0.000657 |
| | | | (0.0346) | | | (0.000664) |
| Observations | 632 | 517 | 393 | 2496 | 2489 | 2485 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| M.E of $p/P$ | 0.00380 | -0.00509 | -0.01200** | 0.00027 | 0.00023 | 0.00001 |
| (Delta Method) | (0.00257) | (0.00337) | (0.00509) | (0.00199) | (0.02131) | (0.00018) |
| M.E of $\frac{L^u_{jt}}{L_{jt}}$ | -0.03136 | -0.03751 | -0.04251 | -0.00050 | -0.00027 | 0.00018 |
| (Delta Method) | (0.03970) | (0.04437) | (0.04540) | (0.00842) | (0.07738) | (0.00514) |
| M.E of $\frac{L^u_{it}}{L_{it}}$ | -0.01084 | -0.00445 | 0.04780 | -0.00374 | -0.00358 | -0.00445*** |
| (Delta Method) | (0.05602) | (0.06031) | (0.07136) | (0.02100) | (0.34159) | (0.00135) |
| AR(1) p-value | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| AR(2) p-value | 0.058 | 0.113 | 0.460 | | | |
| AR(5) p-value | | | | 0.782 | 0.797 | 0.696 |
| Hansen's oid p-value | 0.266 | 0.031 | 0.003 | 1.000 | 1.000 | 1.000 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Geographically decomposed growth and unionization in South Korea, 1989-2019

| | (1) $StructG_{jt}$ | (2) $StructG_{jt}$ | (3) $StructG_{jt}$ | (4) $WithinG_{jt}$ | (5) $WithinG_{jt}$ | (6) $WithinG_{jt}$ |
|---|---|---|---|---|---|---|
| $L^u_{jt-4}/L_{jt-4}$ | -11931.8** | | | 10828.1 | | |
| | (4657.8) | | | (6929.8) | | |
| $L^u_{jt-5}/L_{jt-5}$ | | -15391.1*** | | | 17174.9** | |
| | | (4877.6) | | | (7271.6) | |
| $L^u_{jt-6}/L_{jt-6}$ | | | -13511.5*** | | | 23717.7*** |
| | | | (5109.1) | | | (7504.6) |
| Constant | 186.6 | 746.6 | 865.9 | 1461.7 | 913.0 | 1121.7 |
| | (609.2) | (627.4) | (650.5) | (906.3) | (935.3) | (955.5) |
| Observations | 358 | 341 | 324 | 358 | 341 | 324 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Geographically decomposed growth and unionization in Taiwan, 1992-2018

| | (1) $StructG_{jt}$ | (2) $StructG_{jt}$ | (3) $StructG_{jt}$ | (4) $WithinG_{jt}$ | (5) $WithinG_{jt}$ | (6) $WithinG_{jt}$ |
|---|---|---|---|---|---|---|
| $L^u_{jt-4}/L_{jt-4}$ | 14.39 | | | -76.59 | | |
| | (38.37) | | | (145.9) | | |
| $L^u_{jt-5}/L_{jt-5}$ | | 5.916 | | | -118.4 | |
| | | (42.72) | | | (162.1) | |
| $L^u_{jt-6}/L_{jt-6}$ | | | 52.81 | | | -111.1 |
| | | | (47.98) | | | (182.1) |
| Constant | 0.973 | 0.0568 | -17.73 | 56.73 | 63.37 | 57.55 |
| | (18.43) | (20.21) | (22.35) | (70.08) | (76.66) | (84.81) |
| Observations | 340 | 314 | 288 | 340 | 314 | 288 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# Figures

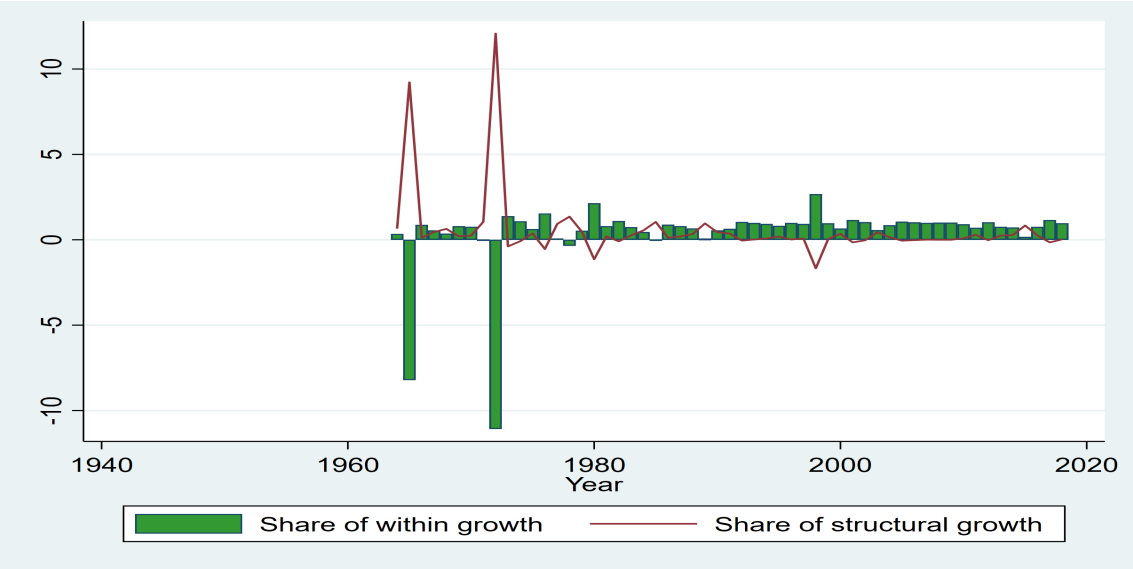


Figure 1: Growth Decomposition of South Korea

(Two extreme years are 1965 and 1972. As the 10-Sector Database ends in 2011, Economic Transformation Database is used since 2012.)

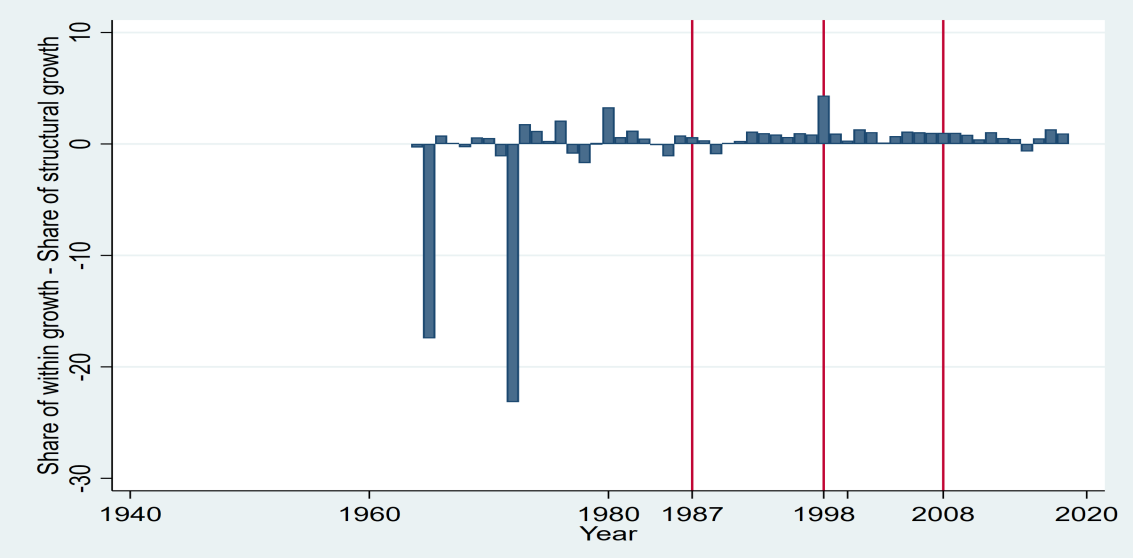


Figure 2: Share of within growth minus share of structural growth of South Korea.

(Two extreme years are 1965 and 1972. The positive value means that the within growth was bigger than the structural growth in according year. Vertical lines indicate the democratization (1987), 1st (1998) and 2nd (2008) power shifts, respectively. )

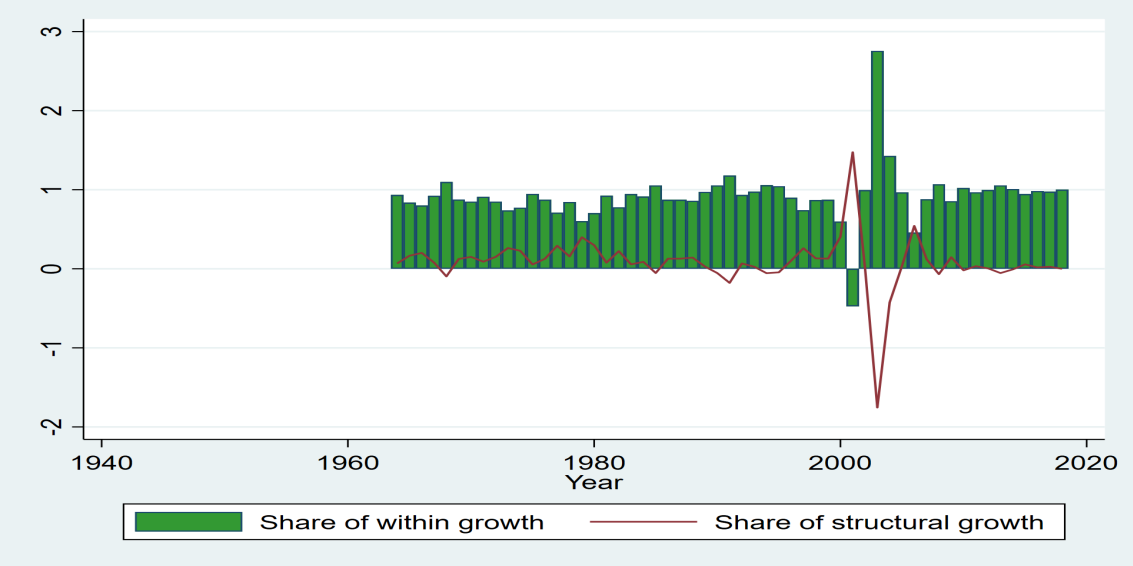


Figure 3: Growth Decomposition of Taiwan

(As the 10-Sector Database ends in 2012, Economic Transformation Database is used since 2013.)

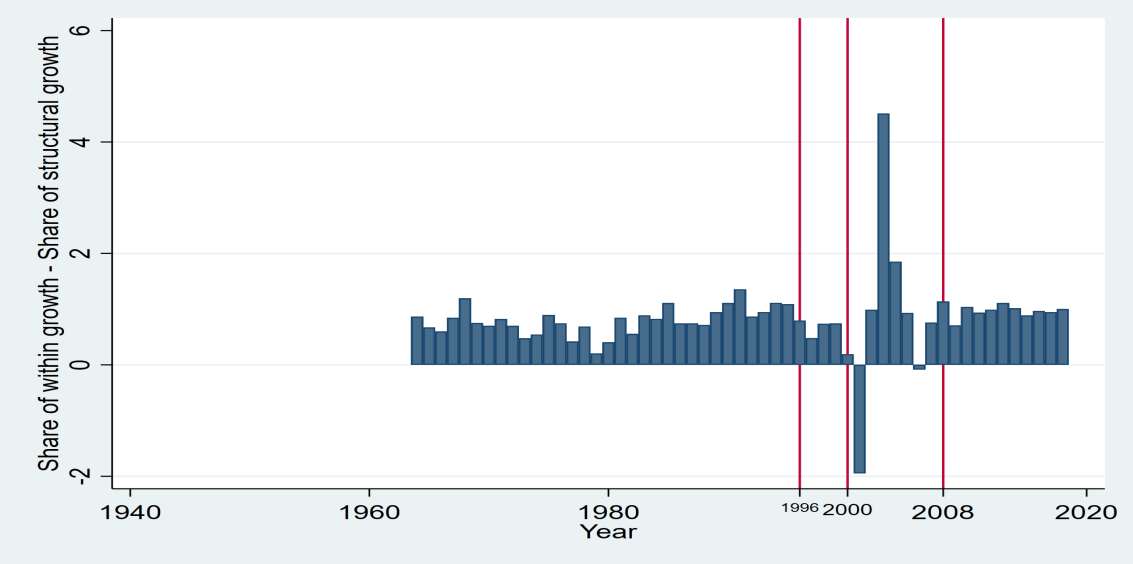


Figure 4: Share of within growth minus share of structural growth of Taiwan.

(The positive value means that the within growth was bigger than the structural growth in according year. Vertical lines indicate the democratization (1996), 1st (2000) and 2nd (2008) power shifts, respectively.)