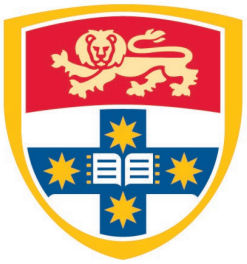

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What Determines Regional Labor Shares? Evidence from Korea

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Abstract

This study investigates the explanatory forces behind changes in labor shares over 2000-2014 in Korea. Unlike previous studies focusing on cross-national differences in labor shares, we focus on the changes in labor shares across regions. Utilizing Census of Establishments and the Economically Active Population Survey and constructing variables at the regional level, we estimate an array of cross-regional and panel VAR models. Our estimates from fixed effects models suggest that the movements in regional labor shares can be largely explained by differences in per capita income growth, the concentration of service industry, the average tenure of firms and union density. Results from panel VAR models generally confirm those obtained from the fixed effects models and also indicate that the effects of those factors on the labor share are significantly different between metropolitan cities and provinces. Technological progress plays a more prominent role in provinces than in cities while the concentration of markets (size of markup) is more important in cities than in provinces to explain the labor share movements. We also find evidence that trade dependence leads to a decline in labor share of income, which reflects capital mobility and labor saving competitive forces across nations. Our results show that it is important to take into account heterogeneities in product and labor markets in order to understand the changes in labor shares in regional income. This suggests that regional variations in industry and trades should be important considerations for policies aimed at targeting labor income.

Keywords: labor share, Herfindahl-Hirschman index, fixed effects model, panel VAR, regional analysis

JEL classification: E21, E22, E25, J30, R11

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1. Introduction

The labor share in national income has been one of the crude measures of income distribution. It indicates a division of income between workers and owners of capital, and possibly shows the position of workers relative to that of capitalists in a society. As pointed out by Kuznets (1933), the labor share of national income entails serious political and social ramifications. The size of labor share of income has also shaped government′s social policies when it appeared to be concerning class struggle and compromise between workers and capitalists, as observed by Kristal (2013).

In recent years, a number of studies have observed and documented a declining trend of labor share in national income among developed and developing countries, especially in the 2000s (Rodriguez and Jayadev, 2010; OECD, 2012; Dunhaupt, 2013; Karabarbounis and Neiman, 2014; van Treeck and Wacker, 2017; Autor et al, 2017). This observation sparked a considerable debate on the causes of the labor share decline. Their proposed explanations vary across capital accumulation and skill-biased technical changes (Bentolila and Saint-Paul, 2003; Driver and Muñoz-Bugarín, 2010; Hutchinson and Persyn, 2012), an increase in import competition and offshoring (Harrison, 2002; Elsby et al, 2013), financial globalization and foreign direct investment (Bassanini and Manfredi, 2014; Decreuse and Maarek, 2015; van Treeck and Wacker, 2017), market structure and product market competition (Blanchard and Giavazzi, 2003; Jaimovich and Floetotto, 2008), union density and bargaining power of workers (Bentolila and Saint-Paul, 2003; OECD 2015), and minimum wage and employment protection legislation (IMF, 2007; European Commission, 2007; ILO, 2012; OECD, 2012).

However, a decline in the labor share in national income, reflecting the relative income position of an average worker, does not indicate that the relative incomes of *all workers* in a country have worsened. Even if the aggregate labor share is stable over time, it is possible that labor shares in certain sectors decline substantially, adversely affecting workers in those sectors. Elsby et al (2013) show that the stable aggregate US labor share prior to the 1980s, in fact, disguised substantial movements, though offsetting each other, in labor shares at the industry level. Accordingly, the changes in the aggregate labor share do not provide adequate information as to how workers are affected differently by those changes, requiring investigation of the changes in the labor share at disaggregate levels.

In this paper, we examine the changes in the labor share at the regional level. Previous studies mainly focused on the changes in the labor share either within a country or across countries to examine cross-country differences. However, the factors identified in these studies such as globalization, import-competition and minimum wage laws are unlikely to be very useful for

understanding why the labor share trend varies across regions within a country.[1] This necessitates an empirical study to investigate if there are other factors driving labor share of income across regions in a country.

If the trend in regional labor income shares is similar to that of aggregate labor income share, then examining the causes for changes in the regional labor income share may not reveal much information. Upon a preliminary inspection of the Korean data, however, we observe there are substantial deviations of the regional labor income shares from the trend in aggregate labor share of national income. Our examination of the changes in the labor share at the regional level also reveals that workers in different regions are affected differently although they face the same economic changes at the national level.

Since we attempt to explain what causes the differences in changes of the labor share across regions, we utilize information at the regional level. An important contributions of our work is that our explanatory variables are constructed directly from the information on firms and individuals at the regional level. For example, we use the *Census of Establishments*, which contains information on all firms in Korea, to construct the Herfindahl-Hirschman (HH) index at the regional level. We also use the *Economically Active Population Survey* to construct the share of temporary workers and the share of university graduates at the regional level. Thus, we are able to link the activities of firms and individuals at a region to the changes of the labor share at that region.

In addition to the Herfindahl-Hirschman (HH) index and the shares of temporary workers and university graduates, we also allow the labor share to respond to changes in region-specific conditions such as the local market structure, the share of employment utilized in the four largest firms, the average tenure of firms, and union density. The share of employment utilized in the four largest firms is used to test the "the superstar firm hypothesis" suggested by Autor et al (2017). The union density is supposed to measure the bargaining power of workers and unions. In Korea, some large corporations and their major plants such as Samsung and Hyundai are strategically located in certain provinces and those large firms tend to be highly unionized. Therefore, the union density can potentially be an important factor to explain differences in the labor shares across regions.

The average tenure of firms is also an additional variable we propose in the model that previous studies have not considered. As the tenure of a firm increases, it is more likely that the firm has a greater marker power since the longer tenure implies longer survival in the market. We expect that the average tenure of firms has a negative impact on the labor share in the regional income on top of the negative effects of the market concentration as measured by the HH index.[2]

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[1] Minimum wage laws can vary across regions in some countries such as the United States. However, Korea, which is our focus of analysis, has a national minimum wage law that applies to all regions in Korea.

[2] It has to be noted, however, that the HH index has certain limitations and is hence an imperfect measure.

Using 16 metropolitan and provincial data from 2000 to 2014 in Korea, we first estimate fixed effects models and then estimate panel VAR models where the labor share as well as other variables described above are all allowed to be endogenous. Our estimates from fixed effects models suggest that the movements in regional labor shares can be largely explained by differences in per capita income growth, the concentration of service industry, the average tenure of firms and union density. The panel VAR results generally confirm those obtained from the fixed effects models and also indicate that the effects of those factors on the labor share are significantly different between metropolitan cities and provinces. Technological progress plays a more important role in provinces than in cities while the concentration of markets (size of markup) is more important in cities than in provinces to explain the labor share movements.

This paper is structured as follows. Section 2 describes how the labor share in income is defined in our study, and presents the trend of the labor shares in national and regional income in Korea. Section 3 presents the econometric models and estimation procedures. Section 4 explains the data and describes how the variables in the model are constructed. Section 5 presents estimation results obtained from both fixed effects and panel VAR models. Section 6 summarizes the main findings of this study and suggests implications of our results on the increasing disparity across regions in Korea.

2. The Changes in the Labor Share in Korea

2.1. The Trend of the Aggregate and Regional Labor Shares

The labor share normally refers to the fraction of national income that belongs to labor. When income is distributed to factors of production, the labor share is then the compensation of employees as a share of gross value-added (Dühaupt, 2013; Elsby et al, 2013). Consistent with their work, we can define the labor share as

$$LS_t = \frac{CE_t}{GVA_t} \tag{1}$$

where CE_t and GVA_t denote the compensation of employees and the gross value added, respectively. Gollin (2002) shows that large differences between labor shares of rich and poor countries disappear when the earnings of self-employed are corrected. There are several ways to adjust for the labor income of self-employed. We follow Gollin's third suggestion that the self-employed earn the same wage as employees.[3] This kind of adjustment was commonly used by many studies (Hutchinson and Persyn, 2012; Kim, 2016; van Treeck and Wacker, 2017). In this case, the

[3] This approach is also adopted by the *Statistics Korea* when reporting adjusted labor shares annually.

adjusted labor share is defined as

$$LS_t = \frac{CE_t}{GVA_t} \text{x} \frac{N_t}{N_t - N_t^{self}} \quad (2)$$

where N_t denotes total number of workers and N_t^{self} the number of self-employed. Figure 1 shows the trends of unadjusted and adjusted labor shares in national income in Korea. The self-employment adjusted labor share is about 15% point higher than the unadjusted labor share. This conspicuous difference comes from the large share of self-employment in Korea.[4]

Figure 1 Trends of the Labor Share in National Income

The national labor share (self-employment adjusted) in Korea increased from 60.6% in 2000 to 62.8% in 2006 and then decreased to 59.3% in 2014. The pattern is quite consistent with the findings of Kim (2014) although his time span is much longer than ours.[5]

Although the labor share in national income is fairly stable in the 2000s, the labor shares across regions present quite a different picture. Table 1 shows the labor shares of 16 metropolitan cities and provinces in Korea during the period 2000-2014. From the table, we can observe two important things. First, the levels of the labor shares are quite different across regions. This implies that there may be intrinsic differences in market structures and production technologies as well as labor market characteristics. Second, the movements of the labor shares over time are also varying across regions. Out of 16 metropolitan cities and provinces, 5 of them experienced an increase in the labor share during that period while 11 experienced a decrease. Figure 2 shows there are substantial disparities in the labor share trends across the regions.

Table 1 Labor Shares in 16 Metropolitan Cities and Provinces in Korea

Figure 2 displays some interesting patterns. First, the regional labor share trends are quite region specific with no visible sign of common forces at work, and far from smooth, often showing ups and downs in the sample period. Second, the labor share in metropolitan areas has not declined while the labor share in most of provincial areas show a clear downward trend. These are mainly areas in which no major industrial complex is located. This is contrasted with the labor share trends observed in some metropolitan areas with strong industrial bases such as Ulsan in which a large portion of Hyundai's

[4] In 2014, the share of self-employed workers in total employment in Korea is 26.8%, whereas the average share for the OECD member countries in that year is 15.4%.

[5] The time span of our analysis is limited to 2000 to 2014 because regional data on income accounts are only available after 2000 in Korea.

plants are located. Ulsan showed an increase in the labor share overall, although there was a sharp decline during 2009-2011. Regions characterized by industrial complexes may be more vulnerable to external shocks leading to a temporary decline in the labor share but are less likely to show a clear downward trend.

However, metropolitan and provincial areas appear to share some similar pattern of trends, although the extent of a decline and hence a discernible trend is manifested in provincial areas. This would reflect a significant labor mobility between the adjacent metropolitan and provincial areas. Provincial areas without a large industrial complex such as Ulsan seems very vulnerable to structural changes and show an unambiguous downward trend in labor share.

Figure 2 Trends in Regional Labor Shares

Figure 3 presents correlations between the labor share in Korea as a whole and the labor share of each city and province. All correlations are positive, indicating that the trend of the labor share in national income generally moves in the same direction with that of the labor shares in the regions. However, the magnitude of the correlations ranges from 0.36 with Gyeongbuk to 0.82 with Chungbuk. The movement of the labor share in national income, therefore, cannot fully explain the changes of the labor share in all regions. In order to understand the changes of the labor shares at the regional level, is has to be explained why different regions have different movements of labor shares despite the common macroeconomic conditions. To answer this question, one needs to consider region specific factors.

Figure 3 Correlations between Regional Labor Share and National Labor Share

2.2. The Decomposition of Changes in Aggregate Labor Share

The aggregate labor share in equation (1), LS_t, can be expressed as the weighted sum of the labor shares, LS_t^i, of the region i in the economy. That is,

$$LS_t = \sum_i \omega_t^i \, LS_t^i, \tag{3}$$

where $\omega_t^i (= GVA_t^i / GVA_t)$ is the share of the gross value added of region i at time t, and $LS_t^i = CE_t^i / GVA_t^i$. Let $\Delta LS_t = LS_t - LS_{t-1}$, then ΔLS_t can be decomposed into two components, shift and share (Elsby et al, 2013). There are two representations of the decomposition. We can either use (ω_t^i and LS_{t-1}^i) or (ω_{t-1}^i and LS_t^i) in decomposition. To avoid arbitrariness, we use averages of ω_t^i and

ω_{t-1}^{i}, and LS_t^i and LS_{t-1}^i. Hence, the decomposition is done as follows:

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$$\Delta LS_t = \sum_i \overline{\omega_i}\, \Delta LS_t^i + \sum_i \Delta\omega_t^i\, \overline{LS_i} \qquad (4)$$

where $\overline{\omega_i} = (\omega_t^i + \omega_{t-1}^i)/2$ and $\overline{LS_i} = (LS_t^i + LS_{t-1}^i)/2$. The first part represents the shift component which results from the change in the labor share within a region while the second part represents the share component which comes from the changes in regional composition in the aggregate gross value added. Table 2 shows the shift-share decomposition results computed using the method described above. The table shows the results over two sub-sample and the full sample periods. The sample is split into the pre- and post-GFC period. Notably, the main results show that the shift component, i.e. resulting from changes within a region, is the more dominant component of the aggregate labor share, rather than the compositional change of region in aggregate gross value added. Over the period 2000-2006, the shift component within a region contributed positively to aggregate labor share. Thus, examining within-region changes of labor share would also help understand changes in aggregate labor share.

Table 2 Shift-Share Decomposition of Changes in Labor Share by Region

3. Theory and Empirical Models

3.1.Theoretical Backgrounds

When product and labor markets are competitive and the production function is Cobb-Douglas, $Q_t = AL_t^{\alpha}K_t^{1-\alpha}$, it can be easily shown that the labor share in total income is represented by the parameter of the labor input (α) which is a constant. When the product market is not competitive, firms enjoy some markups and hence the labor share depends on the markup as well as the parameter of the labor input. Specifically, if the production function is of a CES form,

$$Q_t = \left[(A_tK_t)^{\varepsilon} + (B_tL_t)^{\varepsilon}\right]^{1/\varepsilon}$$

then the labor share becomes:

$$LS_t = \frac{\eta_w}{\mu} \qquad (5)$$

where μ is the markup and η_w is the elasticity of the capital-labor ratio with respect to wage, holding capital constant. Bentolila and Saint-Paul (2003) show that the elasticity of substitution between *K* and *L* (σ_{LK}) is related to η_w, together with the capital-labor ratio and the elasticity of the labor share with respect to the capital-labor ratio. It is known that if σ_{LK} is smaller than one in absolute value, an increase in the capital-labor ratio lead to a decline in the labor share (Bentolila and Saint-Paul, 2003; Dühaupt, 2013).[6]

Equation (5) indicates that the labor share is inversely related to the markup. As the markup increases when the product market is more concentrated, we expect the labor share in income to decrease as the measures of market concentration such as the Herfindahl-Hirschman (HH) index or the market share of a small number of firms increase.

The bargaining power of labor can also influence the labor share in income. Using the "efficient bargaining model" where unions and firms bargain over wage and employment, Bentolila and Saint-Paul (2003) show that when there is an increase in workers' bargaining power, the labor share increases given the capital-output ratio.[7] Hutchinson and Persyn (2012) also consider the efficient bargaining model when firms can relocate their plants in a foreign country as an outside option. Their theoretical model shows that the labor share depends on the union's bargaining power, but the direction of the effect is ambiguous. Kim (2012) constructs a theoretical model where the product market is imperfectly competitive and unions and firms jointly determine wages and employment. The labor share is then derived as:

$$LS_t = \frac{\eta_L}{\mu} k + \gamma\left(1 - \frac{1}{\mu}\right) \qquad (6)$$

where μ is the markup, η_L the elasticity of output with respect to labor, k the capital-labor ratio measured in efficiency units, and γ the bargaining power of unions. From equation (6), it is easily seen that an increase in the markup (μ) lowers the labor share as long as η_L is larger than the bargaining power (γ), and an increase in the bargaining power (γ) raises the labor share because μ>1.

As discussed briefly in the introduction, our purpose is to empirically explain the differences in changes of the labor share at the *regional level* rather than at the national level. Therefore, we construct measures for markup and workers' bargaining power for each of 16 metropolitan cities and provinces in Korea. We also consider other factors that can influence labor shares in regions such as

[6] On the other hand, Karabarbounis and Neiman (2014) estimated the capital-labor elasticity of substitution to be greater than unity so that a decrease in the relative prices of capital goods actually leads to a decline in the labor share.

[7] However, their empirical results do not strongly support the theoretical prediction. They used the number of labor-management conflicts as a proxy for the union power, but the effects of the variable on the labor share are negative and sometimes statistically insignificant.

the share of temporary workers, the share of university-educated workers, and the average age of firms. We do not, however, consider such factors as trade liberalization, tax system, and minimum wage law because they are largely common to all regions in Korea.

3.2. Fixed Effects Models

Based on the discussion from theoretical models above, our basic specification of the empirical model is as follows:

$$\log LS_{it} = \alpha + \beta_1 \log Y_{it} + \beta_2 HHM_{it} + \beta_3 HHS_{it} + \sum_{k=1}^{K} \emptyset_k X_{k,it} + \mu_i + \tau_t + \epsilon_{it} \qquad (7)$$

where $\log LS_{it}$ is the log of adjusted labor share(LS_{t-1}), $\log Y_{it}$ the log of real GDP per capita, HHM_{it} and HHS_{it} Herfindahl-Hirschman index for manufacturing and services as a measure of market concentration, X_{kit} a vector of other 'candidate' explanatory variables, and μ_i and τ_t regional and time fixed effects.

The coefficient on the log of real GDP per capita (β_1) is supposed to measure the impact of the economic growth on the labor share. If economic growth is skill biased or capital intensive, then we expect β_1 to be negative. Herfindahl-Hirschman indices measure the degree of market concentration and hence the size of markup in industries. Therefore, it is expected that β_2 and β_3 are negative in sign. In estimation, we will also use the share of employment utilized in the four largest firms in the industry instead of HHM_{it} and HHS_{it} to test "the superstar firm hypothesis" by Autor et al (2017).

A vector of other 'candidate' explanatory variables ($X_{k,it}$) include the average tenure of firms, the proportion of the college educated in the work force, the proportion of temporary workers, and the trade openness which is measured as the ratio of the sum of exports and imports to GDP at the regional level. As the average tenure of firms increases, the market is dominated by mature firms that are likely to have a greater market power. Therefore, we can anticipate its impact on the labor share to be negative. College educated workers are generally equipped with greater human capital and hence are expected to receive higher wages. Therefore, the proportion of college educated workers is likely to have a positive effect on the labor share. On the other hand, temporary workers have weaker attachment to the labor market and accumulate less human capital. We expect the proportion of temporary workers to have a negative effect on the labor share. Finally, trade openness may capture the severity of import competition or market expansion in the international market. The former may lead to a decline in the labor share due to plant closure or offshoring, and the latter may lead to an increase in the labor share if more trade creates more jobs for workers. Therefore, the impact of trade openness on the labor share is not certain *a priori*.

Information on union density at the regional level is only available for 2000-2010, so we can only test the effect of workers' bargaining power on the labor share for the sub-sample. We also include dummy variables for industries in $X_{k,it}$ to ensure that the effects of those factors come from differences across regions, not coming from differences across industries. Finally, we estimate equation (7) by fixed effects models to control for unobserved heterogeneities in regions and in all regressions we include time dummies to account for the common aggregate shocks for all regions.

3.3.The panel VAR

In recent years, the vector autoregressive (VAR) model, a well-understood empirical tool in macroeconomic time series, has been extended to incorporate panel data settings. The advantage of the panel VAR is that it allows summarizing dynamics of data while allowing for cross-sectional heterogeneities. Moreover, it is the impulse response and variance decomposition analysis that comes with a VAR setting and applying this to a panel data framework has the potential to enrich an empirical analysis in many applications.

Following Canova and Ciccarelli (2013), consider the following panel VAR model. Let y_{it} be a vector of *G* variables for each cross-sectional unit *i* = 1, …., *N* for each time unit *t* = 1, …., *T*, and X_t is a set of *M* exogenous variables. For simplicity of exposition, assume that there are *G*=4 variables, *N*=4 cross-sectional units[8], and 2 weakly exogenous variables forming the vector of exogenous variables $X_t = [X_{1t}, X_{2t}]'$. Since the exogenous variables can be incorporated, the representation is the panel VARX model.

$$\begin{aligned}
y_{1t} &= A_{11}(L)y_{1t-1} + A_{12}(L)y_{2t-1} + A_{13}(L)y_{3t-1} + A_{14}(L)y_{4t-1} + F_1(L)X_t + u_{1t} \\
y_{2t} &= A_{21}(L)y_{1t-1} + A_{22}(L)y_{2t-1} + A_{23}(L)y_{3t-1} + A_{24}(L)y_{4t-1} + F_2(L)X_t + u_{2t} \\
y_{3t} &= A_{31}(L)y_{1t-1} + A_{32}(L)y_{2t-1} + A_{33}(L)y_{3t-1} + A_{34}(L)y_{4t-1} + F_3(L)X_t + u_{3t} \\
y_{4t} &= A_{41}(L)y_{1t-1} + A_{42}(L)y_{2t-1} + A_{43}(L)y_{3t-1} + A_{44}(L)y_{4t-1} + F_4(L)X_t + u_{4t}
\end{aligned} \tag{8}$$

where $u_t = [u_{1t}, u_{2t}, ..., u_{Nt}]' \sim iid(0, \Sigma), A_{ih}(L)$ is the lag polynomials in matrices for *j* lags. Note

[8] Our number of cross-sectional units is much larger, *N*=16, rather than *N*=4.

that $E(u_t u_t') \equiv \Sigma_u = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} & \sigma_{14} \\ \sigma_{21} & \sigma_{22} & \sigma_{23} & \sigma_{24} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} & \sigma_{34} \\ \sigma_{41} & \sigma_{42} & \sigma_{43} & \sigma_{44} \end{bmatrix}$ is a full matrix where σ_{ij} are 6×6 matrices for *i*, *j* = 1, .. 4, since the *G* (2 in the above model) variables are the same for each unit. The model allows dynamic interdependencies, static interdependencies and cross-sectional heterogeneities.

In our application, dynamic cross-sectional differences are likely to be important because you use a panel dataset consisting of heterogeneous regions in terms of demography, industry structure and regional policies. We aim to use the panel VAR framework to add a different but complementary dimension to the empirical framework adopted in the previous section. In particular, we follow the production function based approach explored by Bentolila and Saint-Paul (2003) and employed by Hutchinson and Persyn (2012).

Consider a production function, $Q = F(K, BL) = Kf(l)$, where *K* is capital, *L* is labor and *B* is the labor augmenting technology. Note that *f*(*l*) is the output-capital ratio, where $l \equiv BL / K$. It can then be shown that the labor share in competitive factor markets is a function of the capital-output ratio.

$$LS(k) = g(k) f'(g(k))k$$

where $k = 1/f(l)$, $l = g(k) = f^{-1}(k)$. After including total factor productivity variable *Z*, this implies that the labor share *LS* can be written as,

$$\log LS_{it} = \beta_0 + \beta_1 \log(K_{it} / Y_{it}) + \beta_2 \log Z_t + \varepsilon_{it}$$

This specification is similar to that of Hutchinson and Persyn, with the exception that we also incorporate total factor productivity. However, unlike their empirical strategy only allowing the labor share to be endogenous, we allow all the variables to be endogenous, and hence the panel VAR provides a natural framework. After including per capita income in each region, our panel VAR model comprises the following endogenous variables: $y_{it} = [LS_{it}, K_{it} / Y_{it}, Y_{it} / POP_{it}, Z_t]'$ plus a set of two weakly and contemporaneously exogenous variables $X_t = [X_{1t}, X_{2t}]'$ to be selected from a set of economy-wide and region specific institutional variables ranging across trade liberalization, economic growth, union density and educational attainment etc. We allow for cross-sectional heterogeneity in our panel VAR model, and report the impulse response function and variance

decomposition of the labor share. We check for the sensitivity of the estimation results to different choice of lags and the vector of exogenous variables.

Estimating a panel VAR model requires a different strategy from a time series VAR or standard panel data model. We follow the estimation strategy of Arellano and Bover (1995), which is to transform variables using forward orthogonal deviation, allowing past realization as valid instruments. We estimate the entire model by a system GMM approach.[9]

4. Data and Descriptive Statistics

4.1. Data Description

Our data for the labor shares are sourced from regional income accounts provided by the Korean Statistical Information Service (KOSIS). Even though some public data on national income accounts are available from 1975, public data on regional income accounts are available only from 2000. For this reason, our analysis is limited to the period 2000-2014. There are 7 metropolitan areas and 9 provinces in Korea, so our full sample consists of 240 region-year observations. From the KOSIS, we also obtain information on real GDP per capita and capital stocks by region.

We use the microdata of the Census of Establishments, which contains information on all firms in Korea, to construct the Herfindahl-Hirschman (HH) index, the market share of top four firms, the average ages of firms, and shares of manufacturing and service sectors. The Herfindahl-Hirschman (HH) index and the market share of top four firms are likely to be positively related to the markups and these measures are calculated at region-industry level. The average ages of firms can also measure market power of firms and they are calculated using the information on founding years of firms provided by the Census of Establishments. The shares of manufacturing and service sectors are obtained by using the number of workers employed in each sector at regional level.

For shares of temporary workers and university-educated workers at regional level, we utilize the Economically Active Population Survey (EAPS). Temporary workers are defined as those whose length of contract is less than one year. University educated workers are those who have at least two-year college degrees.

We considered two measures (the number of strikes and union density) for workers' bargaining power. Data on the number of strikes by region are available for 2006-2014 while data on union density are available for 2000-2010. Therefore, in order to test the effects of workers' bargaining power on the labor shares in regional incomes, we limit our sample to those sub-periods. Data on the number of strikes and union density are obtained from the surveys on union activities at regional level conducted by the ministry of labor in Korea.

[9] We estimated our panel VAR using the Stata procedures originally written and implemented by Love and Zicchino (2006).

For the panel VAR section, the key variable of interest is the capital-output ratio as outlined in the preceding Section 3. In general, capital stock series is not available except for the annual series at the aggregate level. Even the annual or quarterly aggregate capital stock series are all computed based on a set of assumption of depreciation rates, capital accumulation dynamics and interpolation. Our strategy for computing capital stock series at the regional level is as follows. First, we obtained the data on consumption of fixed capital and the investment series at the regional level. While this allows us to estimate the net change in capital stock, we need the initial capital stock in order to use the equation governing capital accumulation. The initial capital stock could then be calculated using the aggregate capital stock at the beginning of our sample by assuming that the investment to capital at the regional level is consistent with that the aggregate level. We also estimate the total factor productivity at the regional level using the Malmquist method, and use the estimated regional TFP series for both dynamic panel and panel VAR estimation.

4.2. Descriptive Statistics

Table 3 presents sample means of the variables that are used in the empirical models for selected years. The average adjusted labor share increased from 60.6% in 2000 to 62.5% in 2005 and then gradually decreased to 59.3% in 2014. The average regional real GDP per capita has increased over time while the growth rate has been decelerating in recent years. The HH indices indicate that the market concentration in the manufacturing industry has decreased while that in the service sector increased and these patterns are consistent with those reflected in the shares of top four firms in markets. The average tenure of firms has increased from 6.1 years in 2000 to 7.5 years in 2014. We calculated the proportions of firms by tenure and found that the proportion of firm whose age is less than 3 years decreased from 0.439 to 0.341 in 2014 while the proportion of firm whose age is greater than 20 years increased from 0.064 to 0.118 in 2014. Therefore, regional markets in Korea have been increasingly dominated by mature firms that are likely to have a greater market power.

Table 3 Means of Variables for Selected Years

As expected, the share of manufacturing sector has been decreasing while that of service sector has been increasing. The share of university-educated workers has been steadily increasing and this is well anticipated given that the university attainment rate in Korea has also been increasing. The proportion of temporary workers whose contract is less than one year has increased until 2010 and then slightly decreased afterwards. Strike rates, measured by the number of strikes divided by

employment, have decreased since 2005 and the union density decreased since 2005. It is interesting that strike rates reached a peak when the union density is high.

Table 4 presents correlations between variables in the model and the labor share by region. The correlation between the log of real GDP per capita and the labor share is negative in most regions although there are some regions with positive but insignificant correlations. The changes in the log of GDP per capita measures the growth rate and so the negative correlation may imply that regional economic growth is accompanied with capital-augmenting technology, reducing the labor share in regional income. The HH indices and market shares of top four firms in manufacturing and service sectors are generally negatively correlated with the labor shares in regions, even though the correlations with market shares of top four firms in manufacturing are found to be positive for some provinces such as Gangwon, Chungbuk, Jeonbuk and Jeonnam. These provinces are, however, regions where agriculture is dominant, so the top four firms in the manufacturing industry are not likely to be capital intensive firms. For provinces like Incheon and Gyeonggi whose major industries are manufacturing, the correlations with the market shares of top four firms are significantly negative. The average tenure of firms is also negatively correlated with the labor share, indicating a decrease in the labor share as firms get mature in the market.

Table 4 Correlations between Variables and the Labor Share by Region

As the manufacturing and service sectors increase relative to the agricultural sector, the labor shares in regional income are likely to decline. However, for Ulsan, which is often called "Hyundai City", the share of the manufacturing sector is strongly positively correlated with the labor share. This seems to be surprising because Hyundai companies are relatively capital-intensive compared to other manufacturing firms. The reasons for this phenomenon may be related to union strikes or union density. Given that union activities are positively correlated with the labor share as we look at the last two columns in Table 4, and given that Ulsan has a high level of strike activities and union density,[10] the positive correlation between the share of the manufacturing sector and the labor share may be derived from the union's strong bargaining power in Ulsan.[11]

The correlations between the share of university-educated workers and the labor share are generally negative. As the share of workers with university degrees increases, the average income of workers tends to increase. However, it is less clear whether it will lead to an increase in the share of labor in total income. If an increase in the share of university-educated workers stems from skill-biased technical changes, which are complementary to capital goods, then an increase in the share of

[10] See Appendix Figure 2 for the strike rates and union densities for 16 provinces and metropolitan cities.
[11] It is well know that the unionisation in Korea's automotive industry is high and militant.

university-educated workers may lead to a decrease in the amount of labor used even if the average income of workers rises. In such a case, we may observe a negative correlation between the share of workers with university degrees and the labor share.

In most regions, the correlations between the share of temporary workers and the labor share are negative, which is consistent with our *a priori* expectations. As the share of temporary workers increases, the average income decreases. Furthermore, an increase in the share of temporary workers may indicate that production technology is less skill-biased and hence the average quality of workers is lower. Finally, as discussed earlier, strike rates and union density are positively correlated with the labor share in most regions. It shows that changes in the labor share in some regions can be significantly affected by the changes in union's bargaining power in the regions.

5. Empirical Results

5.1.Estimation Results of Fixed Effects Models

Table 5 shows the estimation results of Equation (7), which are obtained from fixed effects models. All specifications include region and time fixed effects to account for unobservable characteristics of regions and the common time shocks across regions. The log of real GDP per capita and capital-labor ratio (K/L) are supposed to measure the effects of economic growth and technology advancement on labor share. If the coefficients on these variables are negative, it suggests that economic growth and capital intensity move in the direction of the substitution of capital for labor, so that the labor share declines. The HHM and HHS measure the market concentration in manufacturing and service industries, respectively, and they are replaced by the market shares of top four firms in those industries in the third column of the table. Finally, the last column includes union density as an additional variable. Due to limited data on union density at the regional level, we use only data from 2000-2010 (176 observations) for this variable.

Table 5 Estimates of the Fixed Effects Models

The estimated coefficient for GDP per capita is negative and statistically significant at the 5% level in the columns (1), (3) and (4), implying that economic growth is accompanied with capital-augmenting technology, reducing the labor share in regional income. Also, the coefficient on the K/L ratio is negative, although it is not statistically significant.

The effects of the market concentration (HHM and HHS) on labor share show quite significant results for the service industry, but not for the manufacturing industry. The negative coefficient on

HHS indicates that as the service industry becomes more concentrated and hence the size of markup increases, the labor share declines in that region. As the proportion of the service sector increases, it is expected that the decrease in labor share is likely to be reinforced in the future given the imperfect competition of the service sector. In column (3) we use the market shares of top 4 firms in manufacturing and service industries instead of HHM and HHS. However, their estimates are not statistically significant although the coefficient on top 4 firms in the service industry is negative. Therefore, "the superstar firm hypothesis" suggested by Autor et al (2017) is not supported to explain regional labor share movements in Korea.

The estimates on the average tenure of firms are negative and significant, implying that the age of firms is associated with the decline of labor share. This has not been documented in previous studies. As the tenure of a firm increases, it is more likely that the firm gains a greater marker power. This implies that increasing labor share in regional income needs more entry of firms in the market.

The proportion of university educated workers has a positive impact on labor share whereas the proportion of temporary workers has a negative effect on labor share, which are all as expected. However, trade openness is not statistically significant in all specifications. Finally, an increase in union density has a strong positive effect on labor share, which shows the importance of workers' bargaining power in determining labor share.

5.2.Estimation Results of Panel VAR

In a panel VAR model, we generalize the fixed effects model presented in the previous section by allowing all variables including labor share to be endogenous while allowing dynamics. Thus, we also estimate a panel VAR model, as described by the equation (8), for the whole region, cities and provinces. This is to examine if the metropolitan or city areas show any qualitatively different responses from the provincial areas in understanding the labor share dynamics. In determining the lag order of the model, we adopt three lags, based on the Akaike information criterion, for the whole sample and two lags for the sub-samples. We included GDP per capita and the openness index as exogenous control variables, but they were not significant and dropped to conserve the degrees of freedom. Given that we already included per capita output (income) among the endogenous variables, this is unlikely to pose any omitted variable issue. Since the main purpose of using the panel VAR is to summarize the dynamic interactions allowing for cross-sectional heterogeneities, we report the impulse response functions and interpret our results. To identify exogenous shocks, we use a recursive scheme based on the following Cholesky ordering: TFP, K/Y ratio, income and labor share. This implies that income and labor shares cannot contemporaneously affect TFP and K/Y ratio while K/Y ratio cannot contemporaneously affect TFP. Economic theory is ambiguous about the causal ordering

between income and labor share but our estimates show that the ordering between income and labor share matters little for estimates.

Figure 4.1 shows the impulse responses to own labor share shocks across the whole regions, cities (metropolitan areas) and provinces. Notably, provincial areas show larger and more persistent labor shares than city areas.[12] Even after six years, the labor share remains significant at above 25 percent of the impact response. This indicates that labor share of income takes much longer to adjust in provincial than metropolitan areas.

Figure 4.2 presents a simple way of verifying the theoretical prediction that a higher capital-output ratio lowers the labor share. For all regions, the response is negative although it is not significant for cities. For provincial areas, the response is speedy and statistically significant in the short run compared to the whole region and cities. This is not surprising given almost all of the large and capital-intensive industries are located in provincial areas in Korea. The labor share in the city areas shows a negative response to a positive capital-output ratio (K/Y) shock but appears less significant compared to the provincial areas. This indicates that applying the theoretical approach suggested by Bentolila and Saint-Paul (2003) is sensitive to the choice of regions. In terms of the speed of response to the capital-output ratio shocks, cities and provincial areas also show heterogeneous responses. Firms in the provincial areas show a more speedy response to the shock, implying that they are more likely to replace labor with capital. On the other hand, city areas show a slower response in substituting capital for labor. The response for the whole sample shows that the impact on labor share is mostly pronounced within three to four years.

Figure 4.3 reports the response of labor share to regional TFP shocks. Unlike the previous impulse responses, the labor share shows the most varying responses to the TFP shocks. While the whole region shows that the labor share declines in response to a positive TFP shock, city and provincial areas show responses of opposite signs. The provincial areas show a negative response to TFP shocks unlike the city areas which show a positive response. This implies that TFP tends to be complementary with respect to labor in cities while it leads to a downward movement in labor share in provincial areas. This is consistent with the results shown in Figure 4.2, as the provincial areas are more responsive to the labor-capital mix in production. This difference in the response of labor share between cities and provinces cannot be uncovered in an aggregate labor share analysis.

Figure 4.4 displays the response of labor share to per-capita income shocks. All figures across different classification of regions show a negative response of labor share to an income shock, indicating that a positive income shock leads to a significant decrease in the labor share. This may reflect the trend that, as a regional economy improves its living standards, the labor share tends to

[12] Note that the terms city and metropolitan areas are used interchangeably.

decrease due to various reasons. A technological progress or a positive wealth shock may be a driving force, which, in turn, lowers the labor share, either due to a capital-labor substitution or an income effect that may reduce hours worked.

We extend the panel VAR model further by incorporating the degree of market concentration in the presence of the capital-output ratio. The variables added in our analysis are the Herfindahl-Hirschman (HH) indices of the manufacturing and services sector. As discussed in Section 3, it can be hypothesized that an increase in mark-up as measured by the HH index leads to a decrease in labor share. In fact, in our preceding panel models we showed results consistent with this hypothesis. So, our vector of endogenous variables is now;

$$y_{it} = [LS_{it}, K_{it} / Y_{it}, Z_t, HHM_{it}, HHS_{it}]'$$

, where *HHM* and *HHS* are the HH index for manufacturing and services sectors, respectively. To keep the model dimension manageable and preserve degrees of freedom, we deleted the income variable from the endogenous vector. Shocks are now identified by a different Cholesky ordering, which is to put *HHM* and *HHS* ahead of other variables. This assumption is justifiable because the degree of market power is not contemporaneously affected by other variables including productivity and capital-output ratio. The assumption however allows that other variables are contemporaneously affected by the degree of market concentration. One may argue whether the TFP variable should be the most exogenous of all but it is well established in the empirical macroeconomic literature that the measured TFP is unlikely to be exogenous due to measurement issues.

Figure 5.1 shows the response of labor share to *HHM* and *HHS* shocks as well as K/Y and TFP shocks. The inclusion of *HH* indexes in our model does not alter or diminish the effects of K/Y and TFP shocks on the labor share. Consistent with the preceding Figures 4.1 and 4.2, the labor share shows a significant and persistent negative response to these shocks. The upper panel of Figure 5.1 illustrates that the labor share shows a significantly negative response to market concentration shocks. The negative responses are consistent with our results from the previous section. An increase in market concentration in both manufacturing and services sectors leads to a decline in labor share. Furthermore, the panel VAR analysis shows that the response of labor share to these shocks is very persistent and even larger in size than the responses to K/Y and TFP shocks. In particular, a 1% increase in the shock to the manufacturing concentration (*HHM*) leads to roughly the same percentage decrease in labor share, making labor share fall quite persistently over five years.

Figure 5.2 shows the labor share response to the same shocks in cities versus provincial areas. Panels (a) and (b) show the response in city areas while (c) and (d) report the response in provincial areas. The responses now reveal some notable differences. The negative response of labor share to *HHM* and *HHS* is strong in city areas while the response is rather positive, although statistically insignificant, in provincial areas. It is clear then that the negative response of labor share for the whole

regions reported in Figure 5.1 is dominated by the responses in city areas. This may indicate that the degree of market concentration may already be quite large in provincial areas compared to city areas. It is common that one or two firms providing the bulk of employment in provincial areas while firms are likely to face more stiff competition city areas, making an increase in market power in city areas leads to a more significantly negative effect on labor share.

We could obtain data on the value of trade as a share of regional output which replaces the exogenous economy wide openness variable. Furthermore, we could calculate the capital-labor ratio in terms of their imputed value. Given the value of capital stock was already available in value terms, we obtained the value of labor by multiplying the average compensation of employees by the number of workers employed in a region. So, the capital-labor ratio calculated can be used to examine how the relative substitution of capital for labor changes over time and across regions. We consider now a vector of endogenous variables as follows.

$$\tilde{y}_{it} = [LS_{it}, K_{it} / Y_{it}, K_{it} / L_{it}, TFP_{it}, TradeDep_{it}]'$$

This analysis can reveal extra information about how labor share is impacted by the relative cost of capital to labor as well as the exposure to international trade, possibly dependence on international trades.

Figure 6 shows the impulse response functions of the labor share to trade dependence, capital-output ratio, capital-labor ratio, and total factor productivity. The results are robust to whether we group the sample by city or province. So, the figure only reports the impulse responses of labor share across the entire cities and provinces. The following results are notable. First, a positive shock to trade dependence has a negative impact on labor share. This response is also quite persistent. A higher dependence or exposure to international competition leads to a decline in labor share. That is, firms directly competing internationally in a region are sensitive to international trade and are more likely to respond by adjusting their labor share to remain competitive. This could also imply that labor intensive firms facing strong international competition are less likely to survive or might choose to move offshore for survival. This corroborates the recent observation that an increasing number of Korean firms with high dependence on labor and exports has either shut down or moved their operation offshore where labor is relatively cheaper. The response of labor share to a TFP shock is initially positive but has a persistent and negative impact on the labor share. This appears to suggest some dynamic adjustment to an exogenous increase in TFP. A shock to capital intensity as captured by the capital-output ratio had a positive impact on labor share, as shown in the bottom right panel. This would imply that a higher capital requirement is associated with a short-run increase in labor share of income, showing complementarity between capital and labor. The response of labor share to

a shock in capital-labor ratio is negative and appears persistent over five years. This may indicate the highly endogenous nature of labor share to the capital labor substitution by firms.

Our panel VAR analysis considered the dynamic responses of labor share to a set of variables that have been shown to drive labor share in economic theory. Our results confirm that the capital-output ratio and the market concentration are indeed the main drivers of labor share. The results also show some heterogeneities in the response of labor share across regions.

6. Conclusion

One of the most pressing issues in modern decades is probably the polarization of income distribution. There are at least two dimensions to it. First, the division of income between capital owners and workers has been observed to be unequal and widening in many countries over several decades. Second, income inequality among workers (skilled vs unskilled) has also increased in many developed countries.

This paper addresses the first aspect of income inequality, i.e., functional distribution, but not at the national level, but at the regional level. Previous studies focused on explaining the aggregate income division between capital owners and workers, ignoring the underlining structural changes at the disaggregate level. Korea shows that the aggregate labor share can be stable, even though it is not stable at the regional level. Hence, it is imperative to analyze changes in labor share at the regional level first, in order to gain an insight into understanding the movements of the labor share at the national level. We explored a panel dataset spanning 16 regions over 15 years and employed an array of cross-regional fixed effects model and panel VAR models to examine the driving forces of labor shares across the regions.

Estimates from our fixed effects models show that differences in economic growth, concentration of service industry, the share of university-educated workers, the share of temporary workers, the average age of firms and union density are all important factors determining labor shares in regional income. Our panel VAR results show that shocks to capital-output ratio, total factor productivity and the concentration of both manufacturing and services industries all lead to a decline labor shares over time. We also show that the concentration of manufacturing and service industries are more important in metropolitan cities than in provincial areas. This indicates that heterogeneities in product and labor markets should be taken into account in properly understanding the changes in labor shares in regional income. Furthermore, we examined how labor income responds to two types of shocks across all regions; the external shock capturing exports and globalization and factor shocks that reflect input substitutions and capital intensity. We find that trade dependence has a strong negative impact on labor income, which is consistent with the recent observation in Korea. A higher capital labor substitution has an immediate and strongly negative impact on labor income share. On the other hand,

a shock to capital intensity to input substitutions and capital intensity as captured by an increase in capital output ratio has a positive impact on labor income share, possibly by raising the quality of labor. Overall, our findings provide important insights for policymakers into understanding what drives labor income share across regions in Korea.

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Tables in Main Text

Table 1. Labor Shares in 16 Metropolitan Cities and Provinces in Korea

	2000	2005	2010	2014	2014-2000	Correlation
Seoul	53.5	54.7	51.6	54.4	0.9	0.56
Busan	75.5	80.8	73.1	69.9	-5.6	0.69
Daegu	76.5	83.8	76.7	73.0	-3.5	0.76
Incheon	69.1	70.1	65.7	66.0	-3.1	0.56
Gwangju	76.7	83.8	75.3	72.1	-4.6	0.71
Daejeon	72.3	82.2	75.0	70.8	-1.5	0.69
Ulsan	55.6	62.9	55.8	65.3	9.7	0.68
Gyeonggi	56.2	63.8	59.6	59.2	3.0	0.59
Gangwon	71.9	76.3	69.2	66.9	-5.0	0.78
Chungbuk	60.2	65.9	59.5	58.8	-1.4	0.82
Chungnam	49.6	50.6	48.0	49.3	-0.3	0.60
Jeonbuk	65.8	71.5	62.9	64.5	-1.3	0.81
Jeonnam	54.3	56.9	49.2	54.0	-0.3	0.67
Gyeongbuk	50.7	49.3	44.8	50.6	-0.1	0.36
Gyeongnam	58.4	62.9	59.8	60.9	2.5	0.68
Jeju	57.6	66.2	60.4	59.5	1.9	0.74
Korea	60.6	62.5	58.0	59.3	1.3	1.00

Note. All labor shares are adjusted for national and regional self-employment. Correlations are calculated between Korea and each city and province.

Table 2. Shift-Share Decomposition of Changes in Labor Share by Region

	2000-2006			2006-2015			2000-2015		
	shift	share	total	shift	share	total	shift	share	total
Seoul	1.267	-0.810	0.458	-0.984	-1.219	-2.204	0.206	-1.952	-1.746
Busan	-0.156	-0.168	-0.324	-0.024	-0.370	-0.394	-0.174	-0.544	-0.718
Daegu	-0.027	-0.188	-0.215	-0.097	-0.184	-0.281	-0.126	-0.370	-0.496
Incheon	-0.161	0.223	0.062	0.100	-0.024	0.077	-0.064	0.202	0.139
Gwangju	-0.095	0.066	-0.029	-0.073	-0.049	-0.122	-0.165	0.014	-0.151
Daejeon	0.117	-0.030	0.086	-0.084	-0.030	-0.114	0.031	-0.058	-0.028
Ulsan	0.088	0.028	0.116	0.010	-0.075	-0.064	0.097	-0.045	0.052
Gyeonggi	1.365	1.120	2.486	-1.201	1.523	0.321	0.291	2.516	2.807
Gangwon	-0.067	-0.094	-0.161	-0.182	-0.029	-0.210	-0.253	-0.118	-0.371
Chungbuk	0.082	-0.064	0.018	-0.251	0.143	-0.108	-0.170	0.080	-0.090
Chungnam	-0.088	0.228	0.140	-0.329	0.597	0.268	-0.415	0.824	0.409
Jeonbuk	-0.042	-0.200	-0.242	-0.172	0.002	-0.170	-0.223	-0.189	-0.412
Jeonnam	-0.071	-0.145	-0.216	-0.160	-0.120	-0.280	-0.234	-0.261	-0.496
Gyeongbuk	-0.033	-0.098	-0.130	-0.193	-0.274	-0.466	-0.227	-0.370	-0.597
Gyeongnam	0.119	0.048	0.167	-0.033	-0.160	-0.193	0.084	-0.109	-0.026
Jeju	0.014	0.005	0.019	-0.001	0.054	0.052	0.013	0.058	0.071
Korea	2.313	-0.078	2.235	-3.674	-0.213	-3.887	-1.330	-0.323	-1.652

Table 3. Means of Variables for Selected Years

	2000	2005	2010	2014	2000-2014
Labor share (adjusted) (%)	60.59	62.52	57.97	59.34	60.45
log(real per capita income)	2.957	3.150	3.298	3.356	3.190
HH index (manufacturing)	0.027	0.022	0.022	0.021	0.023
HH index (service)	0.0021	0.0021	0.0029	0.0026	0.0025
Top4share (manufacturing)	0.344	0.317	0.313	0.297	0.318
Top4share (service)	0.181	0.166	0.209	0.195	0.193
Average tenure (years)	6.100	6.937	8.233	8.703	7.504
Share of manufacturing (%)	18.575	17.031	16.381	16.969	17.025
Share of service (%)	66.506	71.219	73.663	74.325	71.630
Share of university-educated workers (%)	22.488	30.069	35.856	39.963	32.021
Share of temporary workers (%)	11.574	17.904	19.479	16.195	15.743
Strike rate (%)	n/a	0.012[a]	0.008	0.008	0.008[b]
Union density (%)	9.039	11.566	7.981	n/a	9.311[c]
Trade Openness (%)	51.17	58.26	75.01	72.69	64.97

Note. a: strike rate for 2006, b: the average for 2006-2014, c: the average for 2000-2010.

Table 4. Correlations between Variables and the Labor Share, by Region

	log(gdp per capita)	HH (manufacture)	HH (service)	top4share (manufacture)	top4share (service)	tenure
Seoul	0.197	0.163	0.097	0.063	0.211	0.316
Busan	-0.502	-0.160	-0.051	0.208	-0.602*	-0.572*
Daegu	-0.390	0.117	-0.371	-0.411	-0.638*	-0.405
Incheon	-0.420	-0.301	-0.495	-0.597*	-0.544*	-0.400
Gwangju	-0.599*	-0.190	-0.738*	0.322	-0.380	-0.480
Daejeon	-0.055	-0.210	0.009	0.290	0.063	0.001
Ulsan	-0.269	0.184	-0.402	-0.010	-0.411	-0.179
Gyeonggi	-0.056	-0.293	-0.248	-0.786*	0.246	-0.015
Gangwon	-0.676*	0.472	-0.290	0.639*	-0.590*	-0.745*
Chungbuk	-0.600*	0.288	-0.092	0.579*	-0.406	-0.631*
Chungnam	-0.649*	-0.856*	-0.694*	0.200	-0.736*	-0.817*
Jeonbuk	-0.572*	-0.308	-0.660*	0.551*	-0.849*	-0.594*
Jeonnam	-0.688*	-0.318	-0.655*	0.557*	-0.477	-0.741*
Gyeongbuk	-0.616*	0.340	-0.585*	0.319	-0.704*	-0.713*
Gyeongnam	0.074	-0.352	-0.490	0.069	-0.286	-0.072
Jeju	-0.350	-0.545*	-0.386	-0.480	-0.320	-0.466
average	-0.197	-0.041	-0.247	0.057	-0.196	-0.189

Note. * indicates a significance at the 95% level

Table 4 (Continued). Correlations between Variables and the Labor Share, by Region

	manufacture	service	university	temporary	strike rates	union density
Seoul	-0.218	0.217	0.294	0.116	0.626	-0.104
Busan	0.279	-0.362	-0.485	-0.140	0.302	0.661*
Daegu	-0.103	0.115	-0.473	0.027	0.587	0.055
Incheon	0.408	-0.415	-0.370	-0.346	-0.056	0.846*
Gwangju	-0.538*	0.106	-0.439	0.380	0.180	0.300
Daejeon	-0.163	0.138	0.209	0.366	0.136	0.666*
Ulsan	0.688*	-0.581*	-0.100	-0.341	0.561	0.810*
Gyeonggi	-0.226	0.193	-0.010	0.415	0.734*	0.386
Gangwon	0.320	-0.641*	-0.674*	-0.624*	0.293	0.927*
Chungbuk	-0.666*	0.070	-0.611*	-0.200	-0.033	0.510
Chungnam	-0.543*	-0.638*	-0.580*	-0.446	0.500	-0.449
Jeonbuk	0.179	-0.368	-0.512	-0.360	0.746*	0.700*
Jeonnam	-0.236	-0.442	-0.626*	-0.713*	0.298	0.528
Gyeongbuk	-0.008	-0.589*	-0.470	-0.776*	-0.414	0.278
Gyeongnam	-0.157	0.199	0.320	0.132	-0.168	0.592
Jeju	-0.057	-0.237	-0.397	-0.172	0.523	0.141
average	0.002	-0.066	-0.203	-0.044	0.238	0.224

Note. * indicates a significance at the 95% level

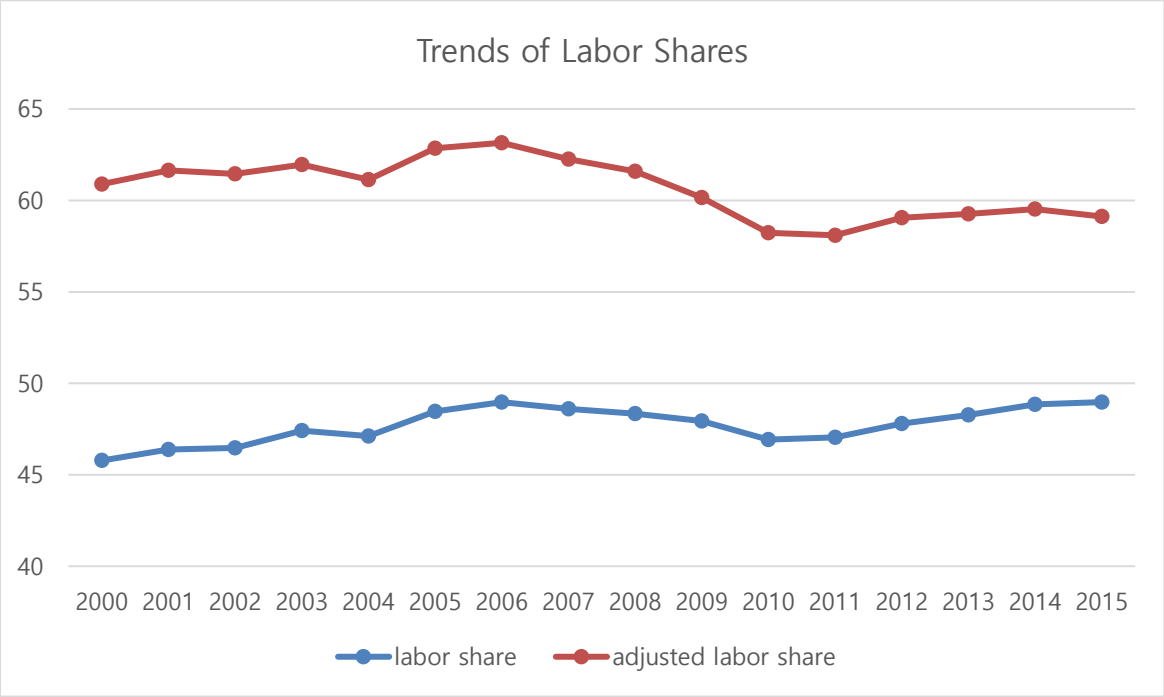
Table 5 Estimates of the Fixed Effects Models

Dependent Variable: Adjusted Labor share in Logarithm				
	(1)	(2)	(3)	(4)
Log GDP per capita	-0.511** (0.087)	-	-0.524** (0.086)	-0.467** (0.106)
K/L ratio	-	-3.7e-7 (3.9e-7)	-	
HHM(HH-manu)	-0.127 (0.733)	-0.344 (0.732)	-	0.793 (0.857)
HHS(HH_serv)	-4.477 (5.470)	-7.415* (3.644)	-	-10.128* (5.025)
top4manu	-	-	0.089 (0.085)	
top4serv	-	-	-0.018 (0.207)	
Tenure	-0.028** (0.012)	-0.032* (0.018)	-0.031** (0.012)	-0.008 (0.017)
University	0.006** (0.002)	0.005** (0.002)	0.006** (0.002)	0.002 (0.003)
Temporary	-0.301* (0.173)	-0.526* (0.272)	-0.296* (0.173)	-0.223 (0.259)
trade openness	0.0001 (0.0001)	0.0001 (0.0001)	0.0001 (0.0001)	0.001 (0.001)
union density	-	-	-	0.001** (0.0005)
Primary	-0.004 (0.003)	0.004 (0.004)	-0.004 (0.003)	-0.003 (0.003)
Utility	0.003 (0.004)	0.005* (0.003)	0.003 (0.004)	0.005 (0.004)
Construct	-0.001 (0.003)	-0.001 (0.004)	-0.002 (0.003)	-0.004 (0.003)
private service	0.002 (0.002)	0.007** (0.003)	0.002 (0.002)	0.002 (0.003)
public service	-0.001 (0.003)	0.008** (0.004)	-0.001 (0.002)	0.003 (0.005)
Constant	5.708** (0.332)	3.903** (0.195)	5.737** (0.330)	5.432 (0.435)
Year Dummy	Yes	Yes	Yes	Yes
sigma_u	0.136	0.142	0.131	0.108
sigma_e	0.026	0.028	0.026	0.024
Rho	0.966	0.963	0.963	0.954
Overall R-squared	0.614	0.400	0.648	0.636
No. of Obs	240	240	240	176

Note: Robust standard errors are in parentheses. * and ** indicate that the estimated coefficients are statistically significant at 10 and 5%, respectively.

Figures in Main Text

Figure 1. Trends of Labor Shares in National Income



Note. The shares are based on equations (1) and (2) in Section 2. The data on the compensation of employees, profits, the consumption of fixed capital, and the share of self-employed are mainly obtained from the KOSIS (Korean statistical information service).

Figure 2. Trends in Regional Labor Shares

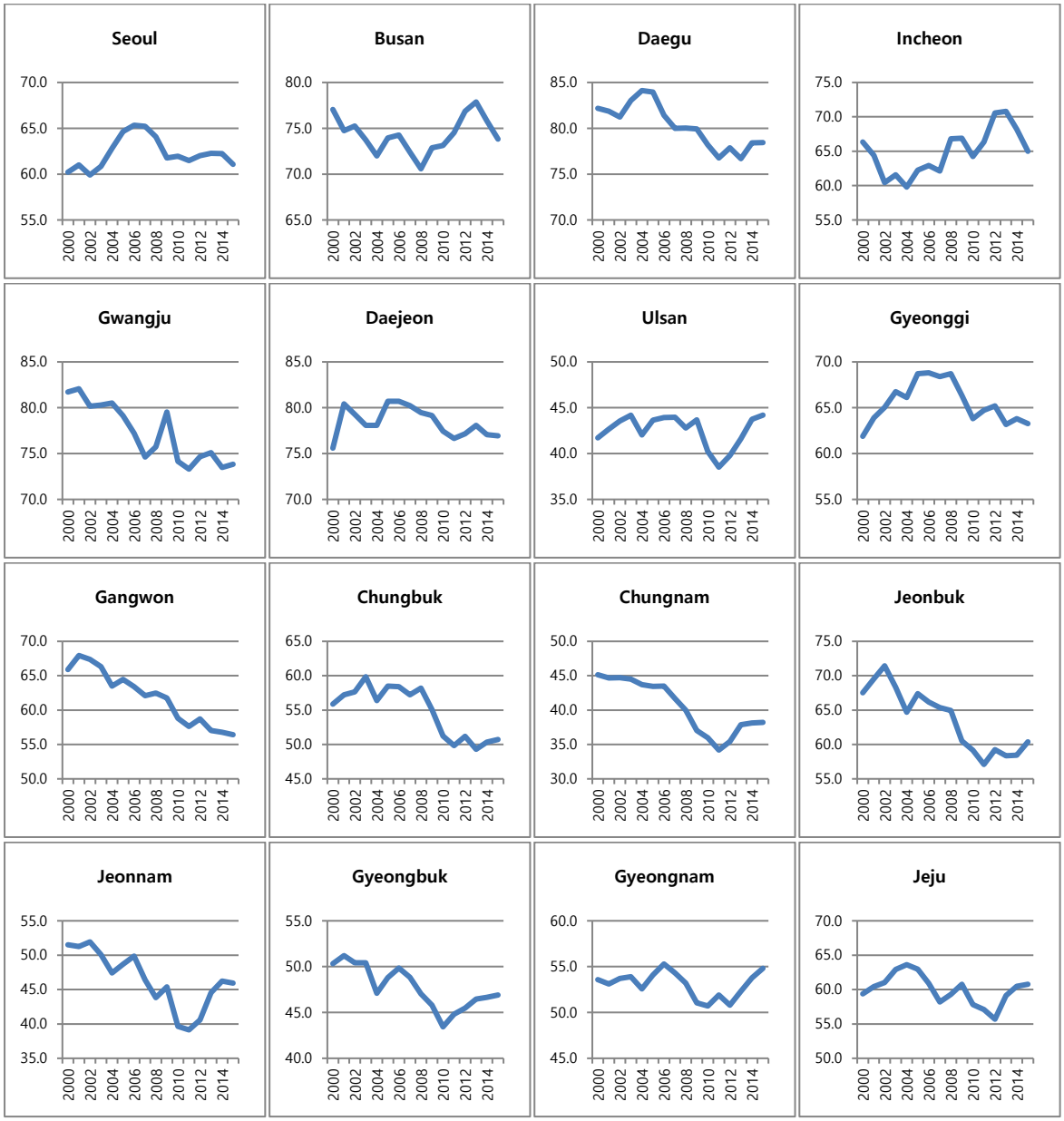
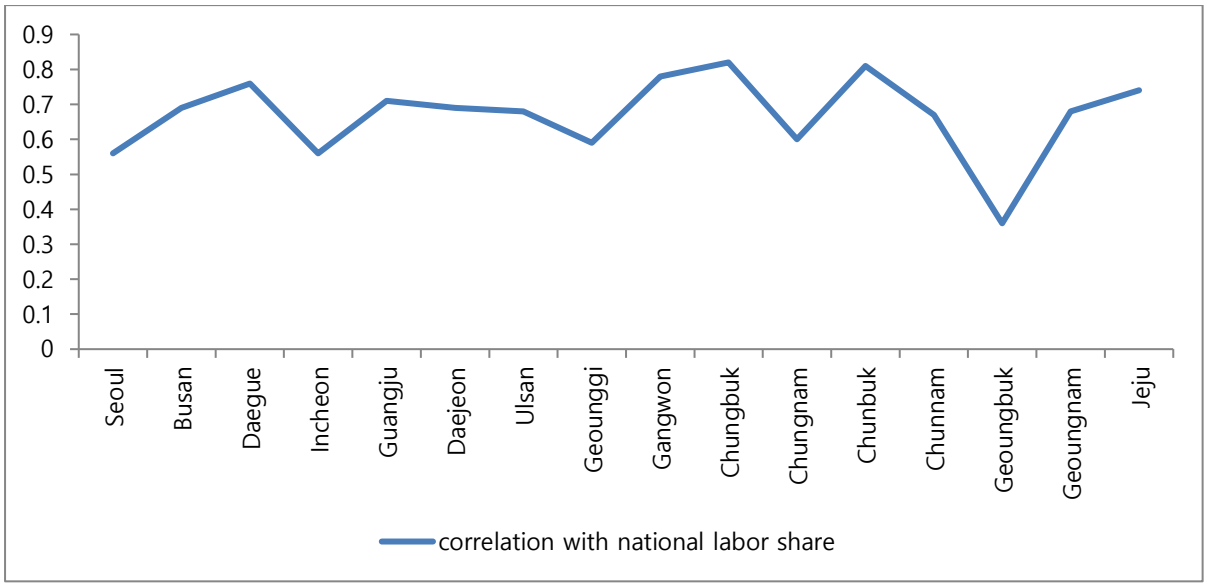
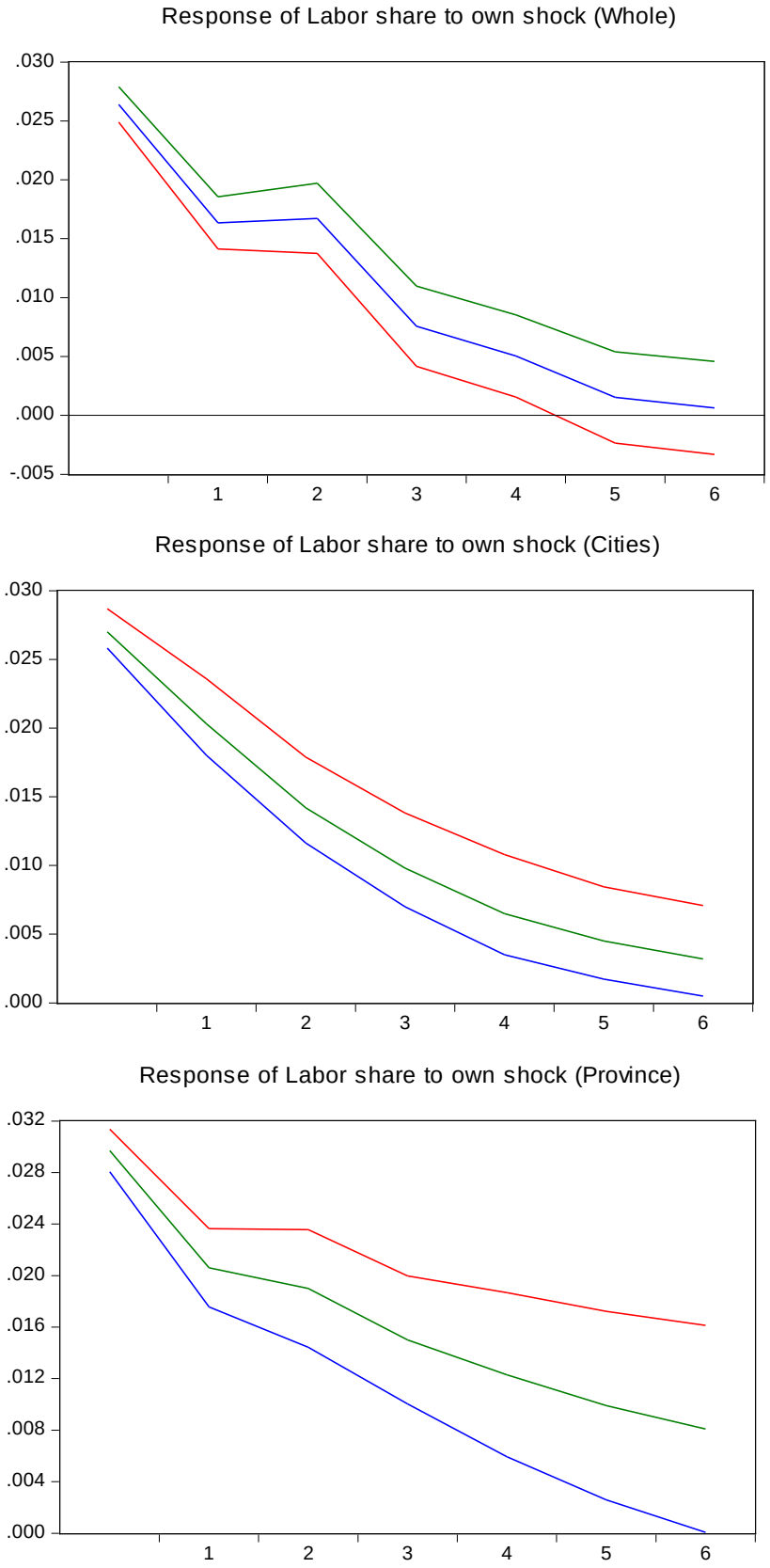


Figure 3. Correlations between Regional Labor Share and National Labor Share



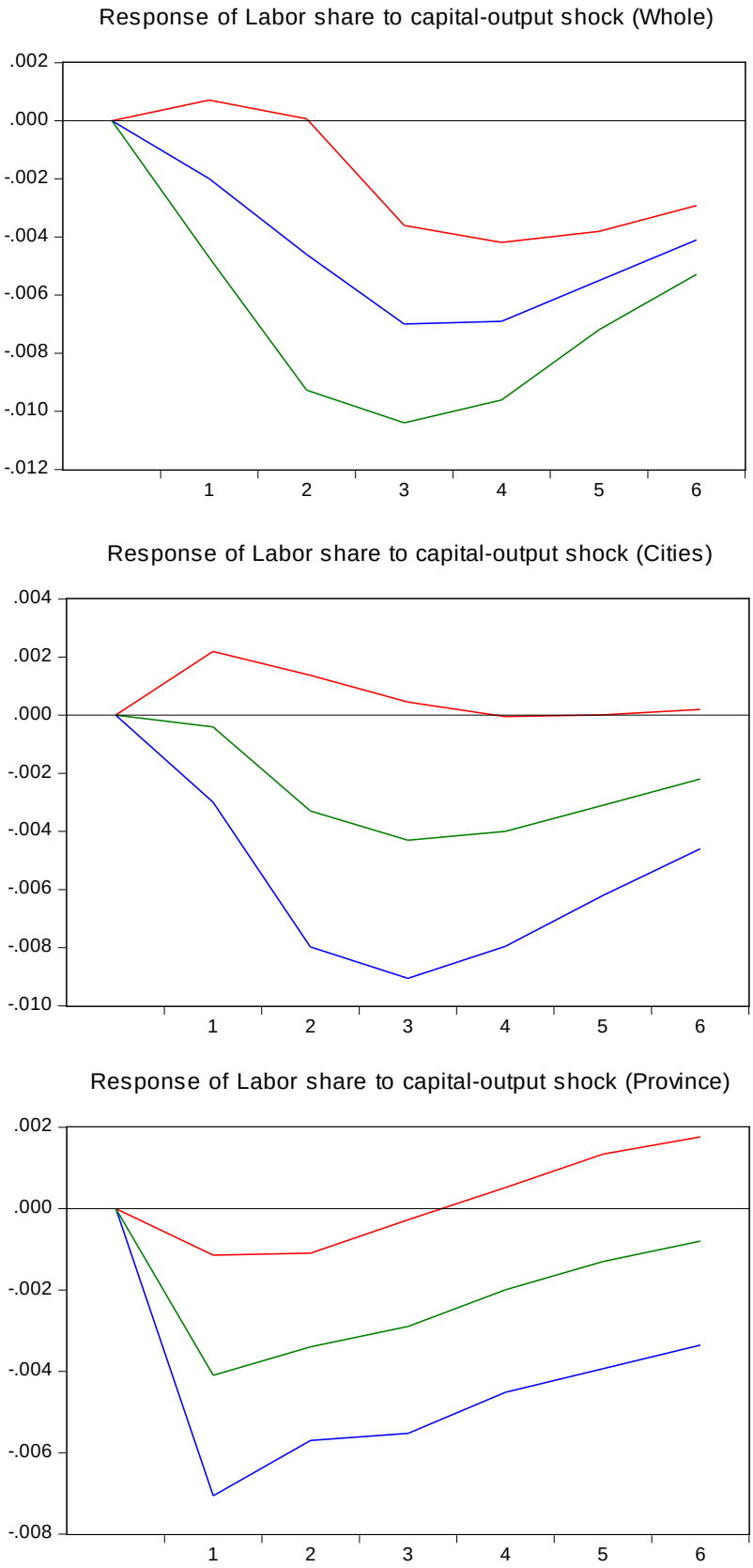
Note. All labor shares are adjusted for national and regional self-employments.

Figure 4.1. Impulse Responses to Own shocks



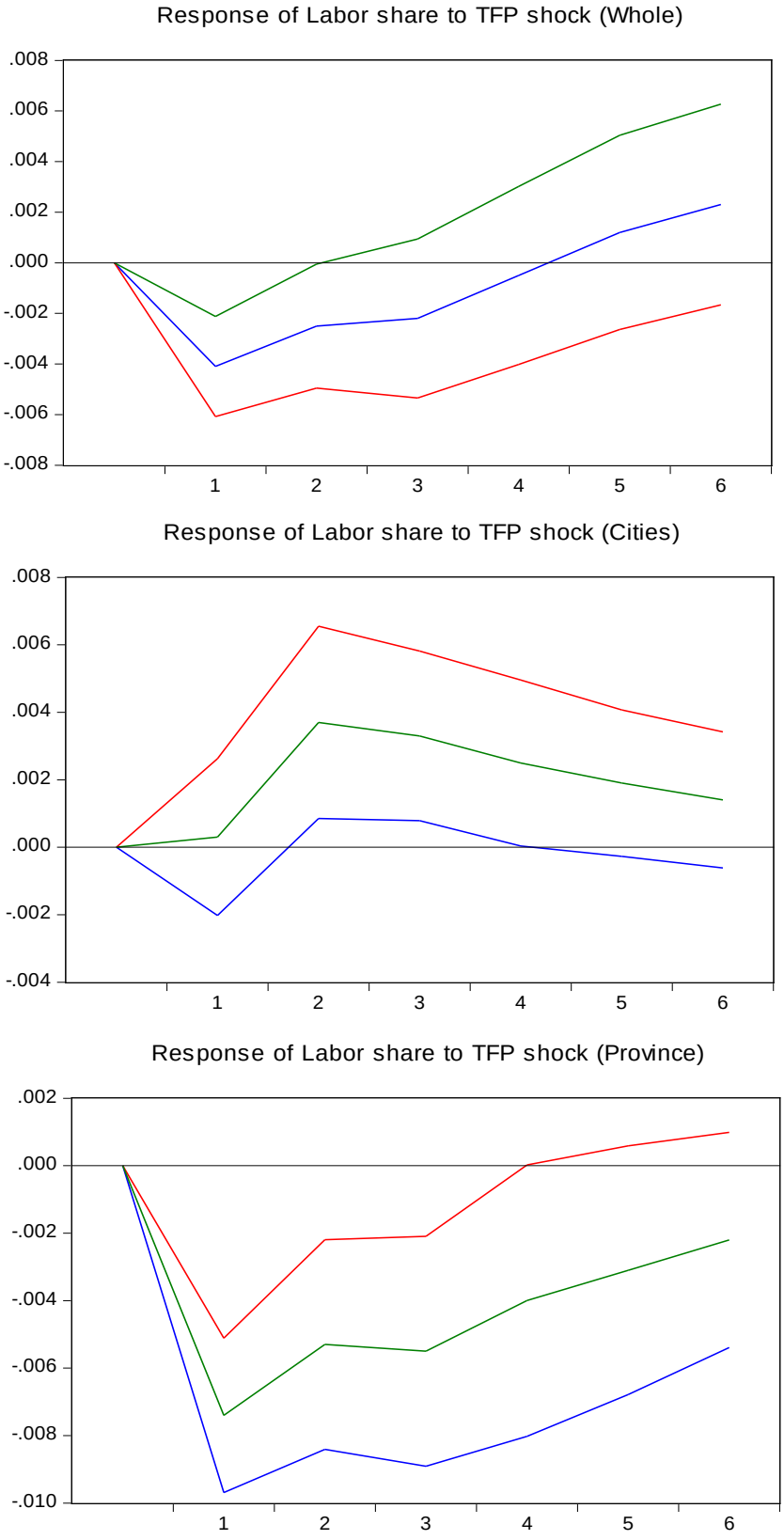
Note: The error bands are 16th and 84th percentiles based on 500 Monte Carlo simulations.

Figure 4.2. Impulse Responses to Capital-Output ratio shocks



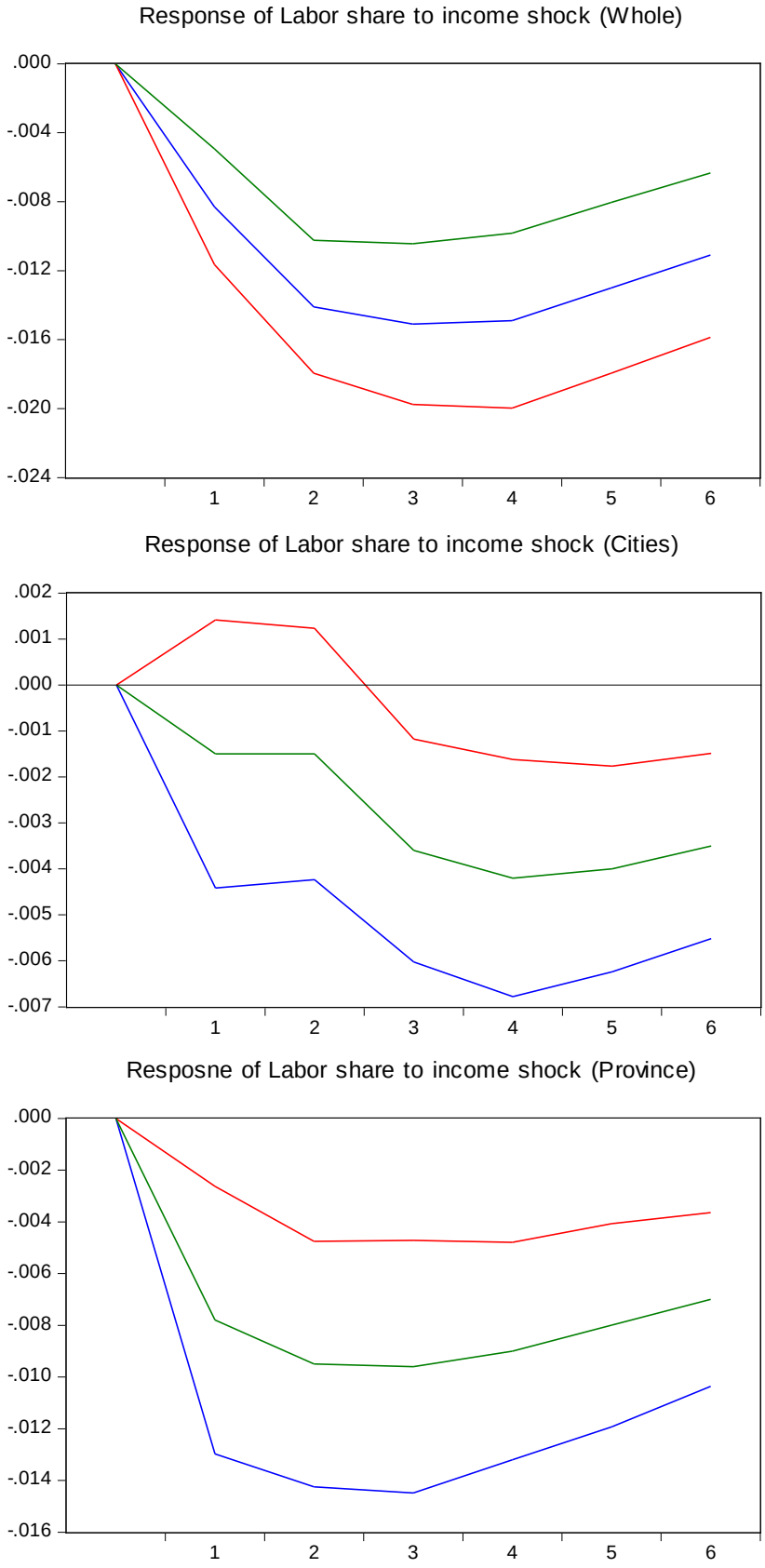
Note: The error bands are 16th and 84th percentiles based on 500 Monte Carlo simulations.

Figure 4.3. Impulse Responses to TFP shocks



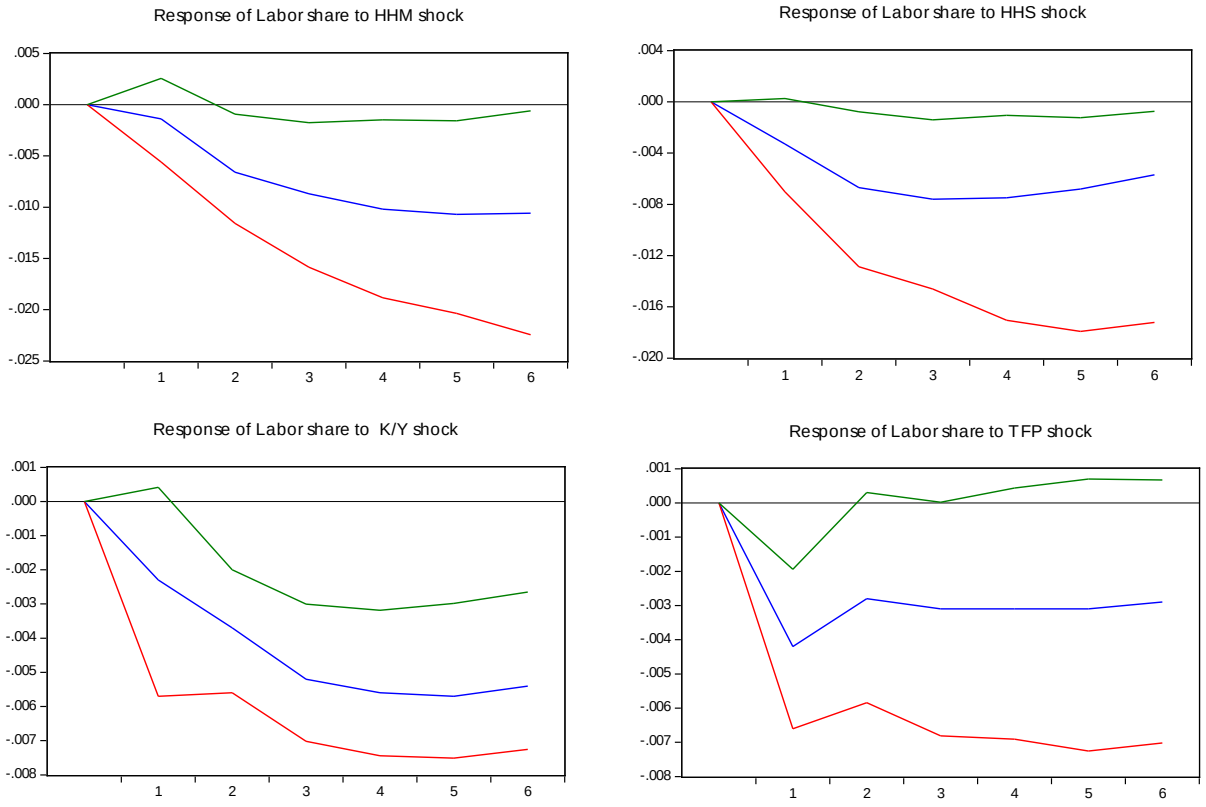
Note: The error bands are 16th and 84th percentiles based on 500 Monte Carlo simulations.

Figure 4.4. Impulse Responses to Income shocks



Note: The error bands are 16th and 84th percentiles based on 500 Monte Carlo simulations.

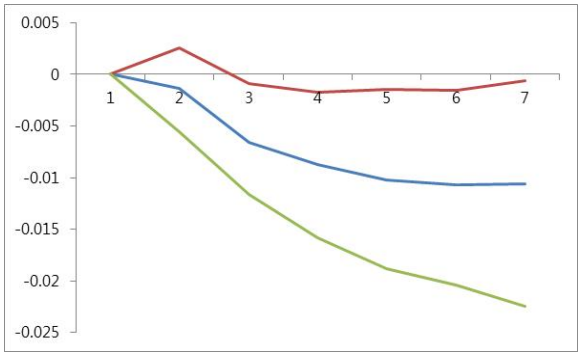
Figure 5.1. Response of Labor share from a 5-variable panel VAR



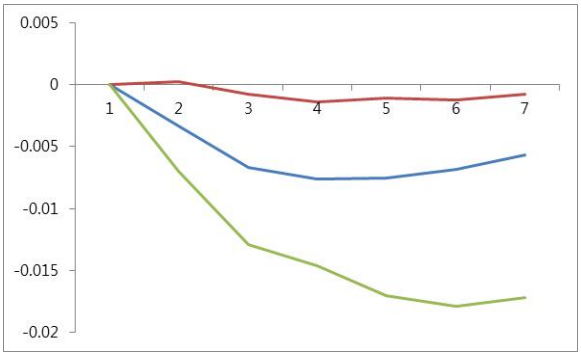
Note: The error bands are 16th and 84th percentiles based on 500 Monte Carlo simulations.

Figure 5.2. Response of Labor share to HHM and HHS shocks in Cities vs Provinces

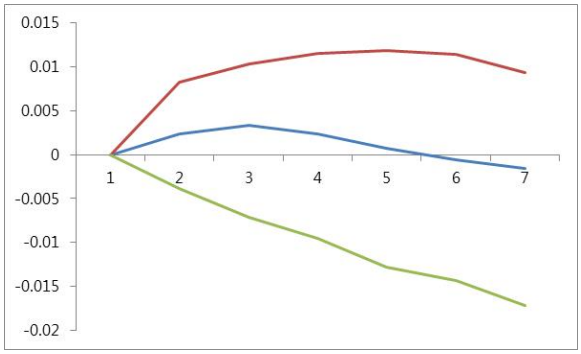
(a) HH-Manufacturing (City)



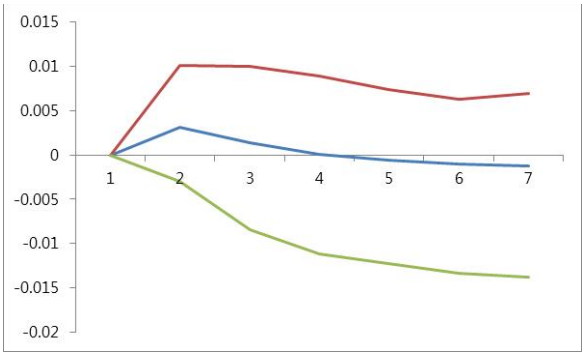
(b) HH-Service (City)



(c) HH-Manufacturing (Province)

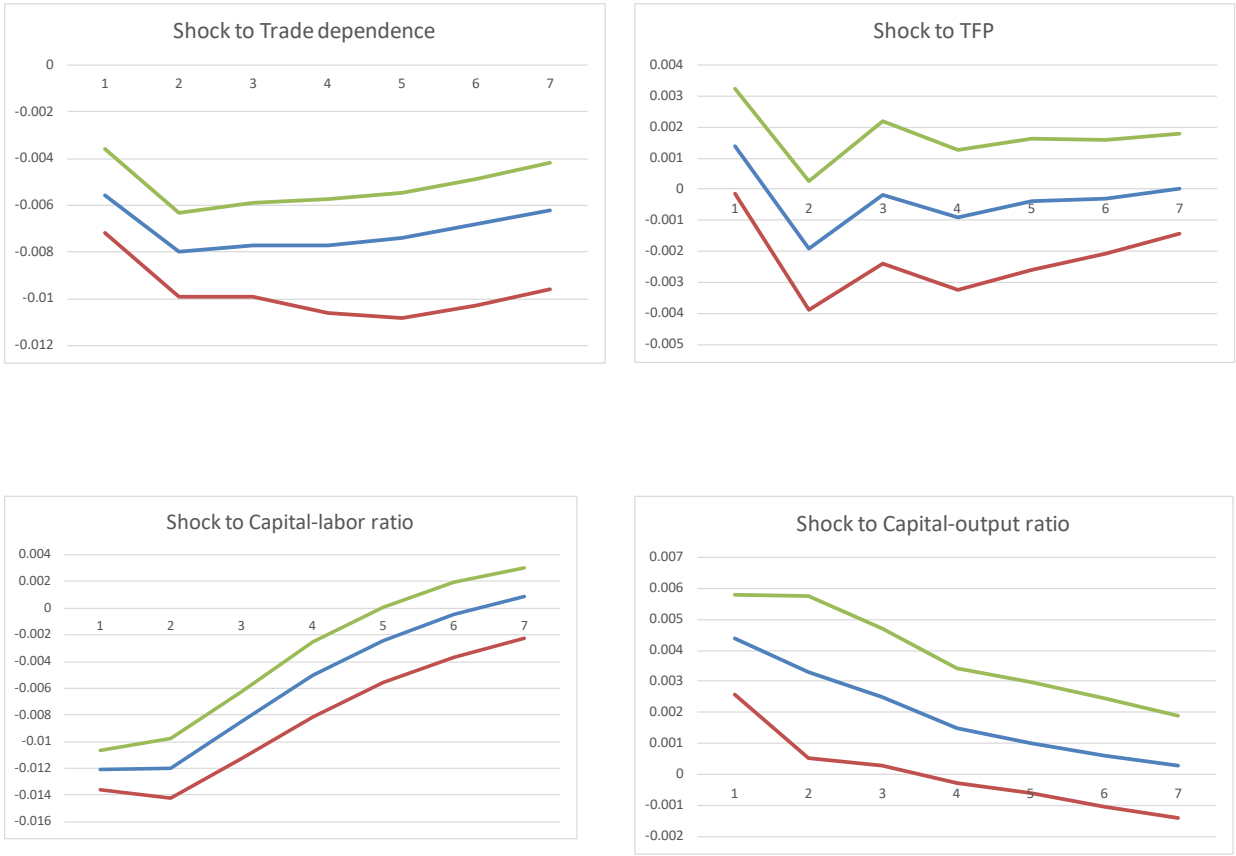


(d) HH-Service (Province)



Note: The error bands are 16th and 84th percentiles based on 500 Monte Carlo simulations.

Figure 6. Response of Labor share to Trade dependence and Factors of production



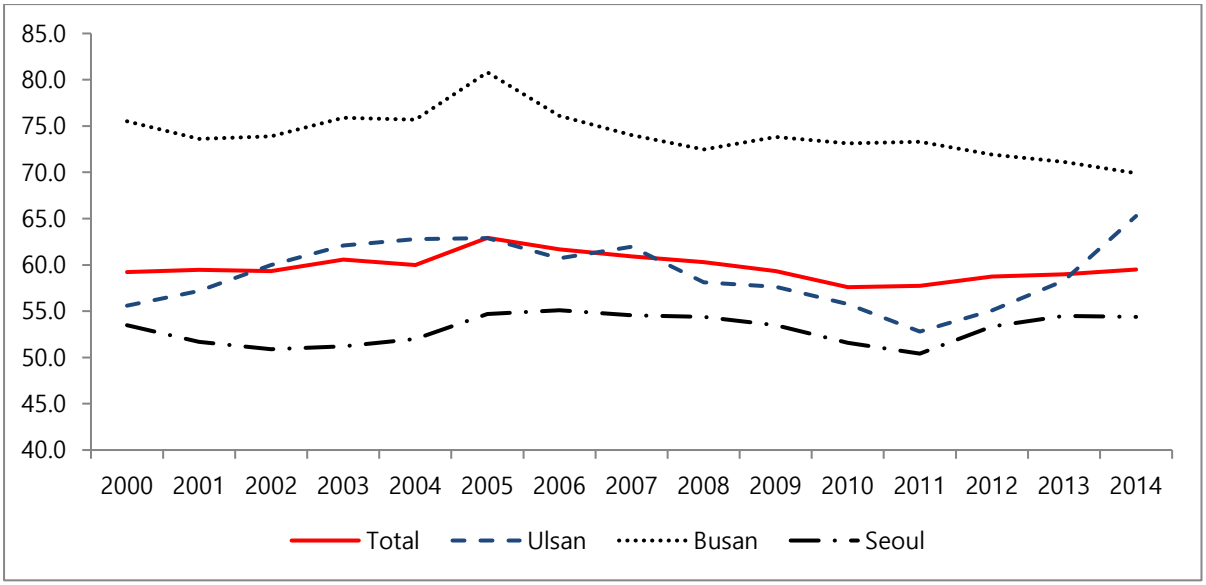
Note: The error bands are 16th and 84th percentiles based on 500 Monte Carlo simulations.

Appendix Table and Figures

Table A1. Shift-Share Decomposition of Changes in Labor Share by Industry

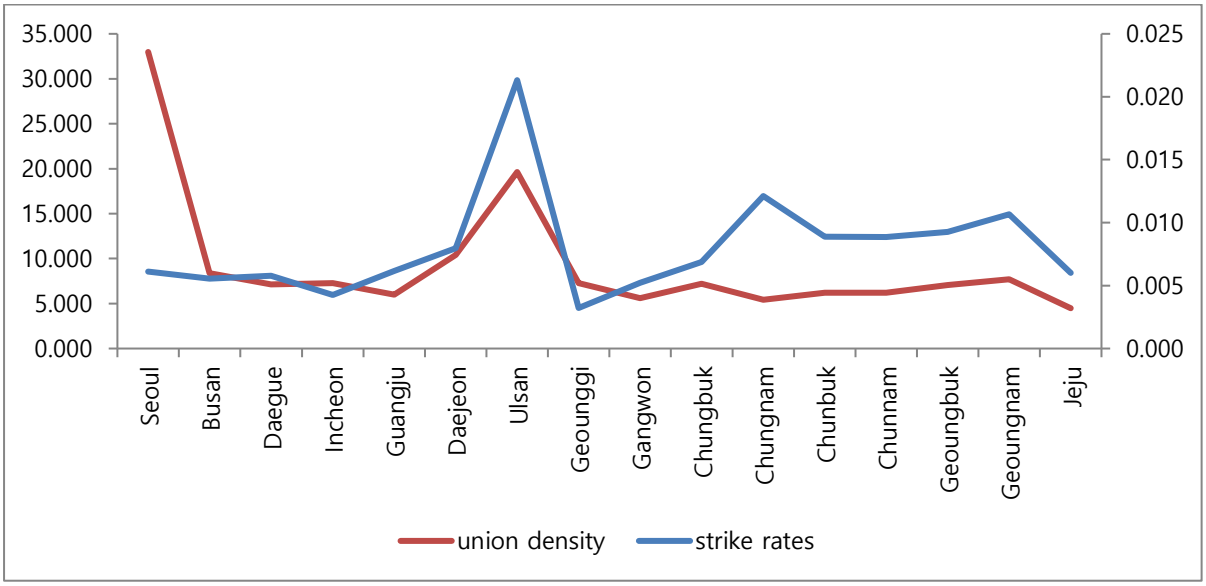
	2000-2006			2006-2015			2000-2015		
	shift	share	total	shift	share	total	shift	share	total
agri_fish	-0.010	-0.161	-0.171	0.070	-0.088	-0.018	0.080	-0.269	-0.190
mining	0.001	-0.024	-0.024	0.013	-0.017	-0.004	0.016	-0.044	-0.028
manufacturing	1.578	-0.580	0.997	-0.955	0.992	0.037	0.658	0.377	1.035
elec_gas_water	0.204	-0.073	0.131	-0.144	0.167	0.023	0.077	0.077	0.154
construction	0.027	0.223	0.250	0.296	-0.844	-0.548	0.313	-0.612	-0.298
retale_hotel	-1.262	-1.254	-2.516	-1.008	-0.137	-1.145	-2.326	-1.335	-3.662
transportation	0.376	-0.110	0.266	-0.056	-0.197	-0.253	0.308	-0.295	0.013
finace_insur	-0.462	0.340	-0.122	0.052	-0.376	-0.324	-0.380	-0.066	-0.446
real_estate	0.136	-0.085	0.050	-0.050	-0.075	-0.126	0.079	-0.154	-0.075
telecommunication	-0.213	0.103	-0.109	0.210	-0.421	-0.211	0.012	-0.332	-0.320
busi_service	0.206	0.811	1.017	0.006	0.885	0.891	0.234	1.674	1.908
public_admin	-0.068	0.555	0.487	-0.388	0.189	-0.199	-0.436	0.724	0.288
education	0.048	0.917	0.965	-0.022	-0.361	-0.383	0.026	0.556	0.582
health_welfare	-0.042	0.740	0.697	-0.068	0.755	0.687	-0.109	1.493	1.384
recreation	-0.164	0.113	-0.051	-0.340	-0.074	-0.415	-0.495	0.029	-0.466
Korea	0.353	1.515	1.868	-2.384	0.396	-1.989	-1.944	1.823	-0.120

Figure A1. The National vs Regional Labor Shares in Korea



Note. All labor shares are adjusted for national and regional self-employments. Busan shows the biggest decrease in labor share while Ulsan experiences the biggest increase between 2000 and 2014 among 16 metropolitan cities and provinces in Korea.

Figure A2. Strike rates and Union Densities by Region



Note. The left axis measures union density and the right axis strike rates.

Figure A3. Adjusted Labor Shares by Industry