SME Size, Job Creation and the Impact of Exchange Rate Fluctuations: the case of Korea

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* First draft: October 2, 2010

This paper is prepared for presentation at the conference held by the Japanese International Economy Association on Oct. 2010. I wish to express my deep appreciation to Professor Kim, In C., president of the Korean International Economy Association, for providing this opportunity and motivating me to finish this paper, and to the Korea Institute of Finance for providing the research facilities.

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1. Introduction

In an open economy, an exchange rate shock can induce changes in employment. Yet there is little recent literature on the relationship between exchange rates and employment. It may hold relevance, however, to the Japanese economy in the following way:

> "Japan still can't rely on domestic demand alone to sustain growth. Still, a recovery in employment is 'pausing' rather than over".
> (Yoshimasa Maruyama, senior economist at Itochu Corp. in Tokyo, June 29, Bloomberg)

Recently Alexandre, et. al. (2010) proposes a trade model with labor adjustment costs that includes the exchange rate explicitly, as well as econometric evidence on the effects of exchange rate changes on employment in a panel of OECD countries. Their model of exporting firm behavior finds that higher labor adjustment costs reduce the influence of exchange rate movements on employment. The main contribution is to include the exchange rate, which is different from the new literature largely derived from the seminal paper on international trade (Melitz, 2003).

There are several papers that deal with the labor market effects of exchange rates in the mid-1980s as globalization accelerates[1]. For the United States, analyses using data through the mid-1980s show that exchange rates have had significant implications for wages (Ravenga, 1992) and for employment across manufacturing industries (Branson and Love, 1987; Campa and Goldberg, 2001; Klein, et al, 2003). A cross-country, cross-industry study by Burgess and Knetter (1996) found statistically significant effects for exchange rates on employment, with the size of these effects related to industry characteristics such as competitive structure. However, Campa and Goldberg (1998) found a weaker correlation between exchange rates and employment in the U.S., but more pronounced effects on wages.

With increased globalization after 1990, the relationship between exchange rates and labor demand changed in the Korean economy. The labor market effects of exchange rates are still an open question but, as seen in the literature, the research on the relationship between exchange rates and labor demand has not been widely scrutinized in Korean as well as Western academic circles. Especially, research on the labor demand effects of exchange rate fluctuations in small- and medium-sized enterprises (SMEs) has not been explored.

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[1] The literature survey quotes from Alexandre, et al (2010) and Glodber and Tracy (1999).

This research is an exploratory paper on the possibility to find empirical evidence for a significant effect from exchange rate fluctuations on SME labor demand. Data on SME labor demand are so limited that time-series analysis is impossible. Hence, the analysis uses total employment and manufacturing employment and the labor demand effect of exchange rates on SMEs is investigated through graphical analysis.

This paper consists of five parts. Following the introduction, the second section describes a partial equilibrium model that incorporates exchange rates. Labor demand is derived from partial equilibrium. The third section presents graphical analysis and econometric evidence on total employment and manufacturing employment with an exchange rate shock. The fourth section investigates the labor demand effect of exchange rate fluctuations on SMEs and large firms. Finally, policy implications are summarized using the prior discussion.

2. Labor Demand and Exchange Rates: Theoretical Approach

The demand for labor in traditional macroeconomic theory is determined by profit maximization. A firm produces for both domestic demand and exports, and the quantity of exports is affected by the exchange rate, e, in addition to the three input factors, namely, labor, capital and imported intermediate materials[2]. Hence total production is:

$$Q = Q(K, N, e) = q^D(K^D, N^D, M, e) + q^E(K^E, N^E, M, e) \quad (1)$$

where q^D is domestic production and q^E export production. Constraints in equation (1) are:

$$K = K^D + K^E \quad (2)$$

$$L = L^D + L^E$$

The cost of production is determined by three factors: labor, capital and imported intermediate materials. The cost of imported intermediate materials denotes H(eM). Then the cost equation (1) is:

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[2] The appendix shows Korea's imports of intermediate inputs – parts and materials-from Japan and elsewhere. Korea's core intermediate inputs have been highly dependent on Japan.

$$C = rL + wL + H(eM) \quad (3)$$

where r and w represent interest rates and wages, respectively.

The objective function for profit maximization using equations (1), (2), and (3) is:

$$\pi = P\,Q(K,L,e) - (rK + wL + m(eM)) \quad (4)$$

where P is the competitive price in the global market. Profits from total production take the price of imported intermediate materials based on exchange rate fluctuations into account. Rising exchange rates boost profits by expanding export production, but it increases the price of imported inputs and, in turn, the cost of production. The former channel increases profits, but the latter channel decreases profits. In this paper, the former channel is called the expansion effect of exchange rates that leads to job-creation, and the latter channel as the cost effect of exchange rates, which leads to job-destruction.

The expansion effect of exchange rates in eq (4) increases the demand for the three input factors, and hence it generates job creation effects. In contrast, the cost effect of exchange rates decreases the demand for the three input factors, and hence it generates job destruction effects. In reality, there is time lag for both channels due to the adjustment costs from exchange rate fluctuations. Theoretically, we can induce the optimal level or range of the exchange rate that creates job by maximizing firms' profits.

The first order condition with respect to the three factors for profit maximization is

$$\frac{\partial \Pi}{\partial N} = P\frac{\partial Q(K,N,e)}{\partial N} - \omega = 0 \quad (5)$$

$$\frac{\partial \Pi}{\partial K} = P\frac{\partial Q(K,N,e)}{\partial K} - r = 0$$

$$\frac{\partial \Pi}{\partial M} = P\frac{\partial Q(K,N,e)}{\partial M} - \frac{dH}{dM} = 0$$

From equation (5), we can derive the demand for labor, the demand for capital, and the demand for imported intermediate materials:

$$N^D = N(w, e, r; K, M) \qquad (6)$$

$$K^D = K(r, w, e; N, M)$$

$$M = M(e, w, r; K, N)$$

Equation (6) can be used to derive the demand for labor which includes exchange rate fluctuations. The demand for labor can be derived from solving for the demand for capital and the demand for imported material inputs in equation (6) simultaneously. The equation to estimate the relationship between the demand for labor and exchange rate fluctuations is:

$$N = \alpha_0 + \alpha_1 w + \alpha_3 e + \alpha_4 r + \alpha_5 Z + \epsilon$$

where Z represents other variables and ϵ is the error term with i.i.d. properties.

3. Empirical Results on Total Employment and Manufacturing Employment

(1) Graphical Analysis

We find in figure 1 that wages move with total employment and that the trends in both the Korean won-US dollar and Korean won-Japanese yen rates move with total employment. In contrast, the yield on 3-year corporate bonds moves countercyclically with total employment.

Figure 1. Total employment, exchange rates, and interest rates

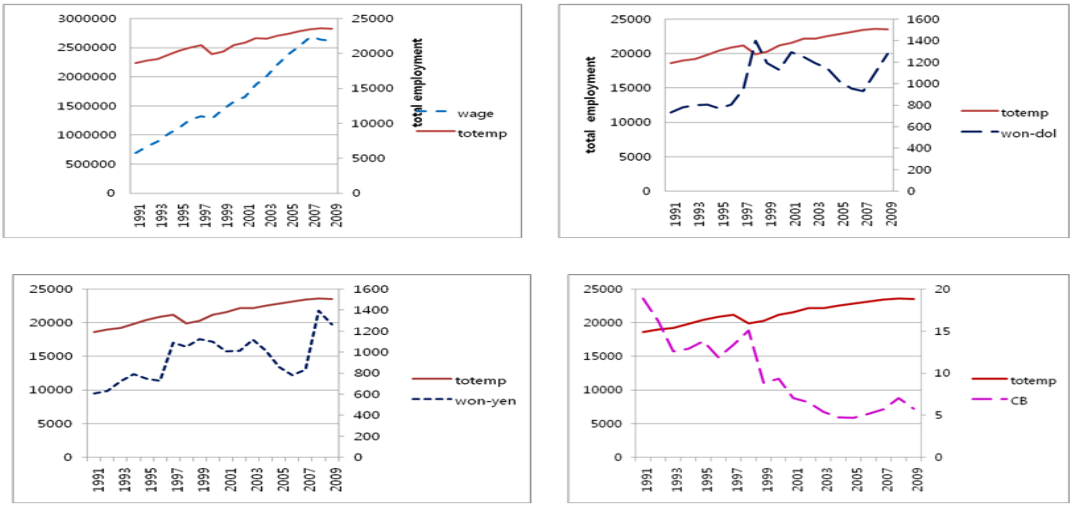


Figure 2. Manufacturing employment, exchange rates, and interest rates

In figure 2, an increase in wages decreased employment in the manufacturing sector. The Korean won–dollar exchange rate and won-yen rate moves countercyclically with the manufacturing sector, and the yield on corporate bonds is in inverse proportion to employment in the manufacturing sector. Graphically, the relationship between declining yields on corporate bonds and manufacturing employment shows that high wages induce the replacing of labor with capital.

(2) Empirical Results

In the 1980s, unemployment was very low, with problems beginning only from the Korean currency crisis in 1997. Time series data on employment in the Korean economy are very limited. In the empirical analysis, I use original data from 1991 to 2009 for both total employment and manufacturing employment drawn from the Principal Economic Indicators published by the Economic Statistics Department, of the Bank of Korea.

In Figures 1 and 2, employment, wages, exchange rates, and interest rates display some trends, which are eliminated by taking the first difference for all variables in the statistical analysis.

For column (1) in Table 1, the labor demand effect of exchange rates on total employment is negative and statistically significant. If control variables are added in columns (2) and (3), only the exchange rate is statistically significant and negative. Wages in columns (2) and (3) are not statistically significant in relation to labor demand, which diverges from the basic theory on labor markets.

Table 1. Effects of exchange rate fluctuations on total employment

Variable	(1)	(2)	(3)
Constant	334.62** (4.306)	309.72 (1.2587)	348.19 (1.3699)
△Won-dollar	-2.1485** (-4.0563)	-2.0604* (-2.0839)	-2.2047** (-2.1643)
△Wages		0.0002 (0.1070)	-0.00006 (-0.0323)
△Interest rates			6.8219 (0.7798)
R^2	0.5069	0.5073	0.5278
Durbin-Watson	1.7284	1.7252	1.6563

(note) the value in ( ) is a t statistic. *denotes statistically significant at 10%, ** statistically significant at 5% .

Column (2) in Table 2 shows that exchange rates are negatively correlated and statistically significant with manufacturing employment. If control variables are added sequentially in columns (5) and (6), only the exchange rate is statistically significant. The sign of wages, like Table 1 is negative, but statistically insignificant.

Table 2. Effects of exchange rate fluctuations on manufacturing employment

Variable	(4)	(5)	(6)
Constant	-43.693 (-1.5473)	-17.156 (-0.1924)	13.338 (0.1584)
△Won-dollar	-0.9828** (-5.1060)	-1.0768** (-3.0056)	-1.1912** (-3.5299)
△Wages		-0.0002 (-0.3148)	-0.0004 (-0.6609)
△Interest rates			5.4078* (1.8663)
R^2	0.6196	0.6221	0.5278
Durbin-Watson	1.5317	1.5675	1.6563

(note) the value in ( ) is t statistic. *denotes statistically significant in 10%, ** statistically significant in 5% .

4. SME Firm Size and Job Creation in Exchange Rate Fluctuations.

(1) Graphical Analysis

Data on SME firm size in Korea are available from 1994 to 2008 and taken from the SME statistics provided through the Kbiz home page.[3] Hence the analysis on SMEs' firm size and job creation in exchange rate fluctuations is dependent on graphical analysis. In Figure 3, the capacity of large firms' job creation starts to fall from 1996, and drastically falls after the Korean currency crisis, from 1997 to 2000. After the crisis, large firms' capacity to create jobs did not recover.

Figure 3. Ratio of employment across firm size and job creation

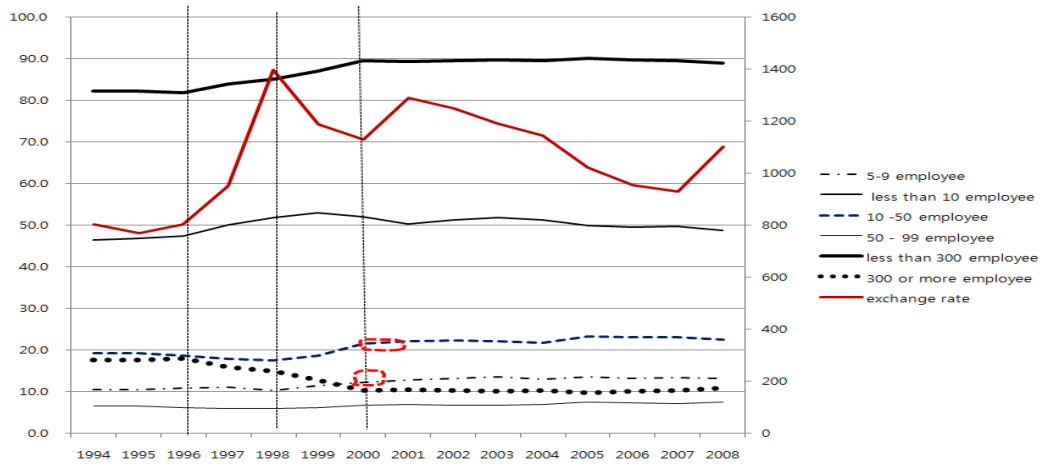
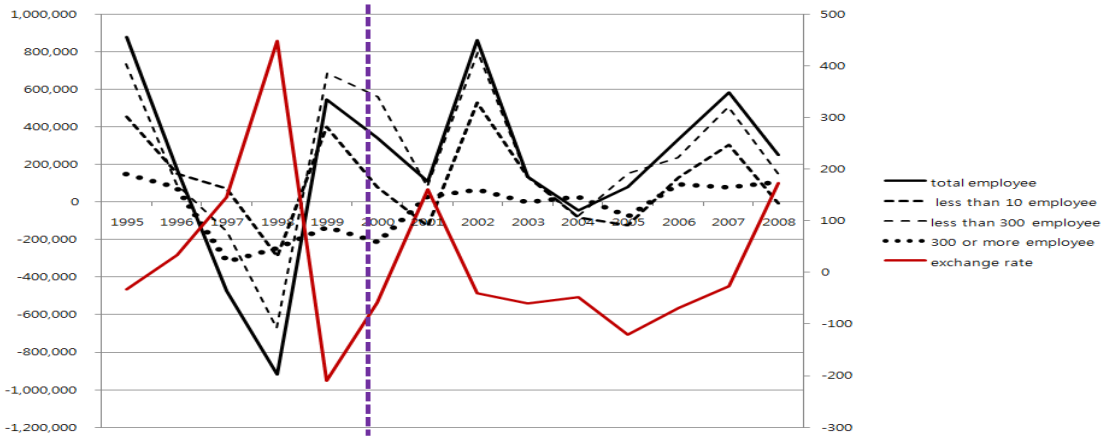


Figure 4. First difference of employment across firm size and exchange rates



In Figure 4, the relationship between the first difference of employment across firm size

[3] Kbiz denotes Korea federation of small and medium business, and home page address is http://www.kbiz.or.kr/

and of exchange rates is more conspicuous. The first difference of large firms' employment is counter-cyclical with respect to the difference in exchange rates until 2000, but pro-cyclical after 2000. That is, the rise (fall) of the won-dollar exchange rate after 2000 is accompanied by that of large firm job creation (destruction).

In contrast, the first difference of small firms' employment is a lag indicator of exchange rate fluctuations. That is, an increase in small firms' job creation follows an increase in the exchange rate.

(2) Cross-correlation

Cross-correlation from Figure 5 to 9 is used to investigate the lag and lead influence of exchange rate fluctuations on labor demand. SMEs after exchange rate shocks act as job creator in the Korean economy and absorb labor demand. The lead and lag pattern of exchange rate shocks on employment across firm size in SMEs are different from that for large firms.

Looking at Figures 5 to 8, SMEs' labor demand effect following exchange rate shocks is generally the biggest in the 4 to 5 period lead and lag. The positive effect of exchange rates on SMEs' employment is dominant in the lead in period, but the negative effect is dominant in the lagged period. The lag and lead pattern of the effect on labor demand of exchange rate shocks in Figure 5 is similar to that in Figure 7. Especially the employment effect of exchange rate shocks on firms employing 1 to 4 persons in Figure 5 has a lead pattern different from the other SME size cohorts. The lag pattern of exchange rate shocks in Figure 6 is similar to that in Figure 5 and Figure 7, but the lead pattern of exchange rate shocks in Figure 6 is different from that in Figure and Figure 7.

The negative labor demand effect of exchange rate fluctuations on firms with over 300 employees (shown in Figure 9) emerges from both in the lead and in the lag. The negative effect in the initial stage after the shock is much bigger than the negative effect in the lag.

The negative large shock in the lead is concentrated over 2 periods, while the decline from the negative shock continues through 4 periods. Finally, the shock turns positive beginning in the 5th period, with the pattern of lead shock becoming hump shaped.

Figure 5. Exchange rates and firms with less than 10 employees

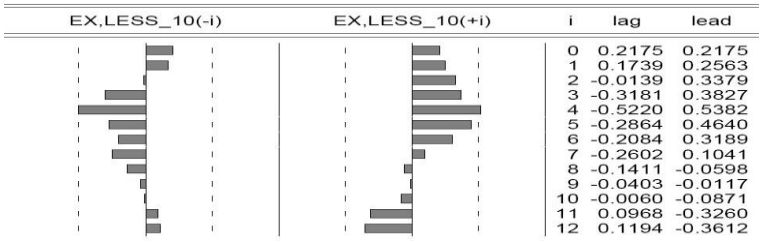


Figure 6. Exchange rates and firms with 1-4 employees

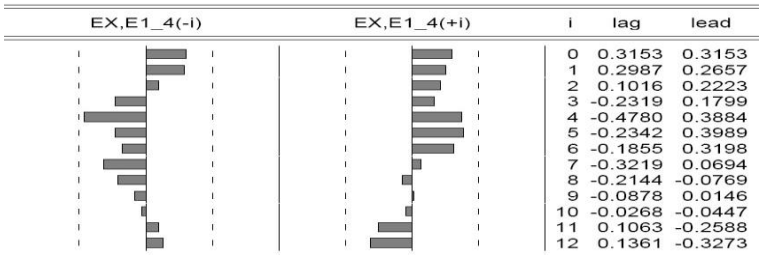


Figure 7. exchange rate and 5-9 employment

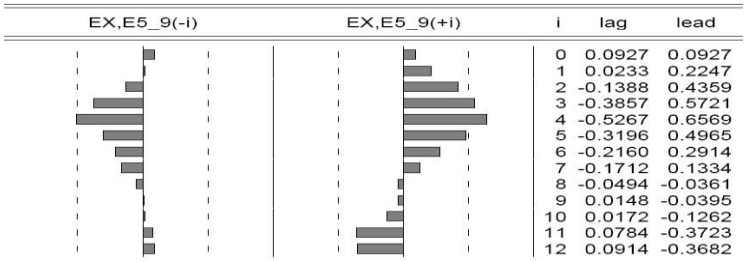


Figure 8. Exchange rates and firms with less than 300 employees

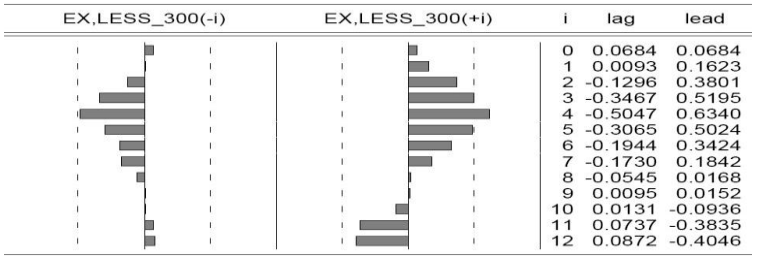
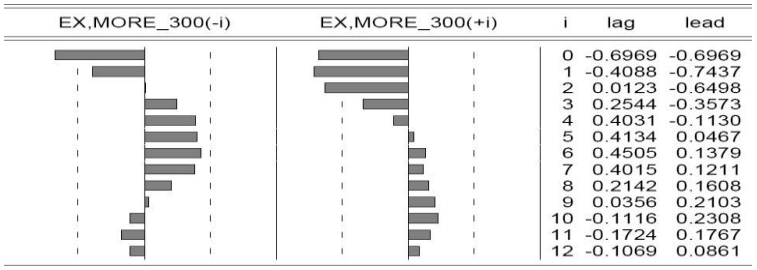


Figure 9. Exchange rates and firms with more than 300 employees



The initial negative shock in the lag in Figure 9 is concentrated in the first period. The shock turns positive from the second period, as the positive shock pattern from periods 2 to 9 are also hump shaped. The shock returns back to negative from the 10th period

lead.

In the Korean economy, a negative exchange rate shock on employment appears in large firms from the beginning, compensating for the positive shock from SMEs. This different response implies that SMEs act as a buffer, increasing labor demand and driving job creation, while large firms' labor demand decreases after such shocks.

(3) Trends between exchange rates and employment across firm size

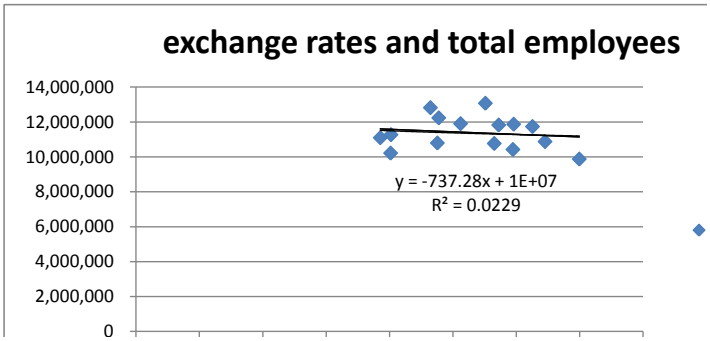
In Section 3, we find a negative effect of exchange rate fluctuations on employment in the difference variable. Further analysis is needed to examine whether the negative correlation between exchange rate and employment in the aggregate time series exists in the data across firm size.

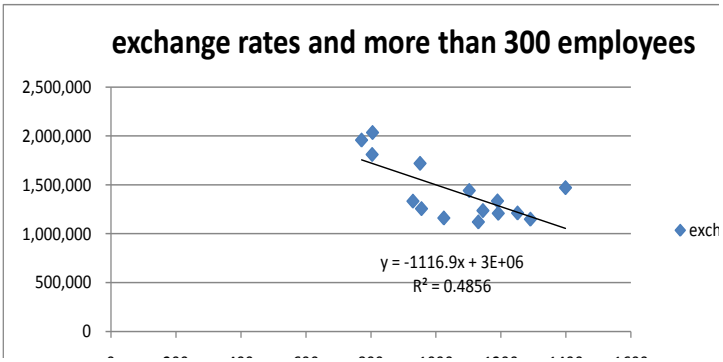
The time series of the sample across firm size is short -from 1994 to 2008. In Figure 10, a negative relationship is found in both total employment and large firms with more than 300 employmees, while a weak but positive relationship between exchange rates and SMEs with less than 300 employees.

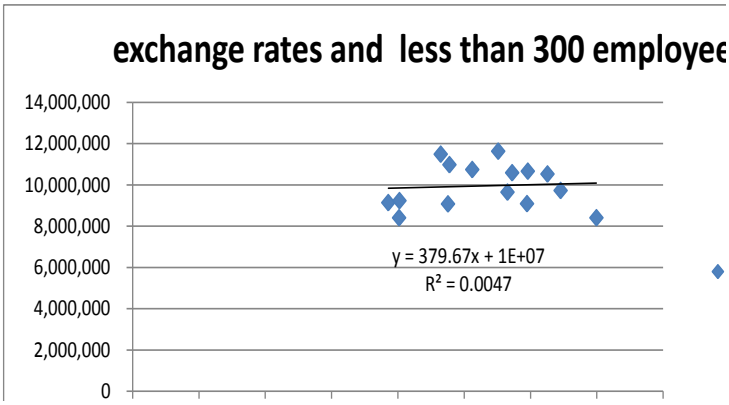
Regression analysis based on the difference variable in Section 3 shows the negative effects on labor demand from exchange rate shocks, though this varies across firm size in the trend analysis in Figure 10. The relationship between exchange rates and employment is negative for both total employment and firms with more than 300 employees, but positive for those with less than 300 employees. A rise in the won-dollar exchange rate in the trend analysis implies an increase in employment at SMEs and a decrease in large firms. Thus, changes in the exchange rate have inverse effects for SME and large firm employment.

In contrast, a decline in the won-dollar exchange rate implies a decrease in SME employment and vice versa at large firms, reinforcing the inverse movements in employment between SMEs and large firms.

Figure 10. Exchange rate and employment across small large firms



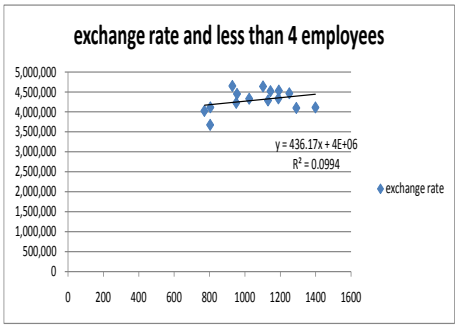


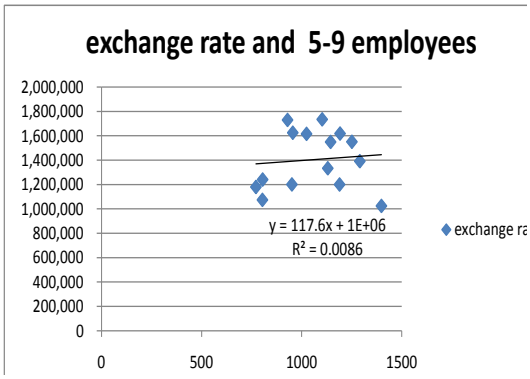


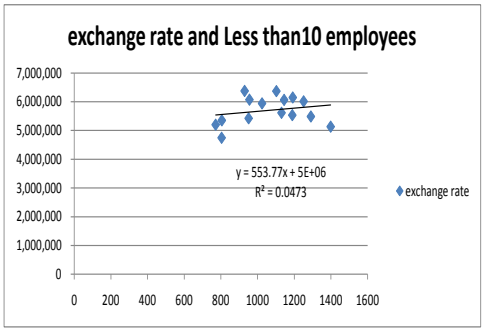
To analyze the relationship between exchange rates and employment across SMEs in further detail, the trend analysis specifies firm size across SMEs in Figure 11. The positive relationship holds up to less than 50 employees, with the positive slope diminishing as firm size . In the firms' size with less than 50 employees, the exchange rate depreciation have a positive influence on the employment , but the appreciation a negative influence on the employment.

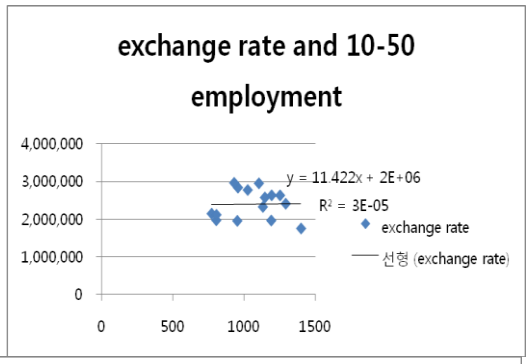
But the relation in more than 50 employees in Figure 11 turns negative. As the number of employees grows, the negative slope increases in absolute value. This means that the marginal effect of changes in the exchange rate on employment is negative and increasing. The shock of a fall in the exchange rate on employment is negative, while the reverse is true for a rise in the exchange rate.

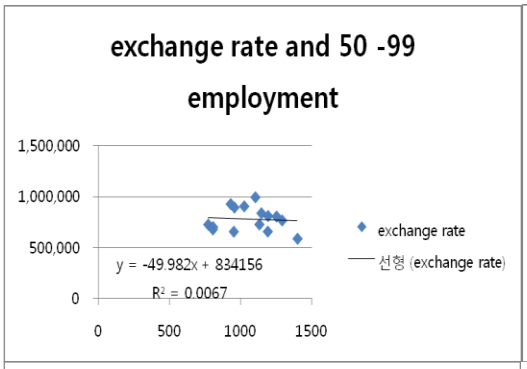
Figure 11. Exchange rates and employment across SMEs

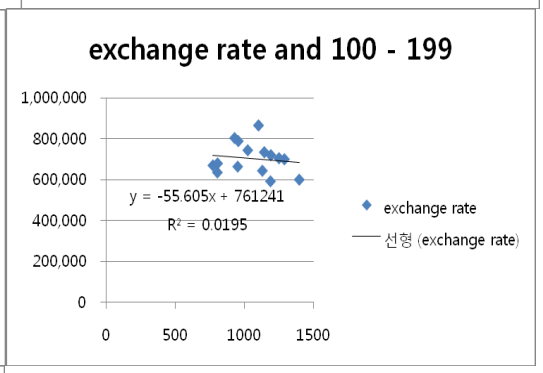


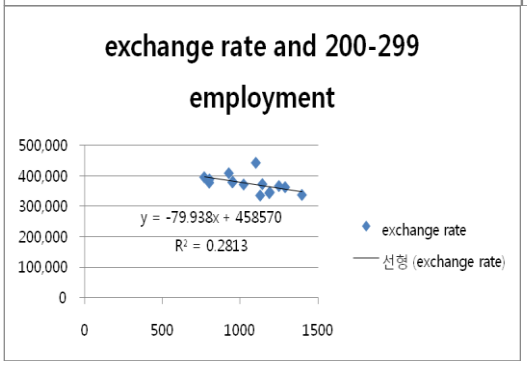












Hence the trend analysis implies that a rise in the exchange rate increases employment only in small firms with less than 50 employees and a decline increases employment in firms with more than 50 employees. This is consistent with the results from the regression analysis based on the difference variable, except for small firms with less than 50 employees.

5. Policy Implications and Further Research

Unemployment is a common problem, and for countries with an open economy and high unemployment, the relationship between the exchange rate and employment is very important.

We present two interesting implications from this paper. One is that, in a time series analysis, changes in the exchange rate give a negative and statistically significant shock to employment. The other is that the effects of changes in the exchange rate are not consistent across firm size in the Korean economy. Combining the empirical results from the time series and firm size analysis, mixed policies are necessary to maximize the increase in employment or minimize the loss of employment, under exchange rate fluctuations.

With fluctuations in the exchange rate, certain size firms increase employment, while others decrease employment. It is a critical task to balance the increase of employment and the decrease across firm size via optimal exchange rate levels. The important problem is to find the optimal level or range of exchange rates that produces a net increase in employment in the economy.

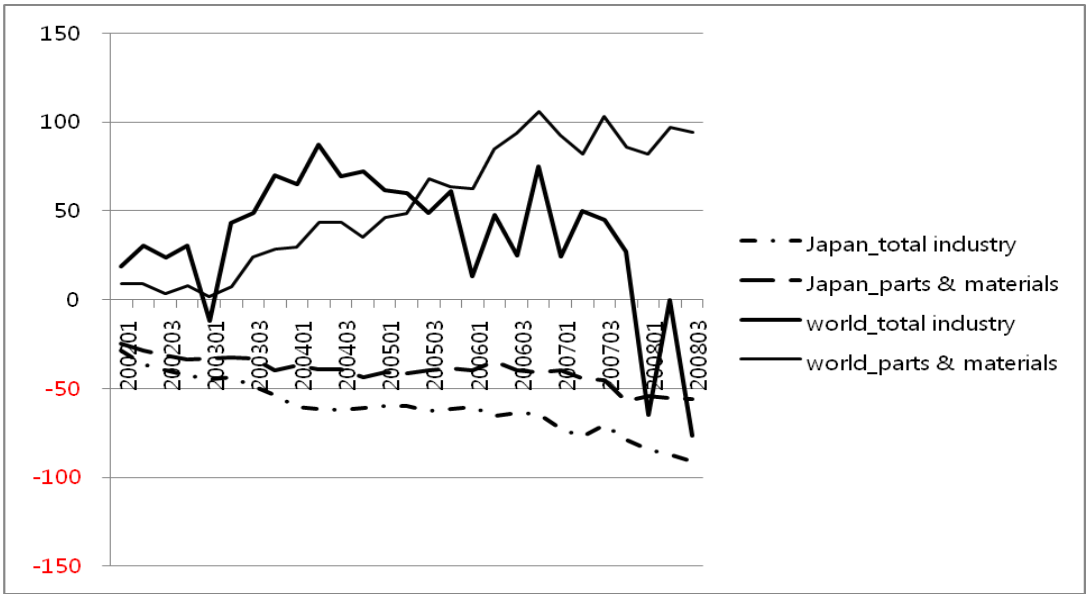
Since this paper faces data constraints, the empirical results are not enough to fully test and make inferences from the theory derived from the model. Further empirical work with larger and more elaborate with large data and long time series is therefore called for.

<Appendix>

As shown in Figure A.1, Korea's industry has depended on imports of parts and

materials from Japan. Especially, leading export products in Korea, i.e. mobile phones and manufacturing facilities, are highly dependent on Japan.

Figure A.1 Korean imports of parts and materials from Japan and the world



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