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An empirical estimation of the relationship between Edmund Phelps' "investment driving forces" and the unemployment rate

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On his invited lecture at Beijing University, China, December 2004, Edmund S. Phelps, the winner of the 2006 Nobel Prize in Economics, proposed four indicators of "investment driving forces", which could be used in measuring the economic growth of a country's performance, and which might in turn also be eventually reflected in the country's employment situation. In addition to Edmund Phelps' four indicators, such as (1) the rate of changes of investment, (2) the rate of changes of foreign exchange (that is, forex) rate, (3) the rate of changes of employees' wage incomes as a proportion of GDP, and (4) the rate of changes of the market values of listed stocks as a proportion of GDP, authors suggested two more indicators (5) the severity of market values of fraud companies, and (6) the overdue rate of overall financial institutions. Through the application of regression analysis methodology, this paper will make an empirical estimation, based on Taiwanese historical investment data, on the relationship among "investment driving forces" and country's economic performance in terms of unemployment rate.

Key words: Edmund Phelps, investment driving forces, fraud companies, unemployment rate.

INTRODUCTION

Edmund S. Phelps, the Nobel Prize Laureate of Economics in 2006, argued in his works, "Structural slumps: The modern equilibrium theory of unemployment, interest, and assets" (1994), that unemployment rate is not only affected by the insufficient overall effective demand proposed by the Keynesian theory, but is also subject to the impact of structural factors such as pay incentives, restrictions of working conditions, tax rate, regulatory restrictions, and changes in technological advances.

The treatise advocates that the rate of changes of investments is determined by real interest rate, the expected technological progress, productivity growth, eligibility rights, patents, stock of corporate assets, labor wealth, tax rate, political atmosphere, investor integrity, social order, etc. These non-monetary factors will determine the value of business investment assets and

investment cost, and furthermore will determine the rate of changes of investment and the unemployment rate. Ten years after the publication of the treatise, Edmund S. Phelps, Hian Tieck Hoon and Gylfi Zoega (2004) proposed the following ideas in addition to reiterate the 1994 viewpoints previously described:

(1) The rise of stock index as a proportion of enterprise investment cost, or the market value of stocks as a proportion of gross domestic product (GDP) will increase the value of corporate assets, which will in turn lead to the expansion of business investment environment, the creation of job opportunities and the reduction of the unemployment rate.
(2) The higher degree appreciation (or depreciation) of country's currency will cause the decreasing (or increasing) of the domestic prices of the imports from abroad, and will make the increasing (or decreasing) of the foreign prices of the exporting products and services. The concerns of the risk of losing (or gaining) customers in the foreign markets, gradually slowing down (or rising

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up sharply) the markup prices of business operations, increasing (or decreasing) the volumes of industry productions and the amounts of investments on enterprises and eventually causing the falling (or rising) of the unemployment rates. The logic of this reasoning is contrary to the arguments of the Keynesian theory that the currency appreciation (or depreciation), will reduce (increase) overall effective demands and increase (or decrease) unemployment rate. The arguments and observations of Phelps et al. (2004) that currency depreciation (or appreciation) will lead to economic contraction (or expansion) and increase (or decrease) unemployment rate were first pointed out in 20 to 30 years ago, by several economists including the lecturing professor at Princeton University, Richard N. Cooper (1971), Taiwanese economists Chau-Nan Chen (1973) and Ching-Chong Lai (1982). However, Wang and Wang (1985) made a systematic exposition in writing, including a methodical discussion of facts and the principles involved. Chun-Yuan Wang published his arguments on international social sciences citation index (SSCI) journals by using the tight money effect and the spillover effect theories respectively, almost 20 years earlier than Edmund S. Phelps' lecture at Beijing University. This type of repetitious is unknown to Edmund S. Phelps as he did not read the previously mentioned four papers.

On December 2004, Edmund S. Phelps proposed four indicators of "investment driving forces", (1) the rate of changes of investment, (2) the rate of changes of forex rate, (3) the rate of changes of employee's wage incomes as a proportion of GDP, and (4) The rate of changes of the market values of listed stocks as a proportion of GDP, for diagnosing a country's economic performance in terms of unemployment rates.

Authors believed that two more indicators should be included, such as (5) the severity of market values of delisted companies (that is, due to closing down for poor management or for false accounting practices, deceitful business or for serious offense and violation of regulations) and (6) the overdue ratio of overall financial institutions. In fact, the economic performances has been significantly harmed deeply and also reflected on the rising scale of the unemployment rates in Taiwan. This paper will make an empirical estimation of the impact of the previously mentioned 6 indicators on the Taiwan's unemployment rate.

THEORIES REGARDING THE IMPACT OF "INVESTMENT DRIVING FORCES" ON UNEMPLOYMENT RATE

Edmund S. Phelps, Nobel Prize Laureate of Economics in 2006, was invited to give a lecture in Beijing University in December, 2004. At that lecture, Edmund S. Phelps proposed the concept of "investment driving forces", arguing to use the following variables as economic indicators to measure a country's investment willingness and judge the growth of a country's economic performance, which may ultimately be reflected in the employment market of the country. The relationships between the four indicators and the unemployment rate of the job market are as elaborated thus:

(1) Investment increase rate $(\dot{I_t})$: if it continues to grow, it will create new employment opportunities in addition to keep the original working opportunities to effectively lower overall unemployment rate. Conversely, if the investment increase rate slows down or grow negatively, the overall unemployment rate will increase.

(2) Rate of changes of foreign exchange rate $(\dot{e_t})$: John Maynard Keynes (1936) argued: appropriate currency depreciation or undervalued currency helps lower exporting prices, enhance export competitiveness or increase the exporting profits of business firms and reduce imports. This will help maintain the original investment and increase a country's newly increased investments, and thus can effectively lower the overall unemployment rate. Conversely, appropriate currency appreciation or currency overvaluation may increase overall unemployment rate. However, Phelps (2004) argued that, currency depreciation leads to rising domestic prices and falling foreign prices. The business greed will lead to over mark-up pricing, coupled with outflow of capital; it will be unfavorable to production and investment, leading to the rise of overall unemployment rate. On the contrary, currency appreciation leads to falling domestic prices and rising foreign prices. Fearing losing market and customers, the business will inhibit mark-up pricing. Coupled with inflow of capital, this will be beneficial to production and investment to lower the overall unemployment rate.

(3) The rate of changes of employee's wage income as a proportion of GDP $(\dot{W_t})$: it continuously and positively grows; it indicates the continuous growth of margin production of the employees. In addition to keep the original working opportunities, it can create new employment opportunities. As the enterprises continue to expand production, it corresponds to lower overall unemployment rate. Conversely, if $\dot{W_t}$ has negative growth, it will lead to relatively higher overall unemployment rate.

(4) The rate of changes of the market value of listed stocks as a proportion of GDP $(\dot{MVD_t})$: the continuous positive growth of it indicates that the value of business investment assets and the investment income and wealth of the general public are growing. As it can help enhance the new investment and consumption of a country, it can effectively lower the overall unemployment rate. Conversely, if $\dot{MVD_t}$ negatively grows, it will lead to relatively higher overall unemployment rate.

We propose the fifth indicator to explain the

unemployment rate, namely, "severity of market value of delisted company due to close down from poor management or for false accounting fraud or for serious offense and violation of regulations (F_t)". The bigger F_t value is, the bigger bankruptcy of the company is. It will directly increase the overall unemployment rate and will indirectly affect economic expansion. In addition, the bigger F_t value also indicates the business investment asset value and the capital loss and the wealth of the general public decrease dramatically. In this case, the political, social and economic environment will be diffused with uncertainty and distrust. As the original investment and consumption cannot be kept, regardless of new investment and consumption, it will lower the employment opportunities and the level of effective demands and enhance overall unemployment rate. Conversely, if the F_t value is smaller or even the F_t value is 0, it will not reduce the business investment asset value, employment opportunities and the level of effective demands and increase the overall unemployment rate. Considering that the delisting of listed companies were few in Taiwan before 1995, we assume the alternative virtual variable FD_t of F value of this period as 0. During the period from 1996 to 2000, Taiwan was in the cross-strait crisis and the Asian financial crisis and many companies went bankrupt with increasing number of delisted fraud companies. Thus, we assume the period FD_t value as 1. From 2001 to 2002, the market value of delisted companies increased abruptly from 971.11million to 240.03 million NTD. As a result, we assume the FD_t value as 2. Since 2003, the delisting market value of the fraud companies has become a high-level economic burden and has been accumulating up to 3429.55 million NTD in 2006, harming the economy seriously. It is continuing to deteriorate and thus we assume the value of FD since 2003 as 3 to indicate the severity.

As is shown thus, we integrate the four indicators of the "investment driving forces" proposed by Phelps (2004) with the indicators proposed in this article the value of F or the FD value to explain the unemployment rate (UR) by using the following function:

$$UR_t = f(\dot{I}_t, \ \dot{e}_t, \ \dot{W}_t, \ \dot{MVD}_t, \ \dot{FD}_t);$$

$$\frac{\partial UR_t}{\partial \dot{I}_t} < 0, \frac{\partial UR_t}{\partial \dot{e}_t} > 0, \frac{\partial UR_t}{\partial \dot{W}_t} < 0, \frac{\partial UR_t}{\partial \dot{MVD}_t} < 0, \frac{\partial UR_t}{\partial \dot{FD}_t} > 0$$

(1)

The regression estimation of unemployment rate function of Equation 1 can be represented as:

$$UR_t = \alpha_0 + \alpha_1 \dot{I}_t + \alpha_2 \dot{e}_t + \alpha_3 \dot{W}_t + \alpha_4 \dot{MVD}_t + \alpha_5 \dot{FD}_t;$$

$$\alpha_0 > 0, \alpha_1 < 0, \alpha_2 > 0, \ \alpha_3 < 0, \ \alpha_4 < 0, \ \alpha_5 > 0 \quad (2)$$

Appendices 1 and 2 illustrate the unemployment rate UR_t, the five indicators $\dot{I}_t$, $\dot{e}_t$, $\dot{W}_t$, $\dot{MVD}_t$, $\dot{FD}_t$; Taiwan Weighted Stock Index P_{st}, $\dot{P}_{st}$, the accumulated value of the delisting market value of fraud companies $\sum F_t$, the average financial institution overdue ratio U_{At} and the relatively high financial institution overdue ratio U_{mt} of Taiwan in 29 years' period of 1978 to 2006. The data was described in Figures 1 to 12 to observe the dynamic relationships of the changes.

PEARSON CORRELATION COEFFICIENTS ANALYSIS OF TAIWAN'S UNEMPLOYMENT RATE UR_t AND MAJOR INDICATORS OF "INVESTMENT DRIVING FORCES"

In the 29 years period of 1978 to 2006, the correlation coefficients of Taiwan's unemployment rate UR_t and the major indicators of "investment driving forces" as proposed by Phelps (2004) including the investment increase rate $\dot{I}_t$, the rate of change of forex rate $\dot{e}_t$, the rate of change of employee's wage income as a proportion of GDP $(\dot{W}_t)$, the rate of change of market value of listed stock as a proportion of GDP (MVD_t) $\dot{MVD}_t$, Taiwan Weighted Stock Index P_{st} and its rate of changes $\dot{P}_{st}$ are as follows:

$$r_{UR_t, \dot{I}_t} = -0.488^{**}; \ r_{UR_t, \dot{I}_{t-1}} = -0.585^{**}$$
$$(\text{P=0.008}) \qquad (\text{P=0.001}) \qquad\qquad (3)$$

$$r_{UR_t, W_t} = -0.194; \ r_{UR_t, W_{t-1}} = -0.019$$
$$(\text{P=0.314}) \qquad (\text{P=0.923}) \qquad\qquad (4)$$

$$r_{UR_t, \dot{W}_t} = -0.414^{*}; \ r_{UR_t, \dot{W}_{t-1}} = -0.263$$
$$(\text{P=0.026}) \qquad (\text{P=0.177}) \qquad\qquad (5)$$

$$r_{UR_t, \dot{e}_t} = 0.226; \ r_{UR_t, \dot{e}_{t-1}} = 0.319$$
$$(\text{P=0.239}) \qquad (\text{P=0.098}) \qquad\qquad (6)$$

1987 to 2006 Period

$$r_{UR_t, MVD_t} = 0.462^{*}; \ r_{UR_t, MVD_{t-1}} = 0.357$$
$$(\text{P=0.040}) \qquad\quad (\text{P=0.133}) \qquad\qquad (7)$$

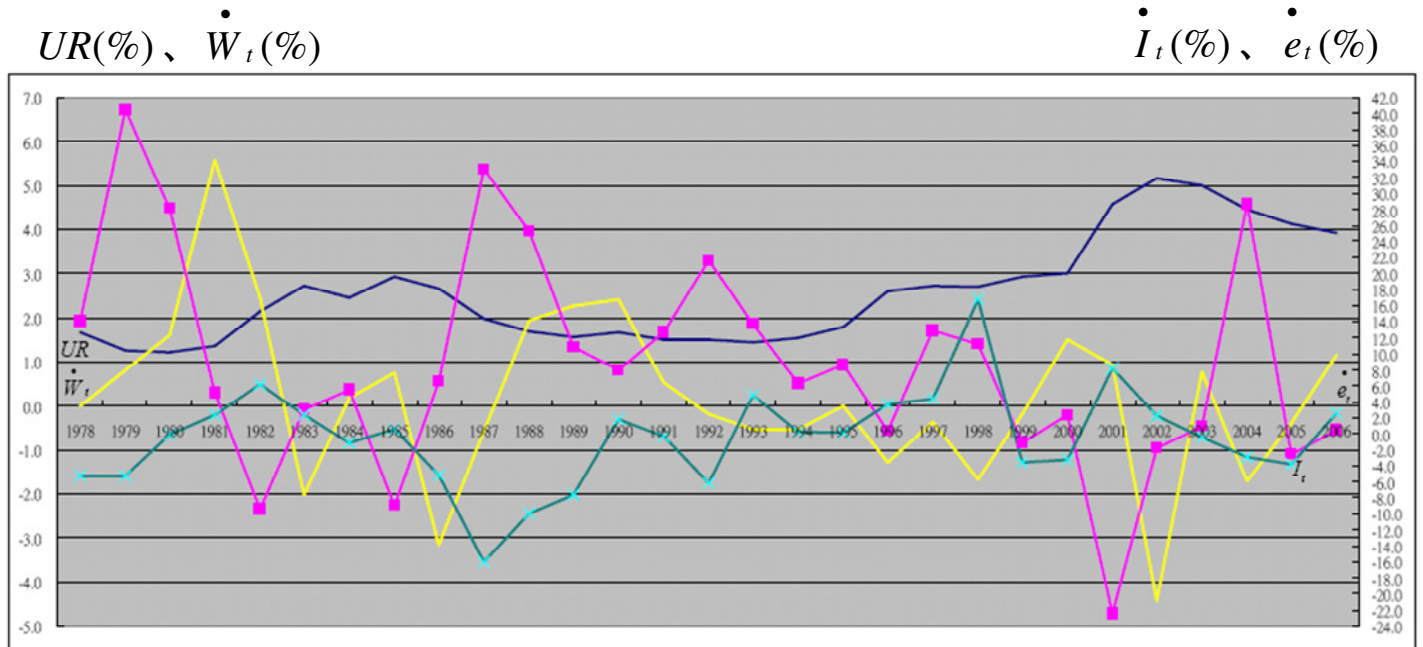$$UR(\%) \text{、} \dot{W}_t(\%) \qquad\qquad\qquad\qquad \dot{I}_t(\%) \text{、} \dot{e}_t(\%)$$

Figure 1. The relationship between Taiwan's unemployment rate UR and $\dot{W}_t$, $\dot{I}_t$ and $\dot{e}_t$ as proposed by Phelps (2004).

$$UR(\%) \qquad\qquad\qquad\qquad W_t(\%) \text{、} MVD_t(\%) \text{、} \dot{P}_s(\%)$$
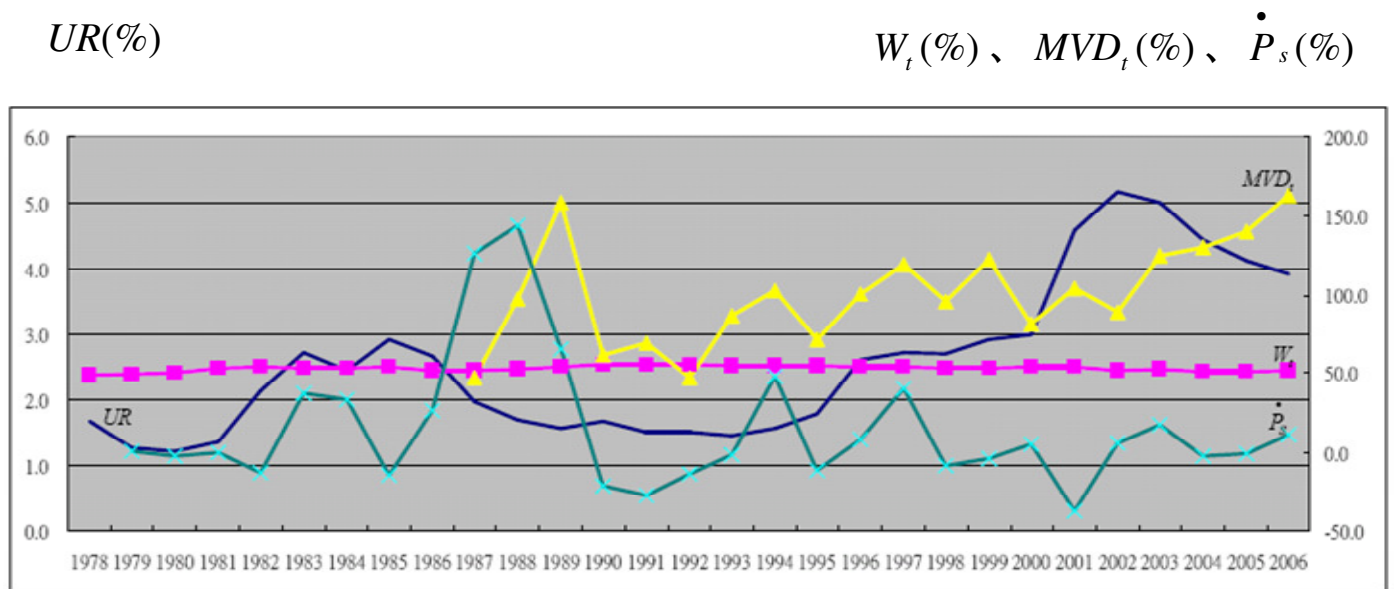

Figure 2. The relationships between Taiwan's unemployment rate UR and W_t, MVD_t and $\dot{P}_s$ as proposed by Phelps (2004).

1988 to 2006 Period

$$r_{UR_t, \dot{MVD}_t} = -0.090 \; ; \; r_{UR_t, \dot{MVD}_{t-1}} = -0.192$$

$$(P=0.713) \qquad\qquad (P=0.445) \qquad\qquad (8)$$

$$r_{UR_t, \dot{P}_{st}} = 0.315 \; ; \; r_{UR_t, \dot{P}_{st-1}} = 0.346$$

$$(P=0.097) \qquad\qquad (P=0.071) \qquad\qquad (9)$$

$$r_{UR_t, \dot{P}_{st}} = -0.186 \; ; \; r_{UR_t, \dot{P}_{st-1}} = -0.282$$

$$(P=0.343) \qquad\qquad (P=0.154) \qquad\qquad (10)$$

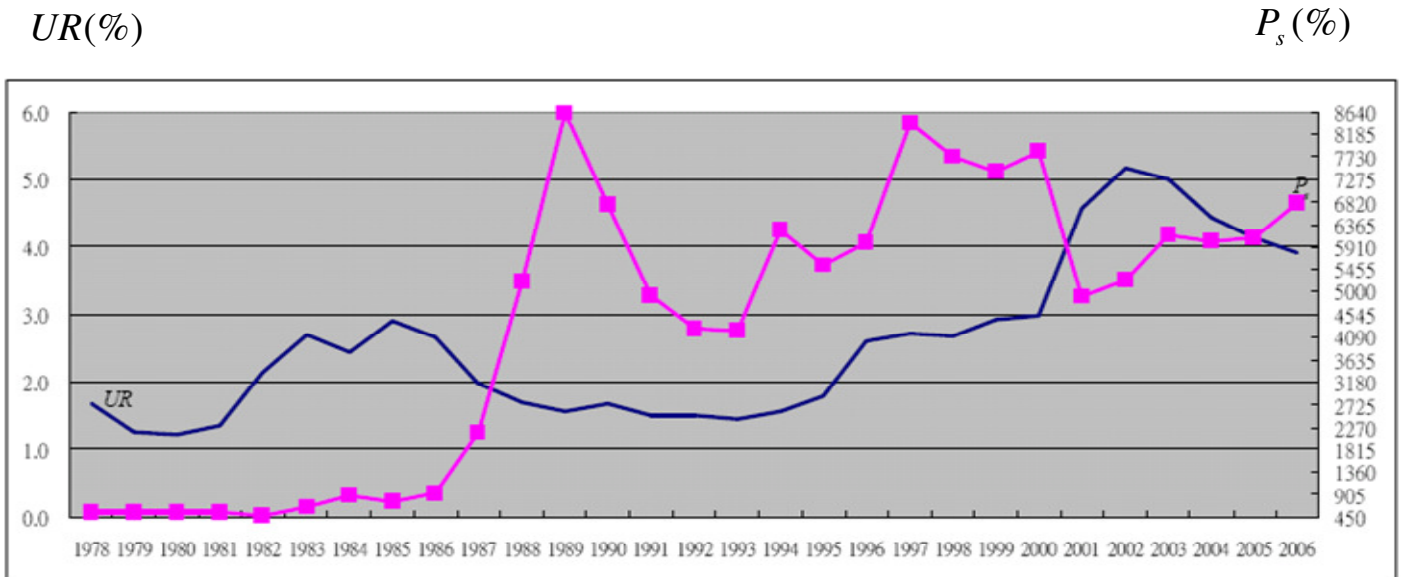$UR(\%)$ $P_s(\%)$

Figure 3. The relationship between Taiwan's unemployment rate UR and Taiwan composite stock index P_s.

$UR(\%)$ $\dot{I}(\%)$

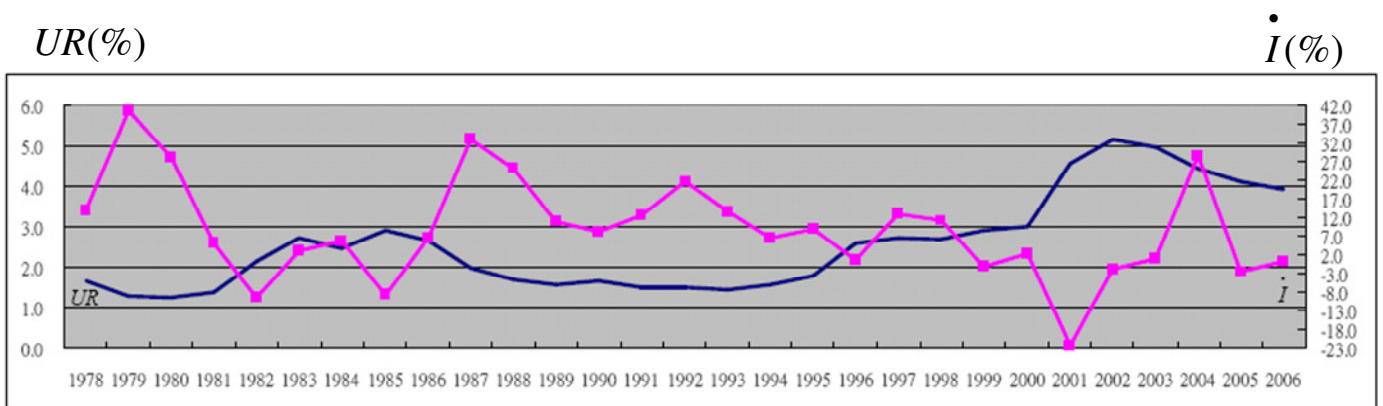**Figure 4.** The relationship between Taiwan's unemployment rate UR and investment growth rate $\dot{I}$.
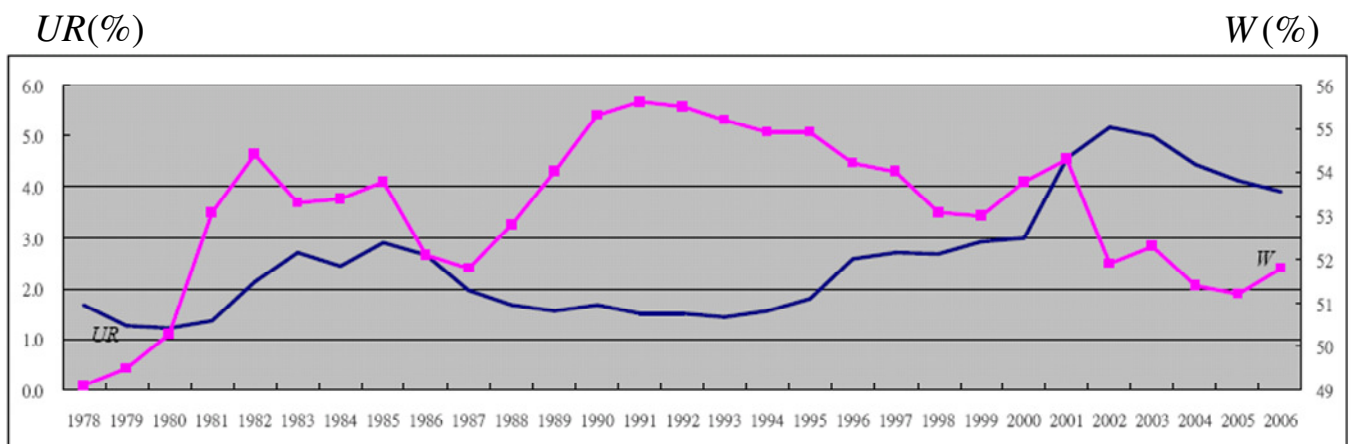
$UR(\%)$ $W(\%)$
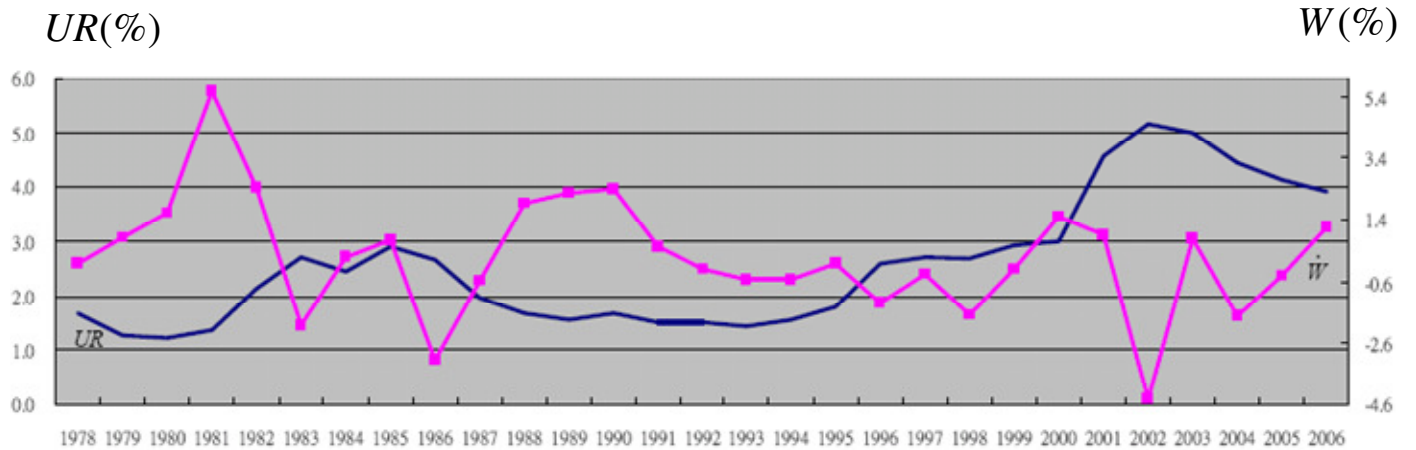

Figure 5. The relationship between Taiwan's unemployment rate UR and W.

$UR(\%)$ $W(\%)$

Figure 6. The relationship between Taiwan's unemployment rate UR and $\dot{W}$.

$UR(\%)$ $\dot{e}(\%)$
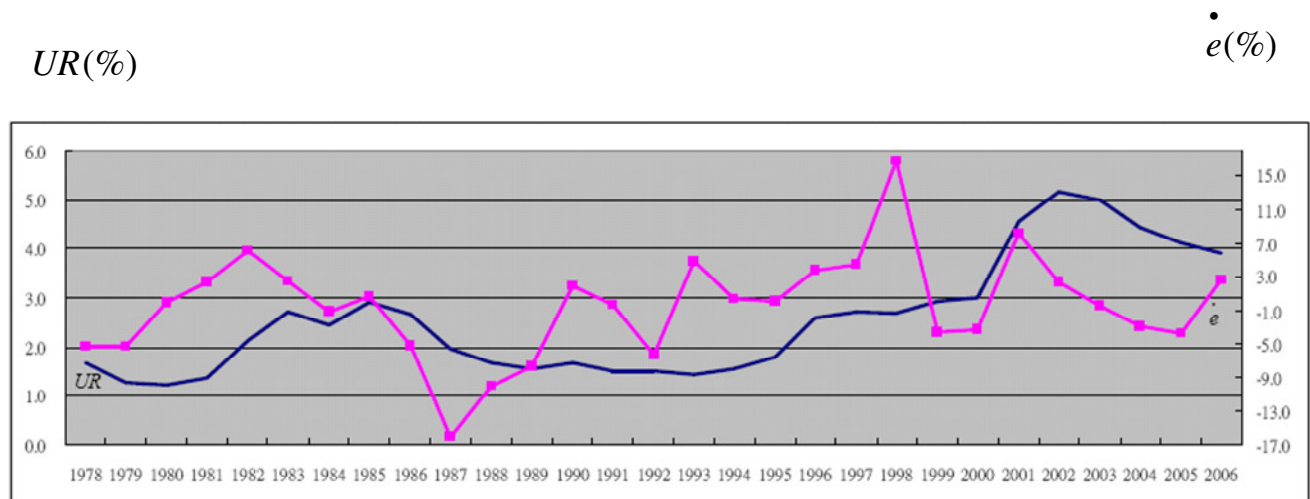

Figure 7. The relationship between Taiwan's unemployment rate UR and $\dot{e}$.

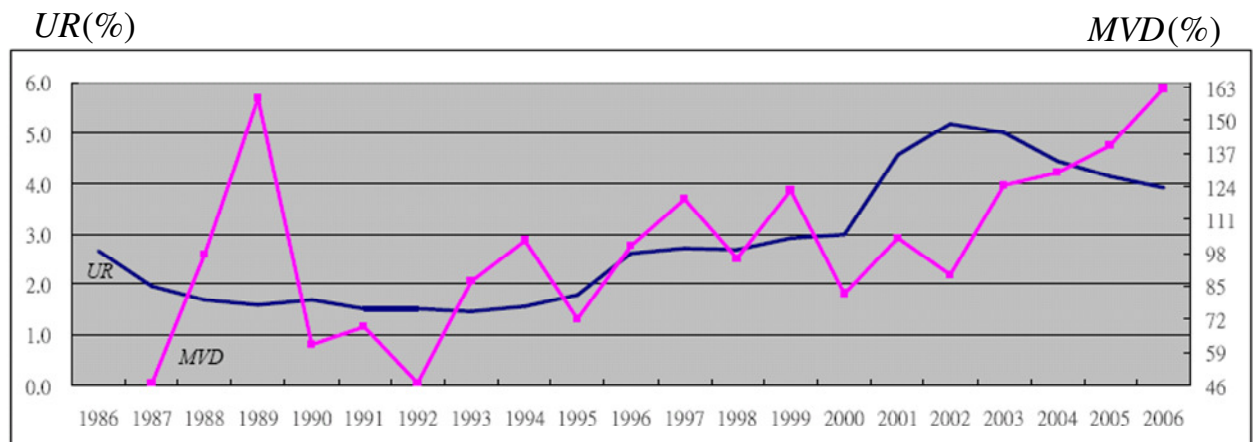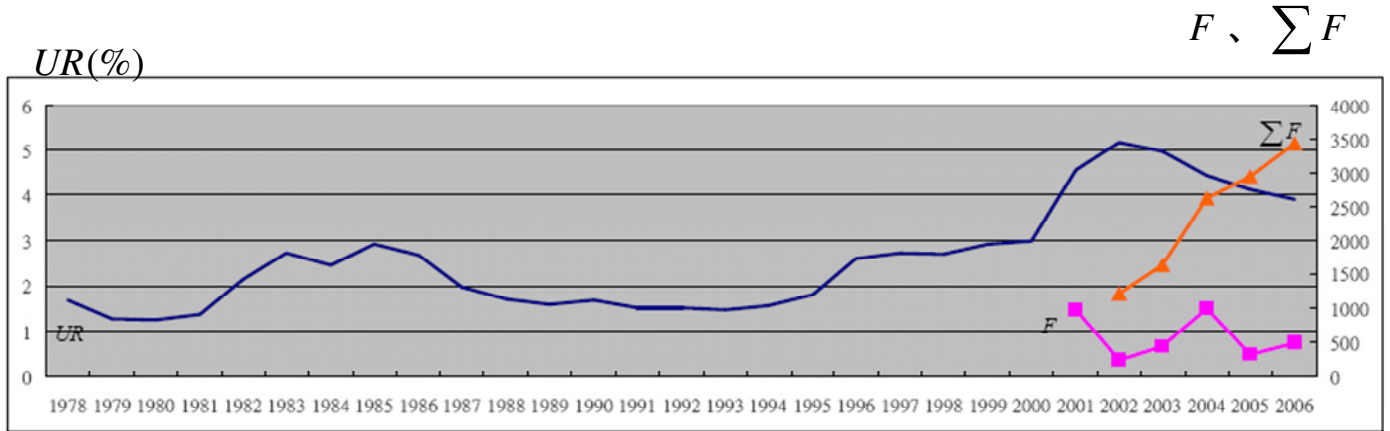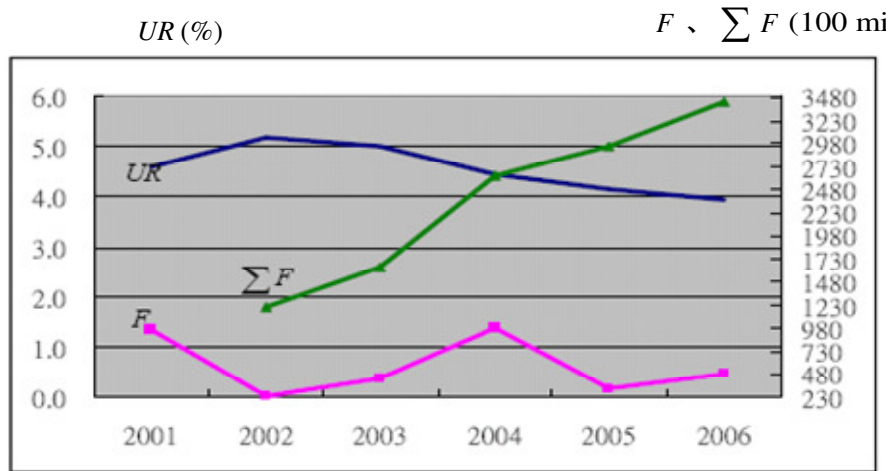$UR(\%)$ $MVD(\%)$

Figure 8. 1986 to 2006 period, the relationship between Taiwan's unemployment rate UR and MVD.
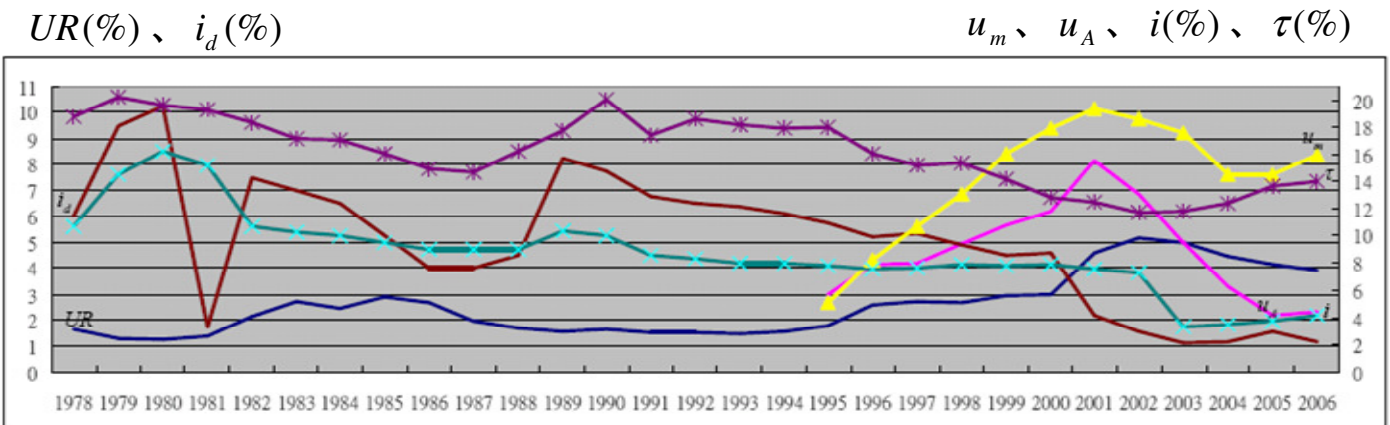
$F \, 、 \, \sum F$

UR(%)

Figure 9. The relationships between Taiwan's unemployment rate UR and the delisting market value of delisted companies F and its accumulated market value $\sum F$.

UR (%) $F \, 、 \, \sum F$ (100 mi

Figure 10. 2001 to 2006 period, the relationships between Taiwan's unemployment rate UR and F , $\sum F$.

$UR(\%) \, 、 \, i_d(\%)$ $u_m 、 \ u_A 、 \ i(\%) 、 \ \tau(\%)$

Figure 11. Taiwan unemployment rate UR and average financial institution's overall overdue ratio u_A, relatively high value of financial institution's overall overdue ratio u_m, deposit and loan interest rates i_d and i, as well as the effective tax rate τ .
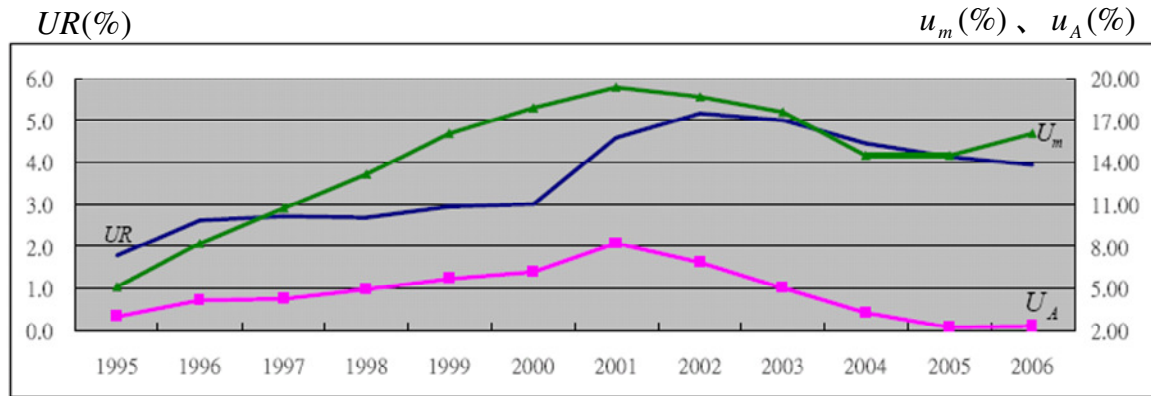
Figure 12. 1995 to 2006 period, Taiwan's unemployment rate UR and average financial institution's overall overdue ratio U_A and relatively high financial institution's overall overdue ratio U_m.

Equations 3 to 10 correlation coefficients imply the following:

(1) The increase or decrease of investment increase rate $\dot{I}_t$ and $\dot{I}_{t-1}$ of the current year and the preceding year is in a negative relationship with the current year's unemployment rate UR_t. In the 99% probability distribution, it is double-tail significant, which is in line with the theoretical propositions of John Maynard Keynes (1936) and Phelps (1994, 2004). The preceding year investment increase rate $\dot{I}_{t-1}$, and the current year UR_t is relatively correlated in more significant way.

(2) The employer wage income as a proportion of GDP in the current year and the preceding year W_t and W_{t-1} as well as their rate of change $\dot{W}_t$ and $\dot{W}_{t-1}$ are negatively correlated to the current year unemployment rate UR_t value; $\dot{W}_t$ is in a negative relationship with UR_t. In the 95% distribution probability, it is double-tail significant, which is in line with the theoretical propositions of Phelps (1994, 2004).

(3) The rate of changes $\dot{e}_t$ and $\dot{e}_{t-1}$ of the current year and the preceding year NTD against USD foreign exchange rate e are positively correlated to the current year unemployment rate UR_t value. This is not in line with the propositions of John Maynard Keynes(1936) that currency depreciation with $\dot{e}_t$ above 0 can increase effective exporting demands and create employment opportunities to lower unemployment rate and UR_t. However, this complies with the propositions and findings of Phelps (1994, 2004).

(4) The market value of listed stock as a proportion of GDP of the current year and the preceding year MVD_t and MVD_{t-1} are positively related to the current year unemployment rate while the current year MVD_t is positively related to UR_t. In the 95% probability distribution, it is double-tail significant, which is not in line with the proposition of Phelps (1994, 2004). However, the rate of change $\dot{MVD}_t$ and $\dot{MVD}_{t-1}$ are negatively related to UR_t, which is in line with the propositions of Phelps (1994, 2004). Taiwan's unemployment rate tends to grow in the long run. The long term growth of the market value of listed stock as a proportion of GDP does not help to lower long term unemployment rate. Namely, the rise of financial market value cannot help the structural employment opportunities in the real economic aspect in the long run. However, the rising rate of change at each short period will slightly help lower the unemployment rate of the period.

(5) The Taiwan stock index P_{st} and P_{st-1} of the current year and the preceding year are positively related to the current year unemployment rate UR_t. Being similar to MVD, it is not in line with the proposition of Phelps (1994, 2004). The rate of change $\dot{P}_{st}$ and $\dot{P}_{st-1}$, however, are negatively related to the current year unemployment rate UR_t, which is in line with the inferences and empirical findings of Phelps (1994, 2004).

(6) According to equations (3) to (10) that, correlation coefficients in between $\dot{I}_t$, $\dot{e}_t$, $\dot{W}_t$, $\dot{P}_{st}$, P_{st}, MVD_t, $\dot{MVD}_t$, except for the $r_{\dot{MVD},\dot{P}_s} = 0.633$ and $r_{MVD,P_S} = 0.509$,

are below 0.5 as not significant. There is no high homology in between the indicators, and thus they can be listed as explanatory variables. The matrix of correlation coefficients is as shown in Table 1.

THE REGRESSION ANALYSIS OF THE IMPACT OF MAJOR INDICATORS OF "INVESTMENT DRIVING FORCES" AND ITS ADDITION ON TAIWAN'S UNEMPLOYMENT RATE UR_t

Regarding the 29 years in the period of 1978 to 2006, we

used the four indicators of the "investment driving forces" as proposed by Phelps (2004) $\dot{I}_t$, $\dot{e}_t$, $\dot{W}_t$ and MVD_t or $\dot{MVD}_t$, P_{st} or $\dot{P}_{st}$, coupled with the FD_t "the virtual variable of the severity of economic damage by fraud listed companies" to explain the variable of Taiwan's unemployment rate UR_t. Due to the various lengths of sample data, we conducted statistical regression by segment to get the following results:

(1) 1988 to 2006 Period

$$UR_t = 3.224 - 0.06\dot{I}_t - 0.045\dot{e}_t - 0.406\dot{W}_t - 0.0001\dot{MVD}_t$$

$$\begin{array}{lllll} SE = 0.342 & SE = 0.025 & SE = 0.053 & SE = 0.182 & SE = 0.007 \\ t = 9.422 & t = -2.395 & t = -0.860 & t = -2.224 & t = -0.034 \\ & \beta = -0.535 & \beta = -0.212 & \beta = -0.507 & \beta = -0.007 \end{array}$$

$R^2 = 0.442$, $\bar{R}^2 = 0.271$, $F = 2.579$ (11)

(2) 1987 to 2006 Period

$$UR_t = 1.846 - 0.05\dot{I}_t - 0.037\dot{e}_t - 0.402\dot{W}_t + 0.013MVD_t$$

$$\begin{array}{lllll} SE = 0.9 & SE = 0.023 & SE = 0.041 & SE = 0.156 & SE = 0.008 \\ t = 2.052 & t = -2.213 & t = -0.89 & t = -2.574 & t = 1.612 \\ & \beta = -0.497 & \beta = -0.037 & \beta = -0.498 & \beta = 0.308 \end{array}$$

$R^2 = 0.538$, $\bar{R}^2 = 0.407$, $F = 4.083$ (12)

(3) 1988 to 2006 Period

$$UR_t = 2.536 - 0.064\dot{I}_{t-1} - 0.029\dot{e}_{t-1} - 0.321\dot{W}_{t-1} + 0.008MVD_{t-1}$$

$$\begin{array}{lllll} SE = 0.913 & SE = 0.023 & SE = 0.042 & SE = 0.158 & SE = 0.008 \\ t = 2.779 & t = -2.769 & t = -0.685 & t = -2.029 & t = 1.024 \\ & \beta = -0.624 & \beta = -0.155 & \beta = -0.394 & \beta = 0.196 \end{array}$$

$R^2 = 0.535$, $\bar{R}^2 = 0.402$, $F = 4.021$ (13)

$$UR_t = 1.074 - 0.056\dot{I}_{t-1} - 0.043\dot{e}_{t-1} - 0.164\dot{W}_t + 0.023MVD_t - 0.006\dot{P}_{st-1}$$

$$\begin{array}{llllll} SE = 0.761 & SE = 0.021 & SE = 0.044 & SE = 0.175 & SE = 0.007 & SE = 0.006 \\ t = 1.410 & t = -2.696 & t = -0.977 & t = -0.939 & t = 3.195 & t = -0.890 \\ & \beta = -0.546 & \beta = -0.230 & \beta = -0.204 & \beta = 0.540 & \beta = -0.212 \end{array}$$

$R^2 = 0.657$, $\bar{R}^2 = 0.525$, $F = 4.979$ (14)

(4) 1979 to 2006 Period

$$UR_t = 3.011 - 0.054\dot{I}_t - 0.028\dot{e}_t - 0.282\dot{W}_t - 0.002\dot{P}_{st}$$

$$\begin{array}{lllll} SE = 0.231 & SE = 0.016 & SE = 0.04 & SE = 0.095 & SE = 0.006 \\ t = 13.020 & t = -2.903 & t = -0.706 & t = -2.982 & t = -0.351 \\ & \beta = -0.533 & \beta = -0.15 & \beta = -0.471 & \beta = -0.70 \end{array}$$

$R^2 = 0.457$, $\bar{R}^2 = 0.359$, $F = 4.638$ (15)

(5) 1980 to 2006 Period

$$UR_t = 2.505 - 0.043\dot{I}_{t-1} - 0.004\dot{e}_{t-1} + 0.0001P_{st-1}$$

$$\begin{array}{llll} SE = 0.375 & SE = 0.018 & SE = 0.036 & SE = 0.0001 \\ t = 6.689 & t = -2.43 & t = -0.105 & t = 1.723 \\ & \beta = -0.498 & \beta = -0.020 & \beta = 0.275 \end{array}$$

$R^2 = 0.426$, $\bar{R}^2 = 0.327$, $F = 4.274$ (16)

$$UR_t = \quad 3.144 \quad - \quad 0.050\,\dot{I}_{t-1} \quad - \quad 0.014\,\dot{e}_{t-1} \quad - \quad 0.17\dot{W}_{t-1} \quad - \quad 0.003\dot{P}_{st-1} \quad \begin{matrix} R^2 = 0.425 \\ \overline{R}^2 = 0.320 \\ F = 4.060 \end{matrix} \quad (17)$$

$$\begin{matrix} SE = 0.238 & SE = 0.016 & SE = 0.041 & SE = 0.097 & SE = 0.006 \\ t = 13.2 & t = -3.092 & t = -0.332 & t = -1.746 & t = -0.448 \\ & \beta = -0.585 & \beta = -0.072 & \beta = -0.284 & \beta = -0.093 \end{matrix}$$

(6) 1988 to 2006 Period

$$UR_t = \quad 2.002 \quad - \quad 0.024\,\dot{I}_t \quad - \quad 0.01\,\dot{e}_t \quad - \quad 0.113\dot{W}_t \quad - \quad 0.001\,M\dot{V}D_t \quad + \quad 0.956FD_t \quad \begin{matrix} R^2 = 0.929 \\ \overline{R}^2 = 0.899 \\ F = 31.248 \end{matrix} \quad (18)$$

$$\begin{matrix} SE = 0.186 & SE = 0.01 & SE = 0.02 & SE = 0.075 & SE = 0.002 & SE = 0.106 \\ t = 10.78 & t = -2.306 & t = -0.486 & t = -1.5 & t = -0.223 & t = 9.044 \\ & \beta = -0.209 & \beta = -0.045 & \beta = -0.141 & \beta = -0.018 & \beta = 0.821 \end{matrix}$$

$$UR_t = \quad 2.449 \quad - \quad 0.022\,\dot{I}_{t-1} \quad + \quad 0.014\,\dot{e}_{t-1} \quad - \quad 0.068\dot{W}_t \quad - \quad 0.006MVD_t \quad + \quad 0.006\dot{P}_{st-1} \quad + \quad \begin{matrix} 1.050FD_t \\ SE = 0.149 \\ t = 7.029 \\ \beta = 0.957 \end{matrix} \quad \begin{matrix} R^2 = 0.933 \\ \overline{R}^2 = 0.899 \\ F = 27.829 \end{matrix} \quad (19)$$

$$\begin{matrix} SE = 0.401 & SE = 0.011 & SE = 0.022 & SE = 0.082 & SE = -0.006 & SE = 0.003 \\ t = 6.104 & t = -2.085 & t = 0.636 & t = -0.836 & t = -1.222 & t = 1.643 \\ & \beta = -0.218 & \beta = 0.074 & \beta = -0.085 & \beta = -0.154 & \beta = 0.204 \end{matrix}$$

(7) 1979 to 2006 Period

$$UR_t = \quad 2.225 \quad - \quad 0.029\,\dot{I}_t \quad - \quad 0.013\,\dot{e}_t \quad - \quad 0.14\dot{W}_t \quad + \quad 0.002\dot{P}_{st} \quad + \quad \begin{matrix} 0.853FD_t \\ SE = 0.080 \\ t = 10.622 \\ \beta = 0.750 \end{matrix} \quad \begin{matrix} R^2 = 0.915 \\ \overline{R}^2 = 0.895 \\ F = 45.133 \end{matrix} \quad (20)$$

$$\begin{matrix} SE = 0.119 & SE = 0.006 & SE = 0.016 & SE = 0.041 & SE = 0.002 \\ t = 18.633 & t = -4.543 & t = -0.787 & t = -3.442 & t = 0.855 \\ & \beta = -0.348 & \beta = -0.068 & \beta = -0.234 & \beta = 0.071 \end{matrix}$$

$$UR_t = \quad 2.363 \quad - \quad 0.027\,\dot{I}_{t-1} \quad + \quad 0.004\,\dot{e}_{t-1} \quad - \quad 0.026\dot{W}_t \quad - \quad 0.00000408P_{st-1} \quad + \quad \begin{matrix} 0.880FD_t \\ SE = 0.085 \\ t = 10.343 \\ \beta = 0.822 \end{matrix} \quad \begin{matrix} R^2 = 0.902 \\ \overline{R}^2 = 0.880 \\ F = 40.568 \end{matrix} \quad (21)$$

$$\begin{matrix} SE = 0.159 & SE = 0.008 & SE = 0.015 & SE = 0.051 & SE = 0.000 \\ t = 14.833 & t = -3.557 & t = 0.293 & t = -0.503 & t = -1.282 \\ & \beta = -0.316 & \beta = 0.023 & \beta = -0.042 & \beta = -0.098 \end{matrix}$$

According to the estimation results of the afore-mentioned 11 regression equations, the analysis of the regression relationships between the major indicators of "investment driving forces" proposed by Phelps et al. (1994, 2004)
coupled with the delisting market value of delisted companies F_t and its accumulated value $\sum F_t$ as well as the indicator of economic harm severity FD_t on Taiwan's unemployment rate in the period of 1978-2006 or the period of 1988-2006 can get the following results:

(1) The rise of the current and previous stage investment increase rate $\dot{I}_t$ and $\dot{I}_{t-1}$, and the change increase rate of employer wage as a proportion of GDP $\dot{W}_t$ and $\dot{W}_{t-1}$ will lower the change in Taiwan's unemployment rate UR_t. And both of them are double-tail significant in case of about 95 to 99% probability distribution, which is in line with the theoretical propositions of Phelps (1994, 2004).

(2) The current stage NTD/USD currency depreciation rate of change $\dot{e}_t$ will lower Taiwan's unemployment rate UR_t. This regression coefficient is not double-tail significant above 90%, rather it is a consistent negative value, complying with the theoretical propositions of John Maynard Keynes (1936) but differing from the arguments and empirical findings of Phelps (1994, 2004). However, the impact of the previous stage currency depreciation rate of change $\dot{e}_{t-1}$ on UR_t may be positive or negative at an insignificant level.

(3) In the regression equations (18) and (19) of higher explanatory capability, the impact of the current period market value of listed stocks as a proportion of GDP MVD_t and its rate of change $M\dot{V}D_t$ on Taiwan unemployment rate UR_t is negative, indicting it helps reduce unemployment rate. This is in line with the theoretical arguments and empirical findings of Edmund S. Phelps (1994, 2004), although at an insignificant level.

Table 1. Pearson correlation coefficients of various explanatory variables of this article indicate that they are not collinear.

	Correlation	$\dot{I}$	$\dot{e}$	$\dot{W}$	$\dot{P}_s$	P_s	$\dot{MVD}$	MVD
$\dot{I}$	Pearson correlation	1	-0.35666579	0.034475642	0.4034201	-0.03740714	0.101325657	-0.147534133
	Sig. (2-tailed)		0.146262121	0.891974216	0.09688998	0.88284619	0.689113439	0.55907918
	N	18	18	18	18	18	18	18
$\dot{e}$	Pearson Correlation	-0.35666579	1	-0.3941731	-0.48811372	0.0570393	-0.236782937	-0.154302651
	Sig. (2-tailed)	0.14626212		0.105533371	0.03986812	0.82213003	0.344142048	0.540979895
	N	18	18	18	18	18	18	18
$\dot{W}$	Pearson Correlation	0.03447564	-0.3941731	1	0.25375235	0.21511016	0.163192028	0.00508062
	Sig. (2-tailed)	0.89197422	0.105533371		0.30960723	0.3913251	0.517619395	0.984037198
	N	18	18	18	18	18	18	18
$\dot{P}_s$	Pearson Correlation	0.4034201	-0.48811372	0.253752349	1	0.2036375	0.633081058	0.341408906
	Sig. (2-tailed)	0.09688998	0.039868121	0.309607235		0.4176635	0.004800119	0.165572438
	N	18	18	18	18	18	18	18
P_s	Pearson Correlation	-0.03740714	0.057039298	0.215110163	0.2036375	1	-0.134897497	0.508667318
	Sig. (2-tailed)	0.88284619	0.822130026	0.391325102	0.4176635		0.593560318	0.031108937
	N	18	18	18	18	18	18	18
$\dot{MVD}$	Pearson Correlation	0.10132566	-0.23678294	0.163192028	0.63308106	-0.1348975	1	0.481561348
	Sig. (2-tailed)	0.68911344	0.344142048	0.517619395	0.00480012	0.59356032		0.043023253
	N	18	18	18	18	18	18	18
MVD	Pearson Correlation	-0.14753413	-0.15430265	0.00508062	0.34140891	0.50866732	0.481561348	1
	Sig. (2-tailed)	0.55907918	0.540979895	0.984037198	0.16557244	0.03110894	0.043023253	
	N	18	18	18	18	18	18	18

*Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

(4) Since the impact of $\dot{MVD}_t$ on the unemployment rate UR_t is slight, we use rate of change $\dot{P}_{st}$ and $\dot{P}_{st-1}$ of Taiwan's Weighted Stock Index P_{st} as the alternative regression variable of $\dot{MVD}_t$. In the regression Equations (19) and (20) of higher explanatory capability $\overline{R}^2$, it can be learnt that the impact of the change in Taiwan Weighted Stock Index on the unemployment rate is positive, indicating it can improve unemployment rate. However, it is not statistically significant. In addition, the regression Equation (21)

adopts the level of P_{st-1} as the explanation variable. Its impact on UR_t is negative and can help reduce the unemployment rate. However, the coefficient value is slight and is double-tail significant in case of probability distribution of 85 to 90%. Hence, the short term changes in stock index or market value of the "virtual" financial perspective can affect the "real" economic perspective in a limited way. The positive expectation on lowering the unemployment rate can never be overestimated.

(5) It is particularly worth mentioning, the impact of the proposed FD_t indicator on the Taiwan unemployment rate UR_t is far reaching and significant. As shown in Equations (18) to (21): the impact coefficient of FD_t on UR_t is around 0.853 to 1.050% and the t value is double-tail significant in case of 99.9% probability distribution. Comparing the regression results in case of taking into consideration of FD_t or not, the explanatory capability $\overline{R}^2$ of the regression equations (11) to (17) is rising from 40 to 52.5% to about 90% of Equations (18) and (21) in most cases.

EMPIRICAL ESTIMATION OF THE IMPACT OF THE DELISTING MARKET VALUE OF DELISTED COMPANIES AND FINANCIAL INSTITUTION'S OVERALL OVERDUE RATIO ON TAIWAN'S OVERALL UNEMPLOYMENT RATE

The FD_t indicator described as is significant in explaining changes in Taiwan's unemployment rate. It is above 99.9% probability distribution and is double-tail significant. Due to its importance, it is added into the four indicators of "investment driving forces" proposed by Phelps (2004).

Similar to FD_t, the rising financial institution's overall overdue ratio will lead to the delisting and bankruptcy of fraud companies in Taiwan and high non-performing debt crisis of the financial institutions as well as the losing overall economic competitiveness and capabilities. The closedown and losing business opportunities will ultimately increase Taiwan's unemployment rate, deteriorating poverty and the desperation of life.

We calculated the correlation coefficients of Taiwan's unemployment rate UR_t and the delisting market value of the delisted companies in Taiwan F_{t-1} in the period of 2002 to 2006, correlation coefficients of the average financial institution's overall overdue ratio U_{At} and the higher value U_{mt} and UR_t in the period from 1995 to 2005 as well as the statistical regression equations. The findings are all in line with the aforementioned inference arguments:

2002 to 2006 Period

$$r_{UR_t,F_{t-1}} = 0.133 > 0$$
(P=0.831)   (22)

1995 to 2006 Period

$$r_{UR_t,U_{At}} = 0.278 > 0 \ ; \ r_{UR_t,U_{mt}} = 0.775^{**} > 0$$
(P=0.382)   (P=0.003)   (23)

$$r_{UR_t,U_{At-1}} = 0.587 > 0 \ ; \ r_{UR_t,U_{mt-1}} = 0.855^{**} > 0$$
(P=0.058)   (P=0.001)   (24)

We selected the above U_{mt}, U_{At-1} and U_{mt-1} of higher correlation coefficients with UR_t as the Shih variables to conduct the regression analysis of UR_t:

$$
\begin{array}{llll}
UR_t = & 0.810 & + & 0.194U_{mt} \\
& SE = 0.744 & & SE = 0.050 \\
& t = 1.089 & & t = 3.875 \\
& & & \beta = 0.775
\end{array}
\quad ; \quad
\begin{array}{l}
R^2 = 0.60 \\
\overline{R}^2 = 0.56 \\
F = 15.013
\end{array}
\quad (25)
$$

$$
\begin{array}{llll}
UR_t = & 2.154 & + & 0.326U_{At-1} \\
& SE = 0.772 & & SE = 0.150 \\
& t = 2.788 & & t = 2.173 \\
& & & \beta = 0.587
\end{array}
\quad
\begin{array}{l}
R^2 = 0.344 \\
\overline{R}^2 = 0.271 \\
F = 4.724
\end{array}
\quad (26)
$$

$$
\begin{array}{llll}
UR_t = & 1.131 & + & 0.184U_{mt-1} \\
& SE = 0.552 & & SE = 0.037 \\
& t = 2.050 & & t = 4.946 \\
& & & \beta = 0.855
\end{array}
\quad
\begin{array}{l}
R^2 = 0.731 \\
\overline{R}^2 = 0.701 \\
F = 24.463
\end{array}
\quad (27)
$$

The estimation results as shown in Equations. 22 to 27 furthermore proved that the propositions of this paper are statistically significant. Namely, the rising F_{t-1}, U_{At}, U_{At-1}, U_{mt}, U_{mt-1} will worsen investment driving forces, economic power and employment opportunities, but increase unemployment rate.

The data of variables F_t, $\sum F_t$, U_{At}, U_{mt} and their relationships with UR_t are as shown in Appendix 2 and Figures 1 to 12.

CONCLUSIONS AND MAJOR FINDINGS

The major findings of this paper are as follows:

(1) Continuously growing investment increase rate $\overset{\centerdot}{i}_t$ can effectively lower the overall unemployment rate.

The empirical results in Taiwan are in line with the theoretical propositions of John Maynard Keynes (1936) and Phelps (1994, 2004).

(2) The rising employee wage income as a proportion of GDP W and the its rate of change $\overset{\centerdot}{W}$ can actually reflect and measure the decrease in overall unemployment rate, which is also in line with the theoretical proposition of Phelps (1994, 2004).

(3) The current period rate of NTD depreciation can lower Taiwan's unemployment rates.

However, the results are consistent, and complying with the propositions of John Maynard Keynes (1936).

(4) According to the regression estimation equation of higher explanatory power that the current period and previous period market value of listed stocks as a proportion of GDP and their alternative variables P_{st-1} and $\overset{\centerdot}{MVD}_t$ affect Taiwan's unemployment rate negatively, which can help reduce the unemployment rate. This is in line with the proposition of Phelps (1994, 2004) despite of being at an insignificant level.

(5) According to the regression estimation equation of higher explanatory power, the rise of the rate of change $\overset{\centerdot}{P}_{st}$ and $\overset{\centerdot}{P}_{st-1}$ of the dramatically changing Weighted Stock Index P_{st} affects Taiwan's unemployment rate positively to increase unemployment rate at an insignificant statistical level.

(6) The FD_t indicator proposed in this paper has a significant impact on the deterioration of Taiwan's unemployment rate and it is double-tail significant at 99.9% probability distribution.

(7) The maximum and average values of the financial institution's overall overdue ratio has a significant impact on the deterioration of Taiwan's unemployment rate, and it is double-tail significant at 95 to 99% probability distribution.

POLICY RECOMMENDATIONS

Based on the research findings, the paper proposes the following policy recommendations:

(1) The government policy makers should constantly improve the overall investment environment to keep the steady growth of domestic investment increase rate.

(2) The government policy makers should address the long term steady growth of employee wage income as a proportion of GDP and its rate of change to judge whether the unemployment rate increases or decreases?

(3) The government policy makers should be optimistic about the currency depreciation after economic decline as it can help reduce overall unemployment rate.

(4) The government policy makers should develop the capital market in a sound and stable way to improve the market value of the investment assets, increase business investment and lower unemployment rate. However, if the capital market is infused with insider transactions, investment uncertainty and fraud companies making false accounts, the stock prices will fluctuate dramatically, which is adverse to the business investment and employment environment.

(5) Government policy makers should be aware of the impact of rising severity of economic damage FD_t of the delisting market value of the delisted companies and the financial institution overall overdue ratio on the deterioration of Taiwan's unemployment rate. The top priority is that the government should improve the overall investment environment, seriously review the qualifications of the listed companies, strictly manage and supervise financial institutions and the management, finances, internal control and integrity of listed companies as well as teach the business the golden mean way of doing business.

REFERENCES

Chen CN (1973). The Monetary Effect of Devaluation. An Alternative Interpretation of the Cooper Paradox. West. Econ. J., (11): 475-480.

Cooper RN (1971). Currency Devaluation in Developing Countries. Princeton Essays in International Finance, No. 86, Princeton.

Hoon HT, Phelps ES (1992). "Macroeconomic Shocks in a Dynamized Model of the Natural Rate of Unemployment." Am. Econ. Rev., 82(4): 889-900.

Phelps ES (1994). Structural Slumps. The Modern Equilibrium Theory of Unemployment, Interest, and Assets. Cambridge. MA: Harvard University Press.

Phelps ES, Zoega G (1998). Natural Rate Theory and Europe's Unemployment. Econ. J. 108(448):782-801

Phelps ES, Hian TH, Gylfi Z (2004). The Structuralist Perspective on Real Exchange Rate. Share Price Level and Employment Path. What Room is Left for Money? New School.

Wang, CY, FS Wang (1985). Currency Devaluation and the Cooper Paradox in the Open-Economy. Marcro-Disequilibrium Model. J. World Econ. Heft, (4): 628-637.