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
arguing to use the following variables as economic
proposed the concept of "investment driving forces",
in December, 2004. At that lecture, Edmund S. Phelps
Edmund S. Phelps, Nobel Prize Laureate of Economics
UNEMPLOYMENT RATE
"INVESTMENT DRIVING FORCES" ON
unemployment rate.
the previously mentioned 6 indicators on the Taiwan's
management or for false accounting practices, deceitful
delisted companies (that is, due to closing down for poor
included, such as (5) the severity of market values of
more (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 perform-
ance, which may ultimately be reflected in the employ-
ment 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 \(i_t\) : 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 \(c_{t'}\) : 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 produc-
tion 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 \(W_{t'}\) : it continuously and positively
grows; it indicates the continuous growth of margin pro-
duction of the employees. In addition to keep the original
working opportunities, it can create new employment
opportunities. As the enterprises continue to expand pro-
duction, it corresponds to lower overall unemployment
rate. Conversely, if \(W_{t'}\) 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 \(M_{t'}\) : 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. Con-
versely, if \(M_{t'}\) 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 \( F_i \)”. The bigger \( F_i \) 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 \( F_i \) 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 \( F_i \) value is smaller or even the \( F_i \) 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 \( FD_i \) 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 \( FD_i \) value as 1. From 2001 to 2002, the market value of delisted companies increased abruptly from 971.11 million to 240.03 million NTD. As a result, we assume the \( FD_i \) 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 \( FD_i \) 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:

\[
UR = f(I_i, e_i, W_i, MVD_i, FD_i); \\
\frac{\partial UR}{\partial I_i} < 0, \frac{\partial UR}{\partial e_i} > 0, \frac{\partial UR}{\partial W_i} < 0, \frac{\partial UR}{\partial MVD_i} < 0, \frac{\partial UR}{\partial FD_i} > 0
\]

(1)

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

\[
UR = \alpha_0 + \alpha_1 I_i + \alpha_2 e_i + \alpha_3 W_i + \alpha_4 MVD_i + \alpha_5 FD_i; \\
\alpha_0 > 0, \alpha_1 < 0, \alpha_2 > 0, \alpha_3 < 0, \alpha_4 < 0, \alpha_5 > 0
\]

(2)

Appendices 1 and 2 illustrate the unemployment rate \( UR \), the five indicators \( I_i, e_i, W_i, MVD_i, FD_i \);

Taiwan Weighted Stock Index \( P_{st} \), \( P_{st} \), the accumulated value of the delisting market value of fraud companies \( \sum F_i \), the average financial institution overdue ratio \( UR \), and the relatively high financial institution overdue ratio \( UR \) 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 AND MAJOR INDICATORS OF “INVESTMENT DRIVING FORCES”**

In the 29 years period of 1978 to 2006, the correlation coefficients of Taiwan’s unemployment rate \( UR \), and the major indicators of “investment driving forces” as proposed by Phelps (2004) including the investment increase rate \( I \), the rate of change of forex rate \( e \), the rate of change of employee’s wage income as a proportion of GDP \( e \), the rate of change of market value of listed stock as a proportion of GDP \( MVD \)

\[
MVD, Taiwan Weighted Stock Index \ P_{st} \ and its rate of changes \ P_{st} \ are as follows:
\]

\[
r_{UR,I} = -0.488^{**}; r_{UR,e} = -0.585^{**} \quad (P=0.008) \quad (P=0.001)
\]

(3)

\[
r_{UR,W_i} = -0.194; r_{UR,W_{st}} = -0.019 \quad (P=0.314) \quad (P=0.923)
\]

(4)

\[
r_{UR,e_i} = -0.414^{**}; r_{UR,e_{st}} = -0.263 \quad (P=0.26) \quad (P=0.177)
\]

(5)

\[
r_{UR,MVD} = 0.462^{**}; r_{UR,MVD_{st}} = 0.357 \quad (P=0.04) \quad (P=0.133)
\]

(7)

**1987 to 2006 Period**

\[
r_{UR,MVD} = 0.462^{**}; r_{UR,MVD_{st}} = 0.357 \quad (P=0.04) \quad (P=0.133)
\]
Figure 1. The relationship between Taiwan’s unemployment rate $UR$ and $W_t$, $I_t$ and $e_t$ as proposed by Phelps (2004).

Figure 2. The relationships between Taiwan’s unemployment rate $UR$ and $W_t$, $MVD_t$ and $P_t$ as proposed by Phelps (2004).

1988 to 2006 Period

\[
\begin{align*}
  r_{UR,MVD} & = -0.090 ; r_{UR,MVD_{t-1}} = -0.192 \\
  r_{UR,P_t} & = -0.186 ; r_{UR,P_{t-1}} = -0.282 \\
  r_{UR,P_t} & = 0.315 ; r_{UR,P_{t-1}} = 0.346 \\
  (P=0.097) & \quad (P=0.071) \\
  (P=0.713) & \quad (P=0.445) \\
  (P=0.343) & \quad (P=0.154)
\end{align*}
\]
Figure 3. The relationship between Taiwan’s unemployment rate $UR$ and Taiwan composite stock index $P_s$.

Figure 4. The relationship between Taiwan’s unemployment rate $UR$ and investment growth rate $I$.

Figure 5. The relationship between Taiwan’s unemployment rate $UR$ and $W$. 
Figure 6. The relationship between Taiwan’s unemployment rate \( UR \) and \( W \).

Figure 7. The relationship between Taiwan’s unemployment rate \( UR \) and \( e \).

Figure 8. 1986 to 2006 period, the relationship between Taiwan’s unemployment rate \( UR \) and \( MVD \).
Figure 9. The relationships between Taiwan’s unemployment rate $UR$ and the delisting market value of delisted companies $F$ and its accumulated market value $\sum F$.

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

Figure 11. Taiwan unemployment rate $UR$ and average financial institution’s overall overdue ratio $u_m$, relatively high value of financial institution’s overall overdue ratio $u_A$, deposit and loan interest rates $i_d$ and $i$, as well as the effective tax rate $\tau$. 
Equations 3 to 10 correlation coefficients imply the following:

1. The increase or decrease of investment increase rate $I_t$ and $I_{t-1}$ 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 $I_{t-1}$, 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 $\epsilon_t$ and $\epsilon_{t-1}$ 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 $\epsilon_t$ 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 $P_t$ and $P_{t-1}$ of the current year and the preceding year are positively related to the current year unemployment rate $UR_t$. Being similar to $MVD_t$, it is not in line with the proposition of Phelps (1994, 2004). The rate of change $\dot{P}_t$ and $\dot{P}_{t-1}$, 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 $I_t$, $\epsilon_t$, $\dot{W}_t$, $\dot{P}_t$, $MVD_t$, $\dot{MVD}_t$, except for the $r_{MVD,P_t} = 0.633$ and $r_{MVD,P_{t-1}} = 0.509$,
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) \( I_t, e_t, W_t \) and \( MVD_t \) or \( MVD_{st}, P_{st} \) or \( P_{st} \), 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

\[
UR_t = 3.224 - 0.066 I_t - 0.045 e_t - 0.406 W_t - 0.0001 MVD_t, R^2 = 0.442
\]

\[
| SE = 0.342 | SE = 0.025 | SE = 0.053 | SE = 0.182 | SE = 0.007 | R^2 = 0.271 |
| \beta = -0.535 | \beta = -0.212 | \beta = -0.507 | \beta = -0.007 |
\]

(2) 1987 to 2006 Period

\[
UR_t = 1.846 - 0.05 I_t - 0.037 e_t - 0.402 W_t + 0.013 MVD_t, R^2 = 0.538
\]

\[
| SE = 0.9 | SE = 0.023 | SE = 0.041 | SE = 0.156 | SE = 0.008 | R^2 = 0.407 |
| \beta = -0.497 | \beta = -0.037 | \beta = -0.498 | \beta = 0.308 |
\]

(3) 1988 to 2006 Period

\[
UR_t = 2.536 - 0.064 I_{t-1} - 0.029 e_{t-1} - 0.321 W_{t-1} + 0.008 MVD_{t-1}, R^2 = 0.535
\]

\[
| SE = 0.913 | SE = 0.023 | SE = 0.042 | SE = 0.158 | SE = 0.008 | R^2 = 0.402 |
| \beta = -0.624 | \beta = -0.155 | \beta = -0.394 | \beta = 0.196 |
\]

(4) 1979 to 2006 Period

\[
UR_t = 1.074 - 0.056 I_{t-1} - 0.043 e_{t-1} - 0.164 W_{t-1} + 0.023 MVD_{t-1} - 0.006 P_{st-1}, R^2 = 0.657
\]

\[
| SE = 0.761 | SE = 0.021 | SE = 0.044 | SE = 0.175 | SE = 0.007 | SE = 0.006 | R^2 = 0.525 |
| \beta = -0.546 | \beta = -0.230 | \beta = -0.204 | \beta = 0.540 | \beta = -0.212 |
\]

(5) 1980 to 2006 Period

\[
UR_t = 2.505 - 0.043 I_{t-1} - 0.004 e_{t-1} + 0.0001 P_{st-1}, R^2 = 0.426
\]

\[
| SE = 0.375 | SE = 0.018 | SE = 0.036 | SE = 0.0001 | R^2 = 0.327 |
| \beta = -0.498 | \beta = -0.202 | \beta = 0.275 |
\]
According to the estimation results of the aforementioned 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 $F$, and its accumulated value $\sum F$, as well as the indicator of economic harm severity $FD$, 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 $i_t$ and $i_{t-1}$, 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 $e_t$ 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 $e_{t-1}$ 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 $MVD$, and its rate of change $\dot{MVD}$ on Taiwan unemployment rate $UR_t$ is negative, indicating 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>
<thead>
<tr>
<th>$UR_t$</th>
<th>$-0.050 \dot{i}_{t-1}$</th>
<th>$0.014 \dot{W}_{t-1}$</th>
<th>$0.17 \dot{W}_t$</th>
<th>$0.003 \dot{P}_{s-1}$</th>
<th>$R^2 = 0.425$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SE = 0.238$</td>
<td>$SE = 0.016$</td>
<td>$SE = 0.041$</td>
<td>$SE = 0.097$</td>
<td>$SE = 0.006$</td>
<td>$t = 13.2$</td>
</tr>
</tbody>
</table>

| $t = -3.092$ | $t = -0.332$ | $t = -1.746$ | $t = -0.448$ | $F = 4.060$ |

| $\beta = -0.585$ | $\beta = -0.072$ | $\beta = -0.284$ | $\beta = -0.093$ |

(6) 1988 to 2006 Period

<table>
<thead>
<tr>
<th>$UR_t$</th>
<th>$0.024 \dot{i}_t$</th>
<th>$0.014 \dot{e}_{t-1}$</th>
<th>$0.113 \dot{W}_t$</th>
<th>$0.001 \dot{MVD}_t$</th>
<th>$0.956FD_t$</th>
<th>$R^2 = 0.929$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SE = 0.186$</td>
<td>$SE = 0.01$</td>
<td>$SE = 0.02$</td>
<td>$SE = 0.075$</td>
<td>$SE = 0.002$</td>
<td>$SE = 0.106$</td>
<td>$t = 10.78$</td>
</tr>
</tbody>
</table>

| $t = -2.306$ | $t = -0.486$ | $t = -1.5$ | $t = -0.223$ | $t = 9.044$ | $\beta = -0.209$ | $\beta = -0.045$ | $\beta = -0.141$ | $\beta = -0.018$ | $\beta = 0.821$ | $t = 31.248$ |

(7) 1979 to 2006 Period

<table>
<thead>
<tr>
<th>$UR_t$</th>
<th>$0.029 \dot{i}_t$</th>
<th>$0.013 \dot{e}_t$</th>
<th>$0.14 \dot{W}_t$</th>
<th>$0.002 \dot{P}_{s-1}$</th>
<th>$0.853FD_t$</th>
<th>$R^2 = 0.915$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SE = 0.119$</td>
<td>$SE = 0.006$</td>
<td>$SE = 0.016$</td>
<td>$SE = 0.041$</td>
<td>$SE = 0.002$</td>
<td>$SE = 0.080$</td>
<td>$t = 18.633$</td>
</tr>
</tbody>
</table>

| $t = -4.543$ | $t = -0.787$ | $t = -3.442$ | $t = 0.855$ | $t = 10.622$ | $\beta = -0.348$ | $\beta = -0.068$ | $\beta = -0.234$ | $\beta = 0.071$ | $\beta = 0.750$ | $F = 45.133$ |

<table>
<thead>
<tr>
<th>$UR_t$</th>
<th>$0.027 \dot{i}_{t-1}$</th>
<th>$0.004 \dot{e}_{t-1}$</th>
<th>$0.026 \dot{W}_t$</th>
<th>$0.00000408 \dot{P}_{s-1}$</th>
<th>$0.880FD_t$</th>
<th>$R^2 = 0.902$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$SE = 0.159$</td>
<td>$SE = 0.008$</td>
<td>$SE = 0.015$</td>
<td>$SE = 0.051$</td>
<td>$SE = 0.000$</td>
<td>$SE = 0.085$</td>
<td>$t = 14.833$</td>
</tr>
</tbody>
</table>

| $t = -3.557$ | $t = 0.293$ | $t = -0.503$ | $t = -1.282$ | $t = 10.343$ | $\beta = -0.316$ | $\beta = 0.023$ | $\beta = -0.042$ | $\beta = -0.098$ | $\beta = 0.822$ | $F = 40.568$ |
Table 1. Pearson correlation coefficients of various explanatory variables of this article indicate that they are not collinear.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>$I$</th>
<th>$e$</th>
<th>$W$</th>
<th>$P_s$</th>
<th>$s$</th>
<th>MVD</th>
<th>MVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>-0.35666579</td>
<td>0.034475642</td>
<td>0.4034201</td>
<td>-0.03740714</td>
<td>0.101325657</td>
<td>-0.147534133</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.14626212</td>
<td>0.891974216</td>
<td>0.09688998</td>
<td>0.88284619</td>
<td>0.689113439</td>
<td>0.55907918</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>

| Pearson Correlation | -0.35666579 | 1    | -0.3941731 | -0.48811372 | 0.0570393 | -0.236782937 | -0.154302651 |
| Sig. (2-tailed) | 0.14626212 | 0.10553371 | 0.03986812 | 0.82213003 | 0.344142048 | 0.540978985 |
| N          | 18   | 18   | 18   | 18    | 18   | 18   | 18   |

| Pearson Correlation | 0.03447564 | -0.3941731 | 1    | 0.25375235 | 0.21511016 | 0.163192028 | 0.00508062 |
| Sig. (2-tailed) | 0.89197422 | 0.10553371 | 0.30960723 | 0.3913251 | 0.517619395 | 0.984037198 |
| N          | 18   | 18   | 18   | 18    | 18   | 18   | 18   |

| Pearson Correlation | 0.4034201 | -0.48811372 | 0.253752349 | 1     | 0.2036375 | 0.633081058 | 0.341408906 |
| Sig. (2-tailed) | 0.9688998 | 0.03986812 | 0.309607235 | 0.4176635 | 0.004800119 | 0.165572438 |
| N          | 18   | 18   | 18   | 18    | 18   | 18   | 18   |

| Pearson Correlation | -0.03740714 | 0.0570393 | 0.21511016 | 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   |

| Pearson Correlation | 0.10132566 | -0.23678294 | 0.163192028 | 0.63308106 | -0.134897975 | 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   |

| Pearson Correlation | -0.14753413 | -0.15430265 | 0.00508062 | 0.34140891 | 0.50866732 | 0.481561348 | 1     |
| Sig. (2-tailed) | 0.55907918 | 0.540978985 | 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 $\cdot MVD\cdot$ on the unemployment rate $\cdot UR\cdot$ is slight, we use rate of change $\cdot P_s\cdot$ and $\cdot P_{s-1}\cdot$ of Taiwan's Weighted Stock Index $\cdot P_s\cdot$ as the alternative regression variable of $\cdot MVD\cdot$. In the regression Equations (19) and (20) of higher explanatory capability $\cdot R^2\cdot$, 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 $P_{a-1}$ 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 0.85 to 1.05% 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 $\bar{R}^2$ 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 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) \hspace{1cm} (22)

1995 to 2006 Period

$$ r_{UR_t, U_{At-1}} = 0.278 > 0 ; \ r_{UR_t, U_{mt}} = 0.775** > 0 $$

(P=0.382) \hspace{0.5cm} (P=0.003) \hspace{1cm} (23)

$$ r_{UR_t, U_{At-1}} = 0.587 > 0 ; \ r_{UR_t, U_{mt}} = 0.855** > 0 $$

(P=0.058) \hspace{0.5cm} (P=0.001) \hspace{1cm} (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 $UR_t$:

$$ UR_t = 0.810 + 0.194U_{mt}$$

$$ SE = 0.744 \hspace{1cm} SE = 0.050 \hspace{1cm} R^2 = 0.60 \hspace{1cm} (25)$$

$$ t = 1.089 \hspace{1cm} t = 3.875 \hspace{1cm} F = 15.013 $$

$$ \beta = 0.775 $$

$$ UR_t = 2.154 + 0.326U_{At-1}$$

$$ SE = 0.772 \hspace{1cm} SE = 0.150 \hspace{1cm} R^2 = 0.344 \hspace{1cm} (26)$$

$$ t = 2.788 \hspace{1cm} t = 2.173 \hspace{1cm} F = 4.724 $$

$$ \beta = 0.587 $$

$$ UR_t = 1.131 + 0.184U_{mt-1}$$

$$ SE = 0.552 \hspace{1cm} SE = 0.037 \hspace{1cm} R^2 = 0.731 \hspace{1cm} (27)$$

$$ t = 2.050 \hspace{1cm} t = 4.946 \hspace{1cm} F = 24.463 $$

$$ \beta = 0.855 $$

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 $\dot{i}$, 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 $\dot{W}$ 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 $P_{t-1}$ and $MVD_t$, 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 $\dot{P}_t$ and $\dot{P}_{t-1}$ of the dramatically changing Weighted Stock Index $P_t$ 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**


