

DOES DEFENCE SPENDING MATTER TO EMPLOYMENT IN TAIWAN?^{*}

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This paper investigates an important but neglected issue regarding the economic role of defence spending on employment in Taiwan. The study herein adopts official time series data of yearly defence spending, employment in the private sector, GDP, average monthly salary from 1966 to 2002, and the Autoregressive Distributed Lag (ARDL) approach to the cointegration proposed by Pesaran and Shin (1998) and Pesaran *et al.* (2001). The main finding of this study is that defence spending is able to benefit the employment situation in the long run, but damages employment in the short run, which is reasonable but different from the finding in Turkey provided by Yildirim and Sezgin (2003). In addition, the change in real GDP has a positive and significant influence on employment in both the short run and long run

Keywords: Defence spending; Employment; Real monthly salary; Taiwan

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INTRODUCTION

In the face of China's possible military ambitions, Taiwan's military spending is now US\$8 billion a year, half of which is used for personnel expenses. However, Taiwan's defence spending has fallen over the past decade from 4.2% to 2.6% of its gross domestic product, or economic output.¹ At the same time, the rate of China's military expansion has been steadily

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¹The reason for this consequence is probably that Taiwan is shirking some of the burden of defending the island, trusting that a US security guarantee is sufficient to deter any attack by China, and also more than 90% of Taiwanese think the chances of a Chinese attack are low, making it difficult for legislators to allot more money for defence.

increasing over the past 10 years, and it plans to increase its defence spending to about US\$25–37 billion in 2004, at a growth rate of 11.6%.

The impact of a decrease in defence spending has to be considered not only on national security, but also for the island's economic situation. It is very possible that lower defence spending may cause an insecure situation for Taiwan. In order to maintain Taiwan's national security, under the condition of a downward trend of defence spending, it is necessary for Taiwan to seek to improve its military capabilities in the coming 6 to 10 years in the face of China's potential military threat. However, the employment influence of defence spending in Taiwan is still an open question.

The literature on the economic effects of defence spending has recently attracted the most attention from scholars since the Second World War. Regarding the employment effect of defence spending, one view is that military spending wastes resources and harbors inefficiencies, is riddled with procurement frauds and private sector crowding-out, and cuts into the social budget. Thus, in this view, an increase in defence expenditure should result in a decrease in employment.

It is also argued that defence spending has a favorable impact on employment. This argument is derived from two different viewpoints. The first, from a school led by radicals, argues that a large proportion of defence spending is used to cover manpower expenses so that an increase in military expenditure would lead to a declining unemployment rate in the country. The other school, led by under-consumptionists, proposes that large-scale defence spending could compensate for insufficient demand and bring economies out of depressions. That is to say, nations with high levels of military spending would experience defence-led economic growth and thus would experience an increase in output and employment.²

In the absence of a universal understanding on the influence of defence spending on employment and in the face of falling defence expenditures in Taiwan, further threatened by the presence of a determined expansionist China, it is important to study the case of Taiwan and to understand which of the above two arguments is applicable. In Taiwan, security and employment both contribute to the island's development. Understanding the relationship between defence spending and employment should be very useful for Taiwan's government officials and legislators to make policy decisions with regard to defence spending.

The purpose of this study is thus to examine the impact of defence spending on Taiwan's employment. Using yearly time series data from 1966 to 2002 and an Autoregressive Distributed Lag (ARDL) approach to cointegration as proposed by Pesaran and Shin (1998) and Pesaran *et al.* (2001), the primary finding of this study is that defence spending is able to benefit the employment situation in the long run, but damages employment in the short run.

The remainder of this paper is organized as follows. The next section reviews the related literature, while the following section provides descriptions of the situation of the labor market and the features of defence spending in Taiwan. The fourth section presents a simple theoretical model to express the relationship between defence spending and employment and describes the empirical model. The analysis of the empirical evidence is outlined and then the final section presents and discusses the conclusions drawn from this study.

LITERATURE REVIEW

A number of previous studies in the field of defence economics has concentrated primarily on the influence of military spending on economic growth over a long time. These studies are

² This suggestion is based on the assumption that, in the intense desire for profit, a mature capitalist economy has a tendency towards overproduction or, conversely, underconsumption, due to depressed growth of wages.

generally developed in the framework of macro-economic modeling to provide a better understanding of the possible relationship between military spending and economic growth. However, they did not result in any general agreement regarding this issue.

Some studies report that military expenditure benefits economic growth by raising aggregate demand, incurring an important technological spin-off effect, and producing key innovation and productivity effects (Benoit, 1973, 1978; DeGrasse, 1983; Ward *et al.*, 1991; Hsieh, 1995; Shih, 1998; Sezgin, 1997, 2000; Yildirim and Sezgin, 2002). Some authors have found no significant relationship between these two variables (Biswas and Ram, 1986; Grobar and Porter, 1989; Ward and Davis, 1992; Smith, 1980; Ozsoy, 2000). Others have indicated that military spending has a direct and very unfavorable effect on economic growth (Deger, 1986a, 1986b; Deger and Smith, 1983; Scheetz, 1991; Huang and Mintz, 1990; Dunne *et al.*, 2001).³

Some scholars have investigated similar issues with respect to Taiwan. However, conclusions resulting from studies concerning the relationship between these two variables in the case of Taiwan are in conflict as well. On the one hand, Chang *et al.* (2001) and Sun (2001) showed an insignificant impact of defence spending on Taiwan's economic growth. On the other hand, Yang *et al.* (2001) and Feng and Chern (2002) confirmed that defence spending has a significant and positive influence on Taiwan's economic growth.

The effects of defence spending on economic growth are transmitted through the channel of a possible crowding-out effect of the workforce and other channels.⁴ It is thus understood that the relationship between military expenditure and economic growth may not provide a substantial understanding of the economic role of military spending. Therefore, a similar debate surrounding the consequences of defence spending on employment has been emphasized. As mentioned before, the relationship between defence expenditure and employment is undetermined, and hence existing empirical studies on the same issue have produced a variety of results.

Boulding (1970), Szymanski (1973), DeGrasse (1983) and Anderson *et al.* (1986) all concluded a negative effect of military spending on employment. Aben (1981) reported that a drastic reduction in defence spending inevitably leads to an increase in unemployment, at least in the short run. Richards (1991) claimed that a major cut in military spending does necessarily reduce employment in some manufacturing industries.

Smith (1977) showed a positive correlation coefficient of 0.79 between the share of military spending in GDP and the unemployment rate based upon data for eight OECD countries for 1973. Chester (1978) did not find any significant influence of military spending on the unemployment rate based upon cross-section data for the same eight OECD countries as investigated by Smith (1977). Abell (1990) asserted that United States defence spending Granger causes unemployment and that the growth of defence spending has harmful effects on black unemployment rates compared with the beneficial effect on white unemployment rates during 1973–1987. Dunne and Smith (1990) concluded that no Granger causality exists between the unemployment rate and the proportion of the national product devoted to defence spending, and the share of military expenditure does not have any significant effect on unemployment in 9 out of 11 OECD countries.

Wing (1991) used input–output planning models to conclude that defence spending creates considerable employment, primarily for uniformed military personnel. Hooker and Knetter (1994) argued that there is a non-linear relationship between military spending and employment, and linear models are likely to underestimate the effects of military spending on the

³ There are three explanations for the negative relationship between military expenditure and economic growth: crowding-out effects, the constraints of industrial capacity, and the objectives of social consumption.

⁴ The other three channels are the possible reduction of investment, the application of military technology less concerned with the economic rules of profitability, and the growth of effective demand.

economy. Paul (1996) proved that the relationship between the unemployment rate and defence spending is not uniform across 18 OECD countries.⁵ Yildirim and Sezgin (2003) found that defence expenditure negatively affects employment in Turkey. Dunne and Watson (2004) provided sophisticated results indicating the negative short-run and long-run effects of military spending on employment.

In the literature, there is no general agreement regarding the impact of military spending on employment. In the case of Taiwan, no one has shed light on the issue concerning the employment effect of defence spending. This study tries to explore the same issue with respect to Taiwan and offers itself as a supplement to the economic role of defence spending in Taiwan.

MILITARY SPENDING AND LABOR MARKET IN TAIWAN

Before conducting an empirical analysis, it is necessary to consider the situation of Taiwan's labor market and the characteristics of Taiwan's defence spending. The time series data for yearly employment in the private sector and yearly defence spending from 1966 to 2002 are shown in Figure 1. Taiwan's employment in the private sector shows an upward trend since 1966. In 1966, the employment number in the private sector was 1.172 million. Since then, this number has increased gradually.

Although the Oil Crisis happened at the end of 1973, it did not have a significant impact on Taiwan's employment in 1973 or in the following year. In 1986 and 1994, employment in Taiwan's private sector exceeded 4 million and 5 million, respectively. Employment in the private sector was 4.081 million in 1986 and 5.159 million in 1994. Because a serious economic recession prevailed globally in 2001, Taiwan (as an export-oriented economy) was

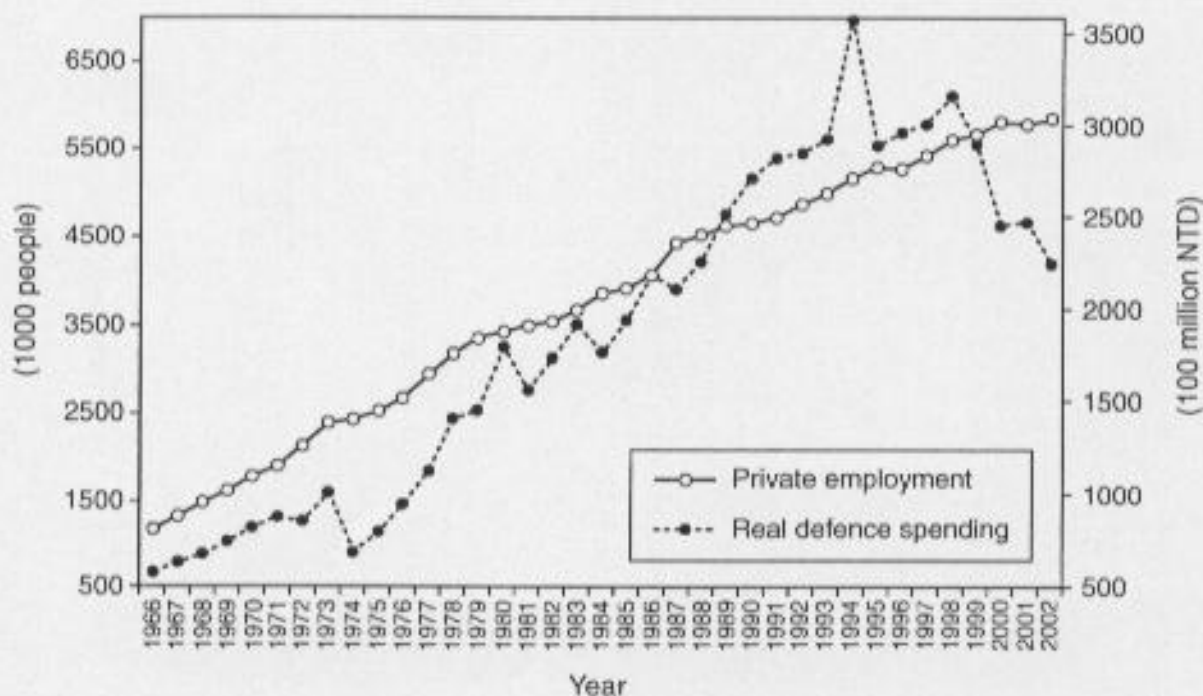


FIGURE 1 Taiwan's private employment and real defence spending (1966–2002).

⁵ Paul (1996) further indicated that defence spending has a favorable impact on the unemployment rate in Germany and Australia, whereas in Denmark it damages the employment situation. In the Netherlands, Japan, Italy, Spain, Austria, New Zealand, Sweden, Canada, and the US, there is no significant causal relationship between the unemployment rate and defence spending.

significantly affected. It was the first time that economic growth turned negative, and employment in the private sector slightly declined, by 24,000.⁶ The world's economy has since begun to recover and Taiwan's own economy and labor market, since 2002, have returned to a normal situation. The total for private sector employment was as high as 5.825 million in 2002.

With regard to Taiwan's defence spending, the amount of real defence spending was 57.78 billion NTD (New Taiwan Dollars) in 1966,⁷ increased gradually until 1974, but then dropped dramatically in 1974 due to a crowding-out effect by huge government investment in construction, the so-called 'Ten-Item Construction', in order to stimulate a declining economy caused by the Oil Crisis. Since then, defence spending has had an upward trend, but has varied every year. There are two peaks shown in Figure 1, in 1994 and 1998, owing to the large payment for buying aircraft and weapons from foreign countries. The amount of real defence spending in these two years exceeded 310 billion NTD. After 1998, real defence spending has shown a downward trend. On the one hand, this is partly because of a significant change in Taiwan's politics, economics, and society.⁸ On the other hand, the functions of different offices have changed; for example, the coastguard and the order of sea traffic were originally controlled by the Ministry of National Defence, but are now executed by other Ministries and Administrations. Undoubtedly, these changes have resulted in declining defence spending. In 2002, real defence spending was 225.7 billion NTD.

The primary features of Taiwan's defence spending can be described as follows. First of all, defence spending comprises a major part of the national budget. Prior to 1986, it was around 40% of total government budget. However, after cross-strait exchanges with China, it has decreased to 30% or even lower. In 2000, it shared only 15.8% of the total government budget. Secondly, the amount of imported arms is quite large. The Peace Time Foundation of Taiwan indicated that Taiwan was the largest arms-importing country during 1995–1999 and spent US\$13.94 billion in imported arms. Although the amount of expenditure on imported arms is large, it was not the major part of defence spending.

The most important feature of Taiwan's defence spending is that the share of personnel cost and maintenance of a large army forms the major part of it. The shares of personnel cost for several countries are shown in Table 1. It indicates that over 50% of Taiwan's defence spending is distributed to personnel expenditure and Taiwan is the country with the highest

TABLE 1 The Share of Personnel Cost in Defence Spending – Comparison among Countries

Country	Share of personnel cost (%)	Armed Forces (10,000 people)
Taiwan	50.1	38.20
USA	37.8	140.16
UK	35.4	18.10
Japan	38.2	21.42
China	45.7	252.00
Germany	36.4	33.80

Source: *Wealth Magazine* (Taipei), 231, 164–166.

⁶ According to official data, Taiwan's economic growth rate was -2.18% in 2001. However, in the same year, Singapore, another Asian dragon, had an even lower rate, an economic decline of 2.37%.

⁷ All real variables utilized in this paper are deflated by CPI at the base year of 2001.

⁸ Taiwan is more democratic than it was, and as more and more legislators express their opinion on defence spending, defence spending faces a more competitive situation as it competes with other items of government spending. Many political and social organizations request Taiwan's government to lower its defence spending budget for the consideration of mitigating any possible conflict between Taiwan and China and in order to establish a more secure society.

share of personnel cost,⁹ compared with other countries listed in Table I. Since Taiwan's current enlistment system is a conscription system, it is worth noting that military employment is not counted as employment in Taiwan's statistics, no matter whether they are volunteers or are part of compulsory service. It is thus proposed that defence spending will not have a direct influence on employment in Taiwan.

As for the influence of defence spending on the employment in Taiwan, this study expects a negative influence, at least in the short run. For the labor demand aspect, as mentioned by DeGrasse (1983), the concentration of military purchases in a small number of industries yielding fewer jobs helps explain why a variety of economic analyses have found that transferring military expenditures to other sectors of the economy creates more jobs. Fontanel (1994) also indicated that military expenditure generates fewer jobs than the education system. Therefore, if the government transfers military expenditures to the non-military sector, the labor demand might increase.

For the labor supply aspect, it is worth noting that since over 50% of defence spending is on personnel cost, if defence spending decreases apply mainly to personnel costs (e.g. the policy of disarmament),¹⁰ then some people who are volunteers or who are a part of the compulsory service will become veterans or be exempt from compulsory service completely or partially due to the reduction in the duration of commissioned service, and they will further enter into the labor market in the private sector. Undoubtedly, an increase in the labor supply in the private sector will cause higher employment. By contrast, if a decrease in defence spending is primarily due to a decrease in weapons and related equipment imports, then the labor will not transfer from the military to the private labor market.

If Taiwan's government transfers defence spending to the non-military sector and the decrease in the defence spending is primarily due to a reduction in personnel cost, then both labor demand and labor supply will increase and finally the level of employment will be higher. Therefore, this study proposes a hypothesis of a negative consequence of defence spending on employment in Taiwan.¹¹

METHODOLOGY

As mentioned before, the purpose of this study is to examine the possible influence of defence spending on employment in Taiwan. This study adopts a simple theoretical model to express the relationship between defence spending and employment and an empirical model to test the hypothesis of whether or not defence spending plays an important role in Taiwan's employment situation.

A Simple Theoretical Model

The simple theoretical model is primarily based upon Dunne and Watson (2004). It is simply assumed that Taiwan has a standard constant elasticity of substitution (CES) production function and this is shown as follows:

⁹ According to data provided by the Ministry of National Defence, Taiwan, this share was 48.24%, 50.02%, 54.03%, 51.62%, 54.04% and 54.54% for 1998–2003, respectively.

¹⁰ Taiwan's government adopted a disarmament policy, called 'Armed Forces Restructuring Program' during 1997–2001. During the execution period, the total armed forces reduced from 450,000 to 385,000. As mentioned by Kuo (2003), this program was proposed as early as 1983.

¹¹ Yildirim and Sezgin (2003) explained the impact of defence spending on employment with respect to reasons related to aggregate demand and GDP. However, this study discusses this issue under controlling the level of GDP. Therefore, any explanation related to aggregate demand or GDP will not be used as the explanation of the impact of defence spending on employment.

$$Y = \gamma \left[sK^{-\rho} + (1-s)(Le^{\lambda t})^{-\rho} \right]^{-1/(1+\rho)} \quad (1)$$

where Y represents national output, and L and K denote the quantity of labor and capital stock, respectively. For the parameters, v is return to scale, γ and s are production scale parameters. The elasticity of substitution σ is equal to $1/(1+\rho)$, and it is assumed that the technical progress is labor augmenting at rate λ . Taking the first partial derivative with respect to L , equating the marginal product to real wage (w/p), and taking logarithms on both sides of the equation, the following equation can be obtained:

$$\log\left(\frac{w}{p}\right) = c + \frac{\rho+v}{v} \log Y - (\rho-1) \log L - \rho\lambda t \quad (2)$$

Since the primary issue investigated in this paper is the relationship between defence spending and employment, how one adds defence spending, denoted as DS in the equation, should be important.¹² Dunne and Watson (2004) assumed $\lambda_t = \lambda_T T + \lambda_{DS} DS$, implying that the defence burden term reflects a 'technological displacement' diversion of resources from civilian to military purposes (particularly in the case of R&D). However, this is not the case for Taiwan, because there is little share of defence expenditure spent in R&D. Therefore, this study adds in a defence spending term to reflect the crowding out effect. A labor demand equation can then be described as follows:

$$\log L = \gamma_0 + \gamma_1 \log(w/p) + \gamma_2 \log Y + \gamma_3 \log DS + \gamma_4 t \quad (3)$$

In the above equation, $\gamma_1 = -\sigma$, $\gamma_2 = [1 + \sigma(v-1)]/v$, $\gamma_4 = -(1-\sigma)\lambda$. After controlling other variables, such as real wage, output, and time trend, γ_3 , the marginal influence of defence spending on employment (more precisely, the so-called 'elasticity') could be negative if a decrease in defence spending is primarily due to a reduction in personnel cost and transferring to non-military sectors. As mentioned before, this might further increase employment in the private sector.

Empirical Model

Many methodologies have been used to investigate the impact of defence spending on employment. For example, Wing (1991) adopted an input-output planning model to estimate the number of jobs needed (including direct and indirect employment) to study Indonesia's defence expenditure. However, as criticized by Adams and Gold (1987), the number of jobs created by military spending is not a good indicator of the influence of defence spending on the job market, due to a lack of consideration of crowding-out effects, which, in the long run, are difficult to quantify.¹³ The other methodology used in previous studies is the Granger causality approach due to the possibility of bi-directional causality between defence spending and the unemployment rate (Dunne and Smith, 1990; Paul, 1996). Since the time-series data

¹² According to Yildirim and Sezgin (2003), it is simply assumed that defence spending DS is a proportion of Y ; that is, $DS_t = gY_t$, where $0 < g < 1$; they further apply this assumption into the labor demand equation. However, as pointed out by the referee, the coefficient of defence says nothing about the effect of defence on employment, only about the effect of output. Therefore, this study does not assume any relationship between defence spending and output based upon the suggestion proposed by the anonymous referee and includes both the output and defence spending variables in the empirical model. The authors deeply appreciate the referee's constructive suggestion on this point.

¹³ Adams and Gold (1987) also argued that defence spending creates jobs only in some regions, but not in others, at certain levels of specification or skill, in particular branches or industries, and for certain firms.

are not large enough to estimate a VAR (vector autoregressive model),¹⁴ the Autoregressive Distributed Lag (ARDL) approach to cointegration as proposed by Pesaran and Shin (1998) and Pesaran *et al.* (2001) is adopted in this study. This methodology has been adopted by Karfakis (2002), Sezgin and Yildirim (2002), and Fatai *et al.* (2003), and also has been used by Yildirim and Sezgin (2003) to explore similar issues in the case of Turkey.

As pointed by Karfakis (2002) and Fatai *et al.* (2003), the primary advantage of the ARDL approach to cointegration constructed by Pesaran and Shin (1998) and Pesaran, *et al.* (2001) is that it can be applied regardless of the stationary properties of the variables in the sample. It also avoids the pre-test problems associated with the unit-root and standard cointegration analysis, and it allows for inferences on long-run estimates, which are not possible under alternative cointegration procedures.¹⁵

The first stage of the process involves establishing the existence of a long-run relationship between the variables. It is tested by computing the *F*-statistic when testing the joint significance of the lagged levels of series in the Error Correction (EC) form of the underlying ARDL model, which is shown as follows:

$$\Delta Y_t = \theta_0 + \theta_1 t + \sum_{i=0}^{k_1} \tau_i \Delta X_{t-i} + \sum_{j=1}^{k_2} \varphi_j \Delta Y_{t-j} + \delta_1 Y_{t-1} + \delta_2 X_{t-1} + \varepsilon_t \quad (4)$$

The null hypothesis of the non-existence of a long-run relationship that will be tested is that the lagged levels of Y_t and X_t are jointly insignificant; that is, $H_0: \delta_1 = \delta_2 = 0$.¹⁶

The second stage is that if the null hypothesis of a no long-run relationship is rejected, then the ARDL approach can be estimated using the differences of the variables and the lagged long-run solution, and either a long-run or short-run EC model version is constructed. The primary issue of this study is to examine the employment effect of defence spending. Therefore, the regression estimated in this paper is constructed according to the ARDL approach to cointegration and equation (3) can be shown as follows:

$$\begin{aligned} \Delta LPEM_t = & \theta_0 + \theta_1 t + \sum_{i=1}^{k_1} \tau_i \Delta LPEM_{t-i} + \sum_{i=0}^{k_2} \varphi_i \Delta LRDS_{t-i} + \\ & \sum_{i=0}^{k_3} \lambda_i \Delta LRMS_{t-i} + \sum_{i=0}^{k_4} \psi_i \Delta LRGDP_{t-i} + \delta_1 LPEM_{t-1} + \\ & \delta_2 LRDS_{t-1} + \delta_3 LRMS_{t-1} + \delta_4 LRGDP_{t-1} + \varepsilon_t \end{aligned} \quad (5)$$

The terms $\Delta LPEM$, $\Delta LRDS$, $\Delta LRMS$, and $\Delta LRGDP$ denote the difference in logarithms of private employment, real defence spending, real monthly salary, and real GDP, respectively. The terms $LPEM$, $LRDS$, $LRMS$ and $LRGDP$ denote the level in logarithms of private employment, real defence spending, real monthly salary, and real GDP, respectively. In addition, according to Figure 1, private employment declined in 2001 due to the global economic recession. As such, a dummy variable for the year 2001 is added to the model.

¹⁴ A VAR model also allows us to identify the long-run and short-run dynamics of defence spending on employment. However, when the number of variables in the system is large, a VAR model is hard to implement due to the consideration of the degrees of freedom.

¹⁵ However, as argued by Fatai *et al.* (2003), the possible disadvantage of the ARDL is the low number of degrees of freedom when estimating a regression with a small sample size.

¹⁶ The tests are distributed according to a non-standard *F*-statistic irrespective of whether the explanatory variables are stationary or non-stationary. The critical value bounds for these tests are computed by Pesaran *et al.* (2001).

After rejecting the null hypothesis of non-existence of a long-run relationship, the third stage determines the speed of adjustment of employment to equilibrium by estimating the ARDL form of equation (5), where the optimal lag lengths, k_1 , k_2 , k_3 and k_4 are selected by using two standard criteria: AIC (Akaike Information Criterion) and SBC (Schwarz's Bayesian Criterion).

The source of yearly time series data from 1966 to 2002 of employment in the private sector is from *Yearbook of Manpower Survey Statistics Taiwan Area 2003*,¹⁷ and the figures of defence spending are from *Statistical Yearbook of the Republic of China 2003*. The variable of monthly salary of employment, including both the industrial and service sectors, is available only from 1979 to 2002 and is provided by *Yearbook of Earnings and Productivity Statistics Taiwan Area 2003*.¹⁸ The figures of this variable prior to 1979 are estimated from an empirical analysis of a regression of this variable on monthly salary of employment in the manufacturing sector which is provided by *Yearbook of Earnings and Productivity Statistics Taiwan Area 2003*.¹⁹ Moreover, the variable of real GDP is provided by the *Social Indicators of the Republic of China 2003* that was published by the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China. For controlling inflation, all variables except for employment are deflated by CPI (Consumer Price Index) at the base year of 2001. Descriptions and statistics of the variables are presented in Table 2.

EMPIRICAL RESULTS

The existence of a long-run relationship between LPEM, LRDS, LRGDP and LRMS in equation (5) is initially examined by computing the F -statistic. After estimating equation (5), the calculated F value for the long-run significance test is $F(4, 15)=2.62$ (p -value=0.08), which is significant at the 10% level. It implies that the null hypothesis of no long-run relationship between these four variables can be rejected and supports the existence of a long-run relationship between them.

TABLE 2 Description and Statistics of Variables

Variable	Description	Mean	SD
PEM	Number of employment in private sector (thousands of people)	3754.05	1449.37
RDS	Real yearly defence spending (100 million NTD)	1879.17	892.93
RMS	Real average monthly salary of employment (NTD)	23379.01	12048.11
RGDP	Real GDP(100 million NTD)	43420.58	30298.39
Observation	From 1966 to 2002		37

Sources: *Year book of Earnings and Productivity Statistics Taiwan Area 2003*, *Yearbook of Manpower Survey Statistics Taiwan Area 2003*, and *Statistical Yearbook of the Republic of China 2003*.

Notes: (1) RMS prior to 1979 are estimated

(2) All real variables are deflated at 2001 prices

¹⁷ The values of this variable prior to 1979 are estimated figures and are provided by the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Taiwan.

¹⁸ The industrial sector includes mining & quarrying, manufacturing, construction, and electricity, gas, & water industries.

¹⁹ The regression result is $MS_t = 71.80 - 45.36 \times T + 1.11 \times MSM_t$, $t=1979$ to 2002, and adjusted $R^2=0.999$. MS_t is monthly salary of employment including both industrial and service sectors, MSM_t is monthly salary of employment in the manufacturing sector, and T represents a time trend. The estimated coefficient of SM_t is significantly different from zero at the 1% significant level. The detailed results are available upon request.

TABLE 3 Error Correction Model for Employment in Taiwan

<i>Dependent variable $\Delta LPEM$</i>			
<i>Variable</i>	<i>Coefficient</i>	<i>Standard error</i>	<i>t-ratio</i>
CONS	-0.009	0.035	-0.245
TREND	-0.001	0.001	-1.023
$\Delta LPEM(-1)$	0.235	0.145	1.615
$\Delta LPEM(-2)$	0.348**	0.150	2.312
$\Delta LRDS$	-0.032	0.028	-1.136
$\Delta LRDS(-1)$	0.003	0.029	0.087
$\Delta LRDS(-2)$	-0.078**	0.032	-2.411
$\Delta LRDS(-3)$	-0.068***	0.021	-3.186
$\Delta LRSA$	-0.088	0.074	-1.184
$\Delta LRSA(-1)$	0.140	0.092	1.527
$\Delta LRSA(-2)$	-0.074	0.078	-0.943
$\Delta LRSA(-3)$	0.201**	0.074	2.712
$\Delta LR GDP$	0.404***	0.078	5.151
D2001	0.014	0.014	0.977
ECM(-1)	-0.098**	0.046	-2.122
Observations		33	
Adjusted R^2		0.870	
L-Likelihood		110.580	
F-statistic		16.247***	

Note: *, **, and *** indicate that the coefficient differs statistically from zero at the 10%, 5% and 1% significant levels, respectively.

The Short-Run EC Estimation and Long-Run Analysis

After supporting the existence of a long-run relationship among these four variables, the short-run EC estimates are shown in Table 3. The results reported in Table 3 show that the ARDL (3, 4, 4, 1) model is determined according to both AIC and SBC²⁰. The EC results indicate that after controlling for other variables, the change in defence spending does not have an immediate effect on employment. However, taking the lags of defence spending growth into consideration, both the second and third lags, but not the first lag, have a significantly negative effect on employment growth, which is reasonable and similar to the finding in Turkey provided by Yildirim and Sezgin (2003).

As described above, Taiwan's government transferring defence spending to the non-military sector and the decrease in defence spending are primarily due to a reduction in personnel cost. Such decreases in defence spending will cause higher employment in the private sector.²¹ In contrast, an increase in defence spending applying mainly to personnel costs and a crowding-out of non-military government expenditure imply more enlistments drawn from the private sector and less job creation, causing a decrease in private employment in the short run.

²⁰ According to a referee's comment that 'the AIC tends to select too many variables, it is an inconsistent estimator of the lag length', this study modifies the empirical model and uses both AIC and SBC as the methods for selecting optimal lag length. The ARDL (3, 4, 4, 1) model is determined by using both criteria and most second- and third-order terms are significant at the 5% level and even at the 1% level. The authors are thankful for the referee's comment on this point which makes this paper better than its previous version in determining the optimal lag length.

²¹ Due to a lack of consecutive yearly data of personnel cost, this study is unable to use personnel cost instead of total defence spending as the independent variable in the model and further supports the hypothesis that a decrease in personnel cost would lead to an increase in employment in the private sector.

Consistent with our expectations, the change in real GDP has an immediately positive influence on employment. It implies that economic growth will make more workers be hired in the private sector. In addition, the change in real monthly salary does not have an instant impact on employment. However, considering the lags of real monthly salary, it is indicated that the first two lags of real monthly salary are insignificant, but the third lag is positive and significant, meaning that real monthly salary and employment move together in a short-run relationship, which is similar to the finding in Yildirim and Sezgin (2003).²² The change in the trend, which is assumed to capture technological progress, has a negative but insignificant effect on employment growth. The dummy variable for a reduction in employment in 2001 due to the global economic recession that occurred also has a negative but insignificant coefficient, indicating that the recent recession has not significantly damaged Taiwan's employment situation. In addition, it is shown in Table 3 that any changes in employment are positively affected by its second lag values.

The estimated ECM coefficient equaling -0.098 is statistically significant at the 5% level, indicating the joint significance of the long-run coefficients. Moreover, the ECM coefficient is not very high, reflecting a slow degree of convergence. That is to say, once the economy is exposed to a shock, it will take a long time (approximately 10 years) to return to equilibrium.

The estimated long-run coefficients are shown in Table 4.²³ It is revealed that the long-run solutions of the estimated ARDL model are not very consistent with the conclusions in the short-run estimation. Both estimated coefficients of defence spending and real GDP have a positive influence on employment in the long run, but it is not true for real monthly salary. However, the estimated coefficient of real GDP is statistically significant at the 1% level, but only at the 10% significant level for the estimated coefficient of defence spending. That is to say, the long-run relationship between real GDP and employment is very significant. However, it is weak for the long-run relationship between defence spending and employment. As concluded earlier, defence spending reduces employment in the short run. However, with the level of GDP being constant, this conclusion implies an improvement in labor productivity might further slightly benefit private employment in the long run. Finally, there is no long-run relationship between real monthly salary and employment in Taiwan.

The Robustness of the Empirical Model

The residuals of the underlying ARDL equation are plotted in Figure 2. In order to confirm the robustness of the model specification suggested in this study, several diagnostic tests are conducted with respect to residuals for econometric issues of serial correlation (SC), heteroskedasticity (HE), and normality (NO). This study utilizes the Serial Correlation LM Test to examine the null hypothesis that there is no serial correlation up to lag order q , where q is a pre-specified integer.²⁴ For testing the null hypothesis of homoskedasticity, the ARCH LM Test proposed by Engle (1982) is adopted.²⁵ A standard method for a normality test, the

²² Yildirim and Sezgin (2003) pointed out that the political conjecture of the period 1974–1979 made trade unions powerful enough to resist an offer for wage decreases in spite of rising unemployment in Turkey.

²³ This study adds a constant term in the long-run dynamics when considering other factors that might affect employment. However, since the time-trend variable is included in the Error Correction ARDL model, it is not included in the long-run dynamic model. The authors appreciate the referee's valuable suggestion on this point.

²⁴ The test belongs to the class of asymptotic (large sample) tests known as Lagrange multiplier (LM) tests. For a further discussion about this method, please refer to Godfrey (1988).

²⁵ The ARCH LM Test is a Lagrange multiplier (LM) test for autoregressive conditional heteroskedasticity (ARCH) in the residuals.

TABLE 4 Estimated Long-Run Coefficients

<i>Dependent Variable LPEM</i>			
<i>Variable</i>	<i>Coefficient</i>	<i>Standard error</i>	<i>t-ratio</i>
Constant	2.003***	0.587	3.411
LRDS	0.192*	0.106	1.802
LRSA	-0.057	0.116	-0.493
LRGDP	0.505***	0.136	3.711
Observations		34	
Adjusted R^2		0.962	
L-Likelihood		38.589	

Note: *, **, and *** indicate that the coefficient differs statistically from zero at the 10%, 5% and 1% significant levels, respectively.

Jarque-Bera statistic, is employed.²⁶ Finally, in order to test for model misspecification (MS), the Regression Specification Error Test (RESET) proposed by Ramsey (1969) is applied.²⁷

The estimated statistics are presented in Table 5, where it is found that the model specification of the ARDL equation satisfies all econometric criteria; namely, there is an absence of serial correlation, homoskedasticity, and normality, and it is unable to detect any model misspecification. All these results indicate that the model of the ARDL approach to cointegration adopted in this study is thus well specified and therefore the estimation results from the empirical model are also quite robust.

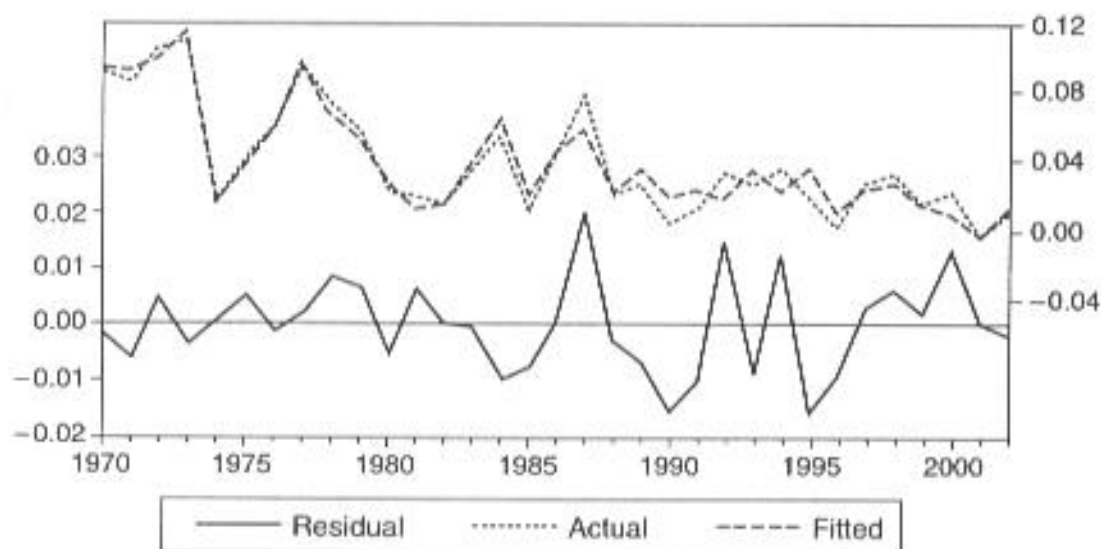


FIGURE 2 The plotted residuals.

²⁶ As mentioned in Greene (2000), Jarque-Bera is a test statistic for testing whether the series is normally distributed. The test-statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. Under the null hypothesis of a normal distribution, the Jarque-Bera statistic is distributed as χ^2 with 2 degrees of freedom.

²⁷ RESET is a general test for the following types of specification errors: (1) omitted variables: the empirical model does not include all relevant independent variables. (2) Incorrect functional form: some or all of the dependent and/or independent variables are transformed to logs, powers, reciprocals, or in some other way. (3) Correlation between independent variable(s) and ϵ , which may be caused by the measurement error in the independent variable, simultaneous equation considerations, combination of the lagged of dependent variable values and serially-correlated disturbances.

TABLE 5 Diagnostic Tests

Test	H_0	Statistic	p-value	Conclusion
SC	There is no serial correlation in the residuals up to q order.	$\chi^2(q=3)=4.101$ $\chi^2(q=6)=9.509$	0.251 0.147	Cannot reject H_0
HE	There is no auto-regressive conditional heteroskedasticity in the residuals up to q order.	$\chi^2(q=3)=6.098$ $\chi^2(q=6)=9.556$	0.107 0.145	Cannot reject H_0
NO	Normal distribution	$JB=0.521$	0.771	Cannot reject H_0
MS	Absence of model misspecification	F -statistic=0.757	0.535	Cannot reject H_0

CONCLUDING REMARKS

The primary purpose of this paper is to investigate an important but neglected issue regarding the economic role of defence spending on employment in Taiwan. Official time series data include yearly defence spending, employment in the private sector, GDP, and average monthly salary from 1966 to 2002. The Autoregressive Distributed Lag (ARDL) approach to cointegration as proposed by Pesaran and Shin (1998) and Pesaran *et al.* (2001) was adopted in this study.

The main finding of this study is that defence spending has a significantly negative effect on employment growth in Taiwan in the short run, but turns out to be weakly significant and positive in the long run. This conclusion is reasonable, but not quite consistent with the finding in Turkey provided by Yildirim and Sezgin (2003). In addition, real GDP has a positive impact on employment in both the short run and long run. The change in real monthly salary has a positive influence on employment in the short run, but not in the long run. Finally, this study conducts several diagnostic tests to confirm the robustness of the empirical model.

This study suggests that a decrease in defence spending would lead to an increase in Taiwan's private employment and further stimulate the economy. The policy of disarmament undoubtedly reduces defence spending, particularly for Taiwan with a high share of personnel costs. Thus, the conclusion suggested by this study seems to support the argument that disarmament has become a mainstream consensus in the world. However, this conclusion is primarily based upon the economic viewpoint, without considering national security.

It is worth noting that China plans to increase its defence spending by 21.83 billion RMB in 2004, at a growth rate of 11.6%. Apparently, Taiwan will face an even greater military threat from China in the years to come. Although the decline in defence spending could benefit private employment and further improve the economic situation, the suggestion of a disarmament policy should be proposed more deliberatively, particularly for Taiwan, which faces a severe military threat from China. If Taiwan's national security is considered, the issue of whether or not the reduction in defence spending is the best policy has to be re-investigated. However, this issue is beyond the scope of this study and will be left for future research.

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