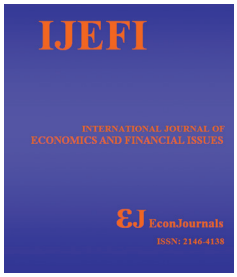

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# The Economic Effects of the Tax Reform: Dynamic Input-output Model Approach

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**ABSTRACT**

The financial crisis in 2008 severely damaged Taiwan's economy, increased unemployment, and reduced the national income level, which has remained low ever since. These consequences have affected funding for various pension systems, particularly national pensions, and thus are of great concern to the government. The National Pension Act stipulated a 1% business tax increase to fund the national pension system. Hence, this study investigates the impact the act on economic growth and offers feasible suggestions for reform based on empirical evidence. Dynamic Input-Output models are designed to analyze the various positive and negative impacts on the economy. Empirical evidences suggests that Although raising business tax by 1% yields certain negative outcomes, proper use of transfer expenditure with financial flexibility yields more positive outcomes, manifested in the growth of NT$ 8.622 billion, 2.2 billion, and 2.256 billion in induced production, gross added value, and earned income, respectively, as well as the employment increase of 3232 new workers. Finally, through the tax revenue model, transfer expenditure is estimated to yield an additional NT$ 5.4711 billion from business tax, personal income tax, and corporate income tax as a "fiscal dividend."

**Keywords:** Tax Reform, Dynamic Input-output Model, Business Tax, Economic Effects
**JEL Classifications:** C67, D57, E62, H20

## 1. INTRODUCTION

The financial crisis in 2008 not only severely damaged the world's economy but also greatly increased countries' debts and decreased their fiscal spaces, thereby causing difficulty implementing national insurance in most countries. Once a country falls into financial difficulty, the promotion and maintenance of national insurance becomes extremely challenging. One such example is the current situation in Taiwan, which is further compounded by the combination of an aging society and low birth rate, both of which exacerbate uncertainty over the funding of the national pension system. Modern governments should not overlook the close interrelationships between a country's tax structure, economic growth, and national pension system. The tax structure and economic growth influence one another, and these two factors combined determine whether the national pension system is tenable. Numerous countries are currently facing the same problems as Taiwan, namely issues relating to the soundness of the national pension system's financial structure, an aging society and low birth rate, imbalance in state revenue and expenditure, and social problems due to globalization, all of which intensify the difficulties of maintaining a national pension system.

According to Article 47 of Taiwan's National Pension Act, " the funding for the subsidized premium and related expenses which should be assumed by the central competent authority according to the act will be in the following orders. (1) Surplus from Public Welfare Lottery for the national pension payment; and (2) increase the levying rate for business tax by 1%." The levying rate for business tax refers to taxation to maintain financial soundness in the national pension system, a goal that other countries have attempted to achieve through tax reform. One notable example is Japan, which relies on increased consumption tax to support its social security system, including basic pensions. However, previous studies have indicated that raising business tax affects not only a country's economic growth and financial structure and causes price fluctuations but also its human capital and population growth.

In summary, national pensions are part of a country's social security system, which affects quality of life among the populace. Therefore, developed countries all view national pensions as a symbol of national progress. The Taiwanese government is currently considering the feasibility of implementing a tax reform to maintain its national pension system, and thus must increase the levying rate for business tax to ensure financial soundness. Although this could reduce economic activity in society, the additional revenue from business tax could help mitigate the monetary burden of the national pension system, improve social welfare, and increase tax revenue. Therefore, the present study investigates two aspects of increasing the levying rate for business tax by 1%. The first is the impact of such an increase on the economy. The second is the economic spillover of weakening the fiscal crowding out effect. Moreover, time must be considered. Raising business tax could cause commodity prices to rise (corporate goods price index and consumer price index) and consumer demand to drop, thereby negatively affecting the economy and increasing the unemployment rate. However, raising business tax by 1% to fund the national pension system could increase fiscal spaces for the government and increase the budget available for social security, thereby improving the economy and increasing the employment rate and tax revenue.

To investigate negative economic impact, the present study must establish an industrial relations price spillover model, economic spillover model, and employment model. To investigate positive economic spillover, a tax revenue model and employment model are required. All of these models are based on the dynamic industrial relations equilibrium model with adjustments corresponding to their purposes.

## 2. LITERATURE REVIEW

In 2014, Japan announced a social insurance and tax reform to raise consumption tax to 8%. The additional revenue would be used to provide half of the national treasury's share of the funding for national pensions. The reform was designed as a measure to ensure stable funding for national pensions and Japan has plans to further raise consumption tax to 10% in the future to further strengthen the financial structure of the social insurance system. Governments often rely on tax reform to replenish fiscal revenue or adjust the tax structure to stimulate economic growth. Hence, financial policies are frequently used as solutions to postwar economic and social problems (Judd, 1987; Chamley, 1986; Koester and Kormendi, 1989; Barro, 1990; Turnovsky, 1990; Rebelo, 1991; Jones and Manuelli, 1992; Stokey and Rebelo, 1995; Razin and Yuen, 1996; Uhlig and Yanagawa, 1996; Kim, 1998; Canton, 2001; Yakita, 2003; Hek, 2006).

Recently, some countries have implemented tax reforms to stabilize social insurance funding and maintain the social security system. Economic growth, tax reform, and social security must all be considered for a country's future development. Previous studies have provided extremely variable information regarding the precise nature of the interrelationships between these three factors, indicating that differences related to time, location, and the environment can result in different conclusions (Marsden, 1983; Skinner, 1987; Koester and Kormendi, 1989; Martin and Fardmanesh, 1990; Wang and Yip, 1992; Mendoza et al., 1997; Kneller et al., 1999; Myles, 2000; Angelopoulos et al., 2007; Keen et al., 2011). Keen et al. (2011) concluded that raising consumption tax affects a country's level of economic activity in the short term; however, this view is not shared in all countries. Therefore, the present study constructs a literature review on the economic impact of tax reform and changes in the tax structure on economic development to further understand the issues surrounding national pensions.

Tax revenue is a problem closely related to considerable economic growth. This is particularly noticeable among the members of the Organisation for Economic Co-operation and Development (OECD), which commonly adopt tax reform as a major solution to tax revenue, although the results vary from country to country (Kneller et al., 1999; Gesko, 2013; Klitgaard and Christian, 2014). Kneller et al. (1999) suggest that distortionary taxation decreases economic growth, whereas nondistortionary taxation does not. Angelopoulos et al. (2007) indicate that different tax rates cause varying degrees of impact on economic growth; raising earned income tax reduces economic growth, whereas raising capital gains tax and corporate income tax achieves the opposite chiefly because the government uses tax revenue for productive investment, thereby stimulating economic growth. Mendoza et al. (1997) analyze consumption tax, capital gains tax, and earned income tax and found that although different tax rates lead to varying degrees of impact on economic growth, the impact of each type of tax was negligible and nonsignificant.

In addition to studies on developing countries, Marsden (1983) compares countries with both high and low income and found that in such countries, the average tax rate invariably exerts a negative effect on economic growth. Skinner (1987) indicates that gross tax revenue is negatively correlated with economic growth. Martin and Fardmanesh (1990) investigate tax burden to analyze economic growth and found the two to be negatively correlated. Koester and Kormendi (1989) argue that the average tax rate has a nonsignificant influence on economic growth, a finding corroborated by Wang and Yip (1992). Branson and Lovell (2001) maintain that the tax burden to be negatively correlated with economic growth.

Harberger (1964) asserts that changing the tax rate influences only investment behaviors and not economic growth and that tax policies exert little impact on long-term economic growth. Engen and Skinner (1996) assert that although lowering tax rates stimulates economic growth, raising them does not necessarily negatively affect economic growth. Milesi and Roubini (1998) contend that consumption tax and capital gains tax hinder long-term economic growth.

Some studies have explored the economic impact of altering the rates of different tax types. Yamarik (2000) indicates that direct taxes are detrimental to economic growth, whereas indirect taxes have only a nonsignificant effect on economic growth. Kocherlakota and Yi (1996) conclude that neither highest tier personal income tax rates nor the effective rate of protection

significantly contribute to economic growth in the United States. Lee and Gordon (2005) identify that corporate income tax has a significant negative impact on economic growth. Kocherlakota and Yi (1997) analyze economic growth from the perspective of the tax burden and tax structure and propose adjusting the tax structure to lower the ratio of direct taxes to indirect taxes, supplemented with comprehensive support measures to stimulate economic growth. Charlet and Owens (2010) propose a flat tax rate for value-added tax, as well as the use of revenue from broad-based value-added tax for transfer payments. By contrast, Mirrlees et al. (2010) argue that multiple tax rates are more appropriate for value-added tax than other forms of tax.

Arnold (2008) reviews data of 21 OECD members after the 1973 oil crisis and indicates that under the premise of fixed tax revenue, when the portion of corporate income tax is levied by consumption tax and property tax, the resultant tax structure stimulates economic growth. Auerbach and Kotlikoff (1987) conduct a structural analysis on dynamic fiscal policies and identify that consumption tax is advantageous for economic growth because it encourages saving and enables greater capital formation than does income tax.

Brander and Dowrick (1994) recognize the close association between economic prosperity and demographic transition, asserting that each country enjoys the "demographic dividends" that promote a positive increase in gross domestic product (GDP) per capita. Bloom et al. (2001; 2003) suggest that as much as one third of economic growth can be attributed to such demographic dividends, an assertion observed in East Asia (Brander and Dowrick, 1994; Bloom et al., 2001; Bloom et al., 2003; Kelley and Schmidt, 2005; Bloom et al., 2010). Demographic transition changes the tax structure, thereby strengthening factors of uncertainty in the maintenance of the national pension system. Because of aging societies and low birth rates, many countries have reached turning points in economic development. Park and Shin (2011) suggest that specific countries have gradually transformed from demographic dividends to a demographic burden. Furthermore, tax reform affects not only economic systems but also commodity processes; the influence of business taxes on prices is notable in this regard. Such influence is a focal point of tax reform, as asserted in previous studies (Creedy, 1999; Tait, 1991; Murrell and Yu, 2000; Karadag and Westaway, 2000; Alm and Melnik, 2005; Sparks et al., 2004; Shanmugam and Sthanumoorthy, 2004).

These studies have investigated the influence of tax reform on a country's economy from various angles, focusing on developed countries. In addition, most of these studies have relied on conventional quantitative economic models for empirical evidence. Because Taiwan is in the process of becoming a developed country, its economic development is facing industrial transformation. Hence, an investigation into its tax system or national pension system requires an analysis of its industrial structure. Although a number of domestic studies on these topics have used industrial relations, they have either confined themselves to using conventional and unsophisticated models or have oversimplified the models used to analyze economic impact. Such empirical analyses are prone to under- or overestimation. Moreover, static industrial relations models tend to overlook time-related changes, which is another factor that can widen the gap between inferred results and reality. Therefore, to investigate the economic impact of raising business tax by 1%, the present study relies on dynamic industrial relations models for more credible analysis of tax reforms and the national pension system.

## 3. EMPIRICAL MODEL

### 3.1. Measurement of the Economic Spillover Effects

Following Miyazawa (2002) and Hong et al. (2017b), the dynamic industry-related model could be constructed as follows:

$$X(t+1) = (K^{-1}D + I[I - \bar{M})A)]^{-1}[(I - \bar{M})F^{d} + E]$$

I is the identity matrix; $K$ is investment coefficient matrixes, $D=I-A-C$, where consumption ($C$) and investment ($K$), A is the input coefficient matrix (n×n).

$$\underbrace{TESE}_{\text{Total Economic Spillover Effects}} = \underbrace{(I - \bar{M})\delta F_1^d}_{\text{Direct Spillover Effects}} + \underbrace{\Gamma^*\left[(I - \bar{M})\delta F_1^d\right]}_{\text{First Indirect Spillover Effects}} + \underbrace{\Gamma^*\left[(I - \bar{M})\delta F_2^d\right]}_{\text{Second Indirect Spillover Effects}} \quad (1)$$

$\bar{M}$ represents the diagonal matrix of import coefficient (n×n); is the amount of the domestic final demand for industry I;

$$\Gamma^* = (K^{-1}D + I)\left[I - (I - \bar{M})A)\right]^{-1}$$

### 3.2. Measurement of the Gross Induced Added Value

$$\underbrace{TV}_{\text{Total Gross Induced Added Value}} = \underbrace{w_j^G (I - \bar{M})\delta F_1^d}_{\text{Direct Gross Induced Added Value}} + \underbrace{w_j^G \Gamma^*\left[(I - \bar{M})\delta F_1^d\right]}_{\text{First Indirect Gross Induced Added Value}} + \underbrace{w_j^G \Gamma^*[(I - \bar{M})\delta F_2^d]}_{\text{Second Indirect Gross Induced Added Value}} \quad (2)$$

$W_j^G$ is the rate of gross induced added, and $v_j^G$ is the gross added value in the industry j.

$$W^G = \left[w_1^G w_2^G \cdots w_n^G\right], w_j^G = \frac{v_j^G}{X_j}, j = 1, 2, \cdots n.$$

### 3.3. Measurement of the Induced Income of Employment

$$\underbrace{TE}_{\text{Total Induced Income of Employment}} = \underbrace{w_j^L (I-\bar{M})\delta F_1^d}_{\text{Direct Income of Employment}} + \underbrace{w_j^L \Gamma^*\left[(I-\bar{M})\delta F_1^d\right]}_{\text{First Indirect Induced Income of Employment}} + \underbrace{w_j^L \Gamma^*[(I-\bar{M})\delta F_2^d]}_{\text{Second Indirect Induced Income of Employment}} \quad (3)$$

$W^{L}_{j}$ is the rate of induced income of employment.

### 3.4. Measurement of the Persons Employed

$$\delta L_i = \left\{\left(I-\bar{M}\right)\delta F_1^d + \Gamma^*(I-\bar{M})(\delta F_1^d + \delta F_2^d)\right\} * H_i \quad (4)$$

$H_i$ is the employment coefficient matrix.

### 3.5. Measurement of the Tax Revenue

#### *3.5.1. Measurement of the business tax*

$$TR^{\text{business tax}} = \begin{Bmatrix}\left(I-\bar{M}\right)\delta F_1^d + \Gamma^*(I-\bar{M}) \\ (\delta F_1^d + \delta F_2^d)\end{Bmatrix} * w_j^G * t_b^e \quad (5)$$

$t_b^e$ is the indirect effective tax rate.

#### *3.5.2. Measurement of the personal income tax*

Following the effective tax rate (JNTO, 2010), the tax revenue model could be constructed as follows:

$$TR^{\text{personal income tax}} = \begin{Bmatrix}\left(I-\bar{M}\right)\delta F_1^d + \Gamma^*(I-\bar{M}) \\ (\delta F_1^d + \delta F_2^d)\end{Bmatrix} * w_j^G * t_p^e \quad (6)$$

$t_b^e$ is the effective tax rate of personal income.

#### *3.5.3. Measurement of the corporate income tax*

$$TR^{\text{corporate income tax}} = \begin{Bmatrix}\left(I-\bar{M}\right)\delta F_1^d + \Gamma^*(I-\bar{M}) \\ (\delta F_1^d + \delta F_2^d)\end{Bmatrix} * w_j^G * t_c^e \quad (7)$$

$t_c^e$ is the effective tax rate of the corporate income.

## 4. EMPIRICAL RESULTS

This study conducts an empirical analysis on the positive and negative impacts of tax reform on a country's economy. The results are as follows:

### 4.1. Scale of Economic Impact

The scale of the economic impact of raising business tax by 1% refers to the degree of impact on production, gross added value, and earned income.

#### *4.1.1. Estimated economic impact*

The mean price elasticity of industry demand is −0.05694 (Hong et al., 2017a) and the increase of business tax by 1% yields a consumption loss of approximately NT$ 602.072 billion. The present study uses this as the basis for estimating the increased tax rate's impact on the economy. Table 1 shows the individual impacts of the direct effect, first spillover, and second spillover in the form of induced production, gross induced added value, induced earned income, and total unemployment.

The direct impact is approximately NT$ 361.27 billion and the first and second indirect spillovers are approximately NT$ 255 billion and 131.17 billion, respectively. Combined, these amount to approximately NT$ 747.42 billion worth of economic impact in the form of induced production. Such a loss in induced production further causes corporations' direct gross induced added value (approximately NT$ 65.84 billion) and indirect spillover (approximately NT$ 124.89 billion) to decrease by approximately NT$ 190.73billion. In addition, induced earned income was reduced by approximately NT$ 195.61 billion, which causes 28,024 people to lose their jobs and 15,099 to directly become jobless.

#### 4.1.2. Positive economic spillover effect

The empirical analysis in the previous section verifies that although raising business tax can have a negative economic impact, it can also enhance flexibility in financial expenditure. Shifting the lightened financial burden of transfer expenditure to social security stimulates the economy and increases employment, thereby creating a positive economic spillover effect.

The economic spillover that lightens the government's financial burden and allows for transfer expenditure amounts to approximately NT$ 833.64 billion, which enables 31,256 people to become employed. The gross induced added value and induced earned income increase by approximately NT$ 212.73 billion and 218.17billion, respectively, thereby effectively enhancing corporate business performance and labor income. A comparison

**Table 1: Economic impact**

| Spillover Stage | Economic effect-induced | Gross added value-induced | Induced income of employment | Unemployed |
|---|---|---|---|---|
| Direct impact | 361.27 | 65.84 | 125.58 | 15,099 |
| First impact spillover | 255.00 | 79.56 | 41.96 | 6,283 |
| Second impact spillover | 131.17 | 45.33 | 28.06 | 6,641 |
| Total impact | 747.42 | 190.73 | 195.61 | 28,024 |

Unit: NT$ billion, people

**Table 2: Positive economic spillover effect**

| Spillover Stage | Economic effect-induced | Gross added value-induced | Induced income of employment | Employment creation |
|---|---|---|---|---|
| Direct spillover effects | 402.94 | 73.43 | 140.07 | 16,841 |
| First indirect spillover | 284.41 | 88.74 | 46.80 | 7,008 |
| Second indirect spillover | 146.30 | 50.56 | 31.30 | 7,407 |
| Total spillover effects | 833.64 | 212.73 | 218.17 | 31,256 |

Unit: NT$ billion, people

between Tables 1 and 2 suggests that the positive effect is greater than the negative effect; induced production, gross induced added value, and induced earned income increase by approximately NT$ 86.22 billion, 22 billion, and 22.56 billion, respectively. In addition, 3232 people become employed. These figures imply that a government raising business tax to properly solve the problem of national pensions can yield more positive economic outcomes despite some negative effects.

The positive economic effects appear to be wide-reaching and potent. In addition to induced production, they enable the creation of a corporate operating profit margin, increase labor income, and alleviate the unemployment problem, which has recently become more severe in Taiwan. Because Taiwan is undergoing industrial transformation, how positively these effects influence different industries determines the level of future success.

### 4.2. Economic Spillover Effects on Tax Revenue

The empirical results in Table 2 provide sufficient evidence of the transfer effects of using business tax revenue in fiscal policies. The spillover of these effects induces increased production, corporate gross added value, and earned income, all of which generate more tax revenue from business activities, personal income, and corporate profit. The present study investigates business tax, personal income tax, and corporate income tax. The results are listed in Table 3.

Of the aforementioned three types of tax, personal income tax has the greatest source of revenue, contributing 71.64% of the total tax revenue of approximately NT$ 54.7 billion. By contrast, corporate income tax and business tax contribute 16.00% and 12.37%, respectively. Regarding the spillover effect on tax revenue, the direct effect accounts for approximately NT$ 26.4 billion, whereas the two spillovers combined account for approximately NT$ 28.3 billion.

## 5. CONCLUDING REMARKS

### 5.1. Conclusion

The success of tax reform must be examined from positive and negative perspectives. Therefore, this study uses a dynamic industrial relations model as the basis for an economic spillover model, gross added value model, earned income model, and tax revenue spillover model to examine various topics. This study draws the following conclusions:

The models suggest that a government can increase its financial flexibility and maintain the required level social security expenditure, thereby negating the aforementioned economic impact and inducing additional production, gross added value, and earned income of NT$ 8.622 billion, 2.2 billion, and 2.256 billion, respectively, in addition to the employment increase of 3232 new workers. Therefore, although raising business tax to support national pensions yields negative outcomes, it yields more positive effects with implementation based on appropriate planning.

A government's financial flexibility can further raise tax revenue. According to the estimation results, the increased revenue from business tax, personal income tax, and corporate income tax amounts to approximately NT$ 54.7 billion, which although not necessarily a large sum, faced with a growing fiscal deficit can be considered a fiscal dividend due to a properly executed tax reform.

### 5.2. Suggestions

After numerous stages of economic development and industrial transformation, particularly the substantial overseas investment and offshoring of major industries in the 1990s, the investment level and industrial hollow-out in Taiwan have degenerated to the point that there is neither sufficient investment, be it foreign or domestic, to drive economic growth, nor a strong enough research and development capacity to enhance the industrial structure. Consequently, Taiwan's economy has been weak for over a decade and the lack of momentum has gradually deprived the government of the tax revenue and financial flexibility required to maintain a balance between economic growth and the industrial structure. The financial crisis in 2008 severely damaged the world's economy and delivered a heavy blow to Taiwan by pushing it into a long-term recession and indirectly exposing serious shortfalls in the funding of labor pensions, the national pension system, and military, civil servant, and teacher annuities. This piqued concerns regarding the future and encouraged heated debates on the reform of various pension systems.

Economic theories tend to attach great importance to the trade-off relationship, with particular emphasis on how to trade off efficiently. In the present study, the trade-off was to raise business tax by 1% to maintain the national pension system. However, this reform being implemented without supplementary measures inevitably cause a considerable economic impact that can hinder economic growth and raise the unemployment rate. Therefore, whether this reform is an effective trade-off is questionable. According to the empirical analysis in this study, if tax reform is implemented to prevent a halt to the national pension system but is done so without appropriate supplementary measures, the economic impact alone will cause a loss of 0.1546% of the real GDP (NT$ 747.42 billion divided by NT$ 48,351.99 billion) in 2016 and a 0.2386% increase in unemployment. By contrast, proper supplementary measures implemented with financial flexibility could induce a gain of 0.1724% of the real GDP (NT$ 833.64 billion divided by NT$ 48,351.99 billion) and a 0.2661% decrease in unemployment. Therefore, the difference between

**Table 3: Economic spillover effects on tax revenue**

| Spillover Stage | Direct effects | First indirect spillover | Second indirect spillover | Total effects |
|---|---|---|---|---|
| business tax | 3.270 | 2.308 | 1.187 | 6.766 |
| personal income tax | 18.944 | 13.371 | 6.878 | 39.193 |
| corporate income tax | 4.230 | 2.986 | 1.536 | 8.752 |
| Total tax revenue | 26.444 | 18.665 | 9.601 | 54.711 |

Unit: NT$ billion

the two approaches determines the impact on the economy and outcome of the practice.

Economic development is closely related to the economic system. In particular, the social security system not only governs the health and quality of life of the populace but also represents advancement for a civilized country. However, the implementation and maintenance of a national pension system require stable funding and cannot depend on the country's fiscal budget in the long term. This is particularly true in times of economic instability because a country would be hard pressed to support its national pension system on a limited budget. This study verifies that raising business tax yields positive and negative outcomes and recommends relaxing financial policies for sufficient financial flexibility. Therefore, the Taiwanese government is advised to stimulate the economy through financial expenditure (transfer expenditure in this study's analysis) to not only overcome the impact of the raised business tax by 1% but also create a new wave of fiscal dividends.

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