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The Evaluation of ASEAN-Members Pension Scheme Performance

Mario Arturo Ruiz Estrada [1] · Evangelos Koutronas [2]

Abstract
This study introduces a comprehensive evaluation tool to study the performance of pension schemes. The Pension Scheme Performance Index (PSP-Index) suggests the following factors: education infrastructure growth rate (ΔV1), training program growth rate (ΔV2), diet improvement growth rate (ΔV3), health coverage growth rate (ΔV4), life expectancy growth rate (ΔV5), pension coverage growth rate (ΔV6), labor market demand growth rate (ΔV7), total tax collection growth rate (ΔV8), and capital expansion growth rate (V9). PSP-index attempts at the standardization of performance measures that have typically applied in pension schemes irrespective of their type and level of development. The model investigates pension scheme performance of five ASEAN-member countries—Singapore, Malaysia, Indonesia, Thailand, and Philippines.

Keywords Social protection · Welfare · Social security · Economic modeling · Policy modeling

JEL Classifications Y20

Introduction

Pension schemes broadly operate on pay-as-you-go or fully funded basis. Pay-as-you-go pensions employ redistribution mechanisms that allow intergeneration transfers between cohorts or across periods. Pay-as-you-go systems are subject to, among others, demographic risk (Feldstein and Liebman 2002). In anticipation of future cash flows, the state does not have to proceed on asset accumulation[1]; benefits simply paid out as they become due. Pension fund is in balance as long as replacement rates remain high or constant.[2] This assumption holds as long as the economy experiences sustain technological progress, constant population growth, and excessive capital accumulation (Aaron 1966). Empirically, the scarcity of natural resources constitutes sustain economic growth implausible,[3] so a pay-as-you-go scheme of compulsory saving, insurance of earning capabilities, and redistribution could only be financially sustainable (Diamond 1977).

Fully funded arrangements alternatively rely upon capital contributions and investment returns.[4] Main concern of fully funded systems is investment risk[5] (Miles and Timmermann

[1] Contribution accumulation may be observed to be invested on low-risk low-yielding investments due to persistent (and unexpected) inflation. However, investment capital gains are intended to use to meet short-term financial obligations and not for the payment of future pension benefits (European Commission 2004).

[2] It is possible, theoretically, for every generation to obtain higher benefits than contributions paid, given that, the pension rate of return exceeds the market rate of return indefinitely (Samuelson 1958). In the case of actuarial imbalance, the state bears the financial risk for benefits payments.

[3] The use of alternative abundant natural resource substitutes, recycling, and, resource optimization can result of purposeful activity in response to signals of increased scarcity (Krautkraemer 2005).

[4] In contrast to pay-as-you-go schemes, fully-funded schemes are dissociated from demographic risks. Oksanen (2001) claimed that this argument is somehow misleading because aging affects savings, which in turn, it should also affect interest rates. Brooks (2000) and Merrill Lynch (2000) produced simulations showing that long-lived retiree population can suffer significant losses to their pension wealth due to an interest rate shock. Certain occupation schemes though, can be subject of demographic risks (Brooks 2000; Stevens 2001).

[5] Fully-funded schemes are subject to liquidity risk. For instance, a potential interest rate rise or stock price fall, may force fund management to liquidate part of its portfolio at unfavorable prices and incur losses. This is normally translated into lower investment returns for the retirees; the fund cannot fully meet its obligations. If pension management exercises the ability to borrow the amount needed in order to meet its liquidity target, portfolio liquidation can be avoided. However, the fund would still bear the cost of borrowing (McLeod et al. 1993). If pension fund chooses to diversify its asset holdings abroad, in principle, it can increase investment returns given the same level of risk (Pfau 2011; Solnik and McLeavey 2004), but asset diversification comes with certain economic and political risks (Leinert and Eche 2000).

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1999). Upon retirement, beneficiaries are entitled to receive their accumulated contributions plus the expense deducted, after-tax investment gains that come from interest payments, dividends, or capital gains.[6] Investment earnings can be continually reinvested, until such time as the funds need to be paid out in the form of pension benefits. Early withdrawals are usually restricted or forbidden, so pension funds have long-term liabilities, allowing holding of relatively higher risk and higher return instruments. A fully funded pension scheme is viable as long as asset market values equal the present value of promised pensions (Novy-Marx and Rauh 2009). Conservative investment strategies may preserve capital and protect against inflation; however, they are likely to lead in inadequate pension benefits in the long run. Hence, actual funding ratios—the ratios of assets to accrued benefit obligations—fluctuate and are often less than 100% (Bohn 2010).

Whatever financing mechanism is used, both pension schemes have exhibited cash flow irregularities, increasing thereby the need to monitor fund efficiency and effectiveness in terms of benefit coverage, pension adequacy, and financial sustainability. Thorough, timely, and accurate evaluation determines whether contribution and investment performance objectives being achieved, facilitating in decision-making. Only then, policymakers will reevaluate current requirements of regulations and standard actions, implementing tailored policies closely related to their specific context. Periods of prolonged economic and financial distress may put into sharper focus underlying structural issues regarding the sustainability of pension schemes.

Empirical literature has identified pension adequacy and financial sustainability as the key evaluation criteria of pension schemes. The first criterion concerns of the ability of pension schemes to enable individuals to maintain their living standards at retirement. The second criterion refers to fund performance. Notwithstanding, the above evaluation methods are monotonic in principle, providing inadequate information about scheme's overall performance. Developing a performance measurement framework specific for pension funds is a relatively new topic in the literature. It is anticipated given that most of the pension schemes in the developing countries are still in their development phase, whereas the well-established pension schemes in developed countries experiencing administrative, regulatory, and political issues.

This paper formulates an analytical framework for evaluating the overall performance of pension schemes. The Pension Scheme Performance Index (PSP-Index) introduces a comprehensive evaluation tool to study the coverage and overall performance of pension schemes irrespective of their type and level of development. PSP-Index is a coordinated indicator that offers compatibility and interoperability evaluation in different pension schemes based merely on macroeconomic analysis rather than microeconomic analysis. The model investigates the pension scheme performance of five ASEAN-member countries—Singapore, Malaysia, Indonesia, Thailand, and Philippines. These countries exhibit comparable social, cultural, and political features with substantial diversity on certain demographic and economic indicators, varying considerably in the sphere of social security and philosophy context given to adequacy, affordability, sustainability, robustness, and the level of safety nets (Koutronas 2015). Furthermore, the aforementioned countries are also still a long way off from having well-designed pension systems that satisfy ideal systemic properties such as adequacy and sustainability. Since failures in both function performance and system design stand in the way of good performance, addressing both types of failure are essential for pension reform.

The paper is organized as follows. Section "Relevant Literature" reviews the evaluation methods that have been proposed and used in the literature. Section "The Pension Scheme Performance Index" describes the underlying model. Section "Application of the PSP-Index in ASEAN-Members Pension Schemes" presents findings in regard to ASEAN pension schemes. Section "Concluding Remarks" concludes. The Appendix contains tables and figures.

Relevant Literature

The methodologies and techniques emerged in the field of pensions focused on the classification of fund performance viewed through a qualitative and quantitative prism (Ruiz Estrada 2011; Ruiz Estrada and Yap 2013; Ruiz Estrada and Park 2018). A content analysis of 100 papers issued by five different journals on pension performance from 1990 to 2016 (JSTOR 2018). Studies employed econometric methods to apply either benefit/cost, probabilistic or forecasting analyses to assess the efficiency of pension schemes in regards to the level of contributions and investment performance.

Funding of Pension Schemes

Most of the developed countries have undertaken substantial pension reforms the last 40 years due to demographic, economic, social, and financial changes. The spectrum of reform arrangements was mainly parametric and systemic in nature encompassing fiscal consolidation policies that include the retrenchment of public pension systems and lower entitlements for current and future retirees. In principle, a well-designed pension scheme should have certain characteristics given the sustainability threshold level of 15 years of retirement (Ehnsson 2008; Schwarz 2006) and the benefit replacement rate of 60% (Grech 2013): broad-based, actuarial, robust, and sufficient (Holzmann and Hinz 2005; Park 2010); certain desired properties: providing social insurance and contributions relating to

[6] Risk differentials of portfolio performance falls on scheme members.

benefits, increasing the incentives to work, and reducing inequities across demographic groups (Blahous 2000); and certain principles: it should cover all populations with no exceptions; the level of benefits should be in balance with the level of contributions paid; pension contributions should be withheld from employee salaries or wages; pension schemes should be financially independent; social security schemes should redistribute wealth from those who have to those who need it; pension benefits should be adjusted over time in terms of current wage and inflation; and the pension schemes should be compulsory (Advisory Council on Social Security (ACSS) 1997; Ball and Bethel 1997). A broad stream of literature therefore started to delve into the broader implications of policy reforms to retirement income adequacy and how best to measure whether pension entitlements will remain adequate.

Replacement rates are considered by researchers as appropriate measures of pension adequacy comparing preretirement with postretirement individual consumption. However, the diversity of perspectives in the definition of pension adequacy is also reflected in the range of indicators used to assess retirement-income adequacy. Goodin et al. (1999) compared effective replacement rates for Germany, the Netherlands, and USA.[7] Blondell and Scarpetta (1999) studied cross-country theoretical replacement rates. Later studies suggested diversification of replacement rates (Clingman et al. 2016; European Commission 2018; Mandatory Provident Fund Schemes Authority 2010; Mitchell and Phillips 2006; Pang and Warshawsky 2013) between income levels (Biggs and Springstead 2008) and between gross and net income (Holzmann and Guven 2009).

Undoubtedly, income replacement varies across countries, individuals, and periods. Income divergence is also extended to the preretirement standard of living as well as to the expected costs required to maintain that standard at retirement. The former refers to target replacement rates, whereas the latter to budgeting (Chybalski and Marcinkiewicz 2016). In the target replacement rate context, Cole and Liebenberg (2008) associated preretirement income with income replacement rate and consumption replacement rate. Hurd and Rohweder (2008) included consumption patterns for the estimation of expected pension earnings. VanDerhei (2006) and Bajtelsmit et al. (2013), among others, incorporated broader economic assumptions in the estimation of expected pension income. Borella and Fornero (2009) compared pre- and postretirement standard of living with the use of comprehensive replacement rates. Chybalski (2012) introduced a synthetic indicator of adequacy of pension system for cross-country analysis. In regards to budgeting, the Mandatory Provident Fund Schemes Authority (2010) employed this methodology for the estimation of replacement rates. Mutchler et al. (2014) proposed the Elder Economic Security Standard Index as a cost of standard of living benchmark. Bialowolski and Weziak-Bialowolska (2014) on the other hand questioned budget approach's usefulness since it is based on survey data.

Replacement rates have their limitations. At first, they are historical measures; it requires the retirement of the work population in order to be verified. Second, they are individual performance measures, and thus, they cannot provide accurate information about the overall assessment of pension funds. Third, they are single-point-in-time indicators that do not take into account longitudinal data and how they affect individuals. Fourth, pension adequacy measures are static, ignoring benefit indexation, changes in pension age, and life expectancy. Overestimation/underestimation of fund performance would reveal concerns about allowing cost information, and particularly benefit-cost analysis, to play a prominent role in policy reform decisions in regards to poverty alleviation and income replacement. Finally, replacement rates exhibit methodological heterogeneity, which constitutes national and international comparative analysis trivial (Grech 2013; Mitchell and Turner 2009).

Investment Performance of Pension Schemes

Theoretical and empirical considerations have employed various techniques and methodologies to measure the performance of professionally managed investment funds. Professionally managed investment funds use common basic investment approaches of involving long-term objectives with due regard to principal safety, yield volatility, and investment diversification. Investment risk refers to the uncertainty arises when the expected level of investment return is not produced due to abnormal market behavior, inefficient investment strategies, or poor individual investment decisions. The main concern for pension funds entails funding risk: fund's inability to meet its financial obligations due to lack of sufficient assets to meet liabilities, or plan sponsor's failure to finance the plan. Respectively, the opposite applies for credit risk where pension fund is endangered by the potential loss of the counterparty or the bond issuer to meet its financial obligations. Concentration risk is also part of investment risk when fund portfolio is overexposed in terms of issuer, geographical area, industry and type of instrument, and, more broadly the risk of insufficient diversification of investment. Early empirical studies focused their attention on the investment performance of mutual funds (Farrar 1962; M. Grinblatt and Titman 1989; Henricksson 1984; Irwin et al. 1970; Irwin and Vickers 1965; Jensen 1968; Mains 1977; Sharpe 1966; Treynor 1965). Pension funds have not been the subject of extensive research due to data availability, especially for pension plan portfolios in their entirety (Beebower and Bergstrom 1977; Berkowitz et al. 1988; Voorheis 1976).

Prior to 1965, fund performance was based on Markowitz's (1952; 1959) seminal work on portfolio theory followed by his

[7] In fact, Goodwin used did not the 'effective replacement rate' as an adequacy indicator but as a measure of the extent to which welfare systems promote stability over an individual's life course.

successors Sharpe (1964), Lintner (1965), and Mossin (1966).[8] Beta coefficient measures volatility of an individual security or a portfolio of financial instruments in comparison to the market average. The aforementioned development on portfolio theory quantified and measured risk with respect to variability of returns, no single tool essentially considered risk and return simultaneously. Alpha ratio measures abnormal return per unit of risk that in principle could be diversified away from holding a market index portfolio. Treynor's ratio (Treynor 1965) considers the excess return relative to risk-free-return per unit of systematic risk. The Jensen's alpha (Jensen 1968) also evaluates performance in terms of systematic risk and shows how to determine whether the difference in risk-adjusted performance is statistically significant. Jensen's alpha expects to be zero in an efficient market and positive in an above-the-average portfolio performance. Close to Treynor's ratio, Sharpe's ratio (Sharpe 1994) examines the average differential return relative to the portfolio's benchmark divided by the standard deviation of the differential return. The two measures provide identical estimates for completely diversified portfolios. Leah and Franco Modigliani (Modigliani and Modigliani 1997) focused on risk-adjusted measure of portfolio performance with the use of total volatility. Goodwin's (1998) information ratio calculates excess return per unit relative to a specific benchmark index instead of risk-free return. The aforesaid five techniques are popularly used to measure risk-adjusted performance of mutual funds. Appendix Table 1 provides a detailed summary of the other most important portfolio performance evaluation measures and techniques.

These evaluation measurements provide useful benchmark to evaluate fund performance that would considerably improve the value of performance measurement in relation to the methods now used that are derived from evaluation of other types of investment management with very different attributes from pension funds. However, investment performance measures do not provide insightful connotations about the fund overall performance (Bohl et al. 2011; Huang and Mahieu 2012; Kumar and Perumal 2016; Lieksnis 2010). Without comprehensive performance measurement criteria that are explicitly derived from consideration of the particular nature of pension funds, reliance on market competition with minimal criteria for investment strategies will not result in an investment portfolio that will effectively achieve the goal of consumption smoothing and income replacement.

The Pension Scheme Performance Index

Consider a pension scheme with T number of registered members. These individuals can be effective members, A, paying regularly their earnings contributions, and ineffective members, P, who do not pay regularly or at all their earnings contributions to pension fund. Let $A = \sum_{i=1}^{\infty} A_i$ be the total number of ineffective fund members and $P = \sum_{i=1}^{\infty} P_i$ be the total number of ineffective fund members, the to the total number of fund members within a year is given by

$$T = A + P = \sum_{i=1}^{\infty} A_i + \sum_{i=1}^{\infty} P_i \tag{1}$$

Differentiation of expression (1) in respect the previous year will give us the marginal pension scheme performance growth rate

$$\Delta T^{'} = \Delta A^{'} + \Delta P^{'} = \frac{\partial \Delta A_t}{\partial \Delta A_{t-1}} + \frac{\partial \Delta P_t}{\partial \Delta P_{t-1}} \tag{2}$$

where $\frac{\partial 2\Delta A_t}{\partial 2\Delta A_{t-1}}$ and $\frac{\partial 2\Delta P_t}{\partial 2\Delta P_{t-1}}$ are the marginal effective pension scheme members growth rate and the marginal ineffective pension scheme members growth rate, respectively. Pension scheme is highly effective when $\Delta A^{'} > 1$; exhibit stagnation when $\Delta A^{'} = 1$; and performed low when $\Delta A^{'} < 1$. An increase of effective pension fund members can be a result of higher contribution rates or higher economic growth. Theoretically, the presence of higher contribution rates reduces disposable income with a negative impact on household consumption preferences, economic growth, and future contribution rate (Zhang and Zhang 2004).[9] Besides, a participation rate increase will have a negative impact on net salaries and net benefits. Higher participation rates can lead to idle labor demand, informal sector expansion, or impoverish individual saving behavior. It is estimated that a sudden 15% increase of participation rate will cause an adverse shock to the labor market. Instead, the preferred alternative is the implementation of a participation rate that labor market can bear and keep it constant over time (Torben et al. 2007).

Empirically, economic growth is positively correlated with welfare growth as we have seen that most of industrial countries experienced during the Golden Age. The concept of perpetual economic growth is implausible. However, economic growth can become a positive indicator for public budget only under the unrealistic assumption that public sector wages and transfers should grow at a slower than the average general income pace (Koutronas 2015).

In the case of ineffective members, pension scheme exhibits expansion when $\Delta P^{'} > 1$; stagnation when $\Delta P^{'} = 1$; and contraction when $\Delta P^{'} < 1$. The second differentiation in expression (3) determines the critical point (inflection point) of the pension scheme performance

[8] Alternative asset pricing models introduced multi-factor approaches. See Feeney and Hester (1964); Ross (1976); Chen et al. (1986); Ingersoll (1987); and Fama and French (1992).

[9] Fully funded model alternatively invests contributions in financial assets therefore the contribution rate is relatively lower resulting an increase to savings (Cigno and Rosati 1992, 1996, 1997; Cigno and Werding 2003; Fuster et al. 2003).

$$\Delta T^{''} = \Delta A^{''} + \Delta P^{''} = \frac{\partial^2 \Delta A_t}{\partial^2 \Delta A_{t-1}} + \frac{\partial^2 \Delta P_t}{\partial^2 \Delta P_{t-1}} \tag{3}$$

Intuitively, pension effectiveness is associated with the level of contribution rate. Higher degree of contributions means more people will save through their pension scheme and this might lead to a higher aggregate saving rate. Capital market development could be stimulated as more resources come available for the capital market when pension schemes are funded. Finally, labor market distortions might be partly taken away because funded pension systems have a less distorting effect on labor supply decisions than unfunded systems. These effects could all be growth-enhancing.

Pension's fund resources are usually allocated to certain pillars of economic activity such as education, healthcare. Consider workforce productivity measured in terms of intensity/quality of labor and capital associated with the aforementioned pillars of the economy. The national TFP_L level (ΔTFP_L) is based on nine variables: education infrastructure growth rate (ΔV_1); training program growth rate (ΔV_2); diet improvement growth rate (ΔV_3): health coverage growth rate (ΔV_4); expansion of life expectation growth rate (ΔV_5); pension coverage growth rate (ΔV_6); labor market demand growth rate (ΔV_7); total tax collection growth rate (ΔV_8); and capital expansion growth rate (V_9). The nine variables do not refer to economic growth per se, but rather the long-term effects of economic growth to living standards. Besides, higher economic growth does not necessarily lead to better living standards. Improved efficiency associated with learning-by-doing, gradual improvements in how machinery and workers are organized and utilized, and increased specialization via training and education can lead in turn to better nutrition and healthcare made possible by the expansion of capital expansion and labor demand all fall into the "technological change" category. Endogenous growth via investment in human capital, innovation, and knowledge are significant contributors to economic growth. Hence, the national TFP_L level is a determinant from a matrix three by three according to expression (4):

$$\Delta TFP_L = \begin{bmatrix} \Delta V_1 & \Delta V_2 & \Delta V_3 \\ \Delta V_4 & \Delta V_5 & \Delta V_6 \\ \Delta V_7 & \Delta V_8 & \Delta V_9 \end{bmatrix} \tag{4}$$

The marginal national TFP_L growth rate ($\Delta TFP_L{}'$) is accordingly

$$\Delta TFP_L^{'} = \frac{\partial \Delta TFP_{Lt}}{\partial \Delta TFP_{Lt-1}} \tag{5}$$

The second differentiation of expression (5) gives similarly the critical (inflection point) for TFP_L

$$\Delta TFP_L^{''} = \frac{\partial^2 \Delta TFP_{Lt}}{\partial^2 \Delta TFP_{Lt-1}} \tag{6}$$

Figure 1 shows that the Marginal Total Pension Scheme Performance Growth Rate ($\Delta T'$) is directly connected to the Marginal National TFP_L Growth Rate ($\Delta TFP_L{}'$) in the long run.

The performance of the marginal national TFP_L level in different periods is given by

$$\int_{i=1}^{\infty} \Delta TFP_{L1}^{'}(\Delta TFP_{L1}) + \ldots + \int_{i=\infty}^{\infty} \Delta TFP_{L\infty}^{'}(\Delta TFP_{L\infty}) + \ldots + \Delta TFP_L, \qquad \Delta TFP_L \neq 0 \tag{7}$$

However, the Marginal Total Pension Scheme Performance Growth Rate ($\Delta T'$) is directly connected to the Marginal National TFP_L Growth Rate ($\Delta TFP_L{}'$):

$$\int_{i=1}^{\infty} \Delta T^{'}\left(\Delta TFP_{L1}^{'}\right) + \ldots + \int_{i=\infty}^{\infty} \Delta T^{'}\left(\Delta TFP_{L\infty}^{'}\right) + \ldots + \Delta T^{'}, \qquad \Delta TFP_L{}^{'} \neq 0 \tag{8}$$

Thus, performance of any pension scheme is represented by

$$\Delta T^{'} = \left\{ t | t-1 \in \mathbb{R}^{+} \forall \Delta TFP_{L_t}^{'} > 0 \neq \Delta TFP_{L_{t-1}}^{'} \right\} \tag{9}$$

Both labor productivity and pension scheme follow a parallel trajectory that gradually their critical points converge to a steady state in the long run. Equation 9 is the basic mathematical condition for any pension scheme. As it is shown in Fig. 2, a pension scheme in its initial development phase grows in the short run as the economy grows. In the long run, pension scheme's performance will stabilize or decline as it reaches the maturity phase, ceteris paribus.

The evaluation of the relationship among these variables under sensitivity analysis shows the following possible scenarios:

- If $\uparrow \Delta TFP' \rightarrow \uparrow \Delta T'$: pension scheme has consistent performance

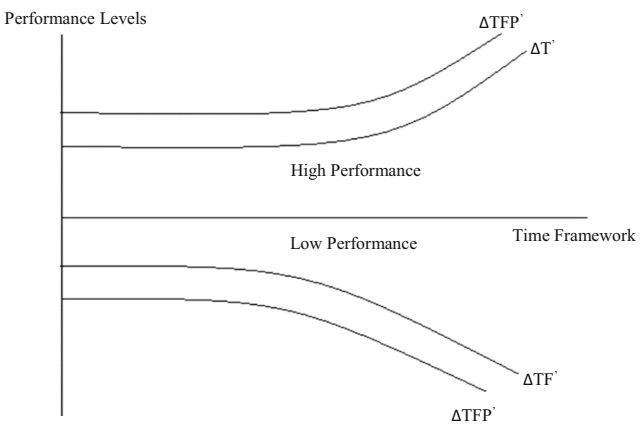

Fig. 1 The Impact of the Marginal National TFP Growth Rate ($\Delta TFP'$) on the Marginal Total Pension Scheme Performance Growth Rate ($\Delta T'$)

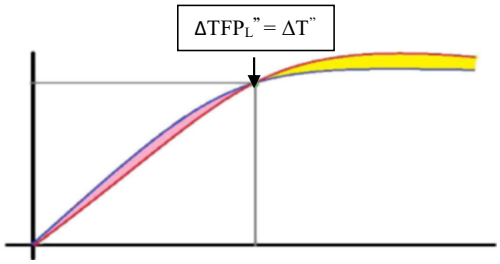

Fig. 2 The Critical National TFP_L ($\Delta TFP_L''$) and The Critical Pension Scheme Performance Growth Rate ($\Delta T''$)

- If $\downarrow \Delta TFP' \rightarrow \downarrow \Delta T'$: pension scheme has consistent performance
- If $\uparrow \Delta TFP' \rightarrow \downarrow \Delta T'$: pension scheme has inconsistent performance
- If $\downarrow \Delta TFP' \rightarrow \uparrow \Delta T'$: pension scheme has inconsistent performance

The Pension Scheme Performance Index (PSP-Index) is an indicator that evaluates pension fund effectiveness:

$$PSP\text{–}Index = \sum_{t=1}^{\infty}\left[\int_{i=1}^{\infty} 1-\left(log\frac{\partial \Delta TFP_L^{'}}{\partial \Delta T^{'}} e\pi^{-1}\right)\right]^{t+1} \quad (10)$$

where the mathematical constants e ($e \approx 2.71$) and π ($\pi \approx 3.14$) are used to minimize logarithm variability. Pension performance is categorized by high performance: [0.76, 1.00]; good performance: [0.51, 0.75]; low performance: [0.26, 0.50]; and poor performance: [0.00, 0.25].

Application of the PSP-Index in ASEAN-Members Pension Schemes

We examine the pension schemes in the five large ASEAN-member countries—Singapore, Thailand, Malaysia, Indonesia, and Philippines from 1990 to 2017 (see Appendix Table 2). ASEAN pension systems are part of what is called the East Asian welfare model (Holliday 2000). The East Asian welfare model primarily focuses on the social policy's positive outcome with regard to state economic development and secondary to the welfare system's institutional role. The welfare state is seen as having an important role in supporting economic growth, political solidarity, social cohesion, and human capital development (Goodman and White 1998). Social policy is heavily concentrated on education and healthcare as part of the nation's long-term development plan (Gough 2000). Welfare state operates within an economic and political environment that shares common characteristics: (i) strict fiscal policy, (ii) relatively flexible labor markets, and (iii) subjective social policy (Aspalter 2006).

ASEAN countries have developed provident fund type pension schemes. Provident funds, a variant of defined-contribution plan, are "publicly administered mandatory occupational retirement savings schemes" (Dixon 1996). What makes these defined-contribution character pension schemes different from the pay-as-you-go schemes is that there are no inter-generational transfers: members pay contributions for their own pensions into a designated savings account to withdraw later upon retirement. There is no automatic indexation. However, welfare benefits and services are limited to formal sector employees while social protection provided by local community and families. In response to the economic crisis, several countries developed a number of targeted support programs, including rice and fuel subsidies, and new cash transfer programs (Koutronas 2015).

We employ secondary data from different domestic and international institutions. The five countries vary considerably in the sphere of infrastructure, economic development, institution capacity, and social policy. They have undergone welfare reforms recently focusing in the following areas: informal labor markets, fiscal space on public finances, and social protection.

Findings show that the marginal total Pension Scheme Performance Growth Rate ($\Delta T'$) is directly connected to the marginal national TFP_L growth rate ($\Delta TFP_L'$) in the long run. In our analysis, Singapore pension fund exhibits relatively the highest performance closely followed by Malaysia (high performance), Thailand (good performance), Indonesia (lower performance), and Philippines (lower performance). Not surprisingly, the pension classification reflects the economic dynamics across urban and rural areas of those countries. Philippines and Indonesia low marginal national TFP_L growth rates ($\Delta TFP_L'$) are translated to a negative pension scheme performance, unable to meet its short and long run objectives. It is imperative for both countries to take implement expansionary welfare policies for the generation higher marginal national TFP_L growth rate ($\Delta TFP_L'$) in the short run. Governments should allocate a significant part of their budgets for welfare expansion, in a context of education, healthcare, and retirement programs both in urban and rural areas as key ingredients of the economic growth strategy. The creation of a strong national pension scheme platform can generate a spillover effect to generate a positive effect on both marginal national TFP_L and growth rate ($\Delta TFP_L'$).

Concluding Remarks

Consistent with empirical evidence (Davis and Hu 2008; Holzmann 1997, 1999), pension funding is associated with

an increase in productivity growth rates. The Pension Scheme Performance Index (PSP-Index) suggests alternative methodological evaluation directly linking pension performance with labor productivity. Changes in labor markets undoubtedly affect pension scheme performance. Higher labor productivity leads to a strong pension system able to adapt to internal and external uncertainties. The marginal increase of labor productivity is determined based on how the human capital factor can be adapted to new technological changes and social issues (political and fast economic transformations).

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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Appendix

Table 1 Performance measures

A: Classical

Type	Statistic	Authors	Observations	Information Required
Selectivity	$T_p = \frac{\bar{r}_p}{\beta_p}$ Excess return per unit of systematic risk	Treynor and Mazuy (1966): Treynor Ratio	Purpose: rank portfolio managers and combine them into a single portfolio. Needs at least a benchmark for comparison purposes. Problems: statistical power; market timing; changes in risk levels; oversimplification	Nonoverlapping synchronized portfolio, benchmark, and risk-free returns
Selectivity	$S_p = \frac{\bar{r}_p}{\sigma_p}$ Excess return per unit of total risk	Sharpe (1966): Sharpe ratio	Purpose: rank portfolio managers and choose a single one, combined with a riskless asset. Needs at least a benchmark for comparison purposes. Problems: statistical power; market timing; changes in risk levels; oversimplification	Nonoverlapping synchronized portfolio and risk-free returns (HPRs)
Selectivity	$SE = \sqrt{\frac{\left(1+\frac{1}{2}(S_p)^2\right)}{T}}$ Annualized Sharpe and standard errors; i.i.d. case	Lo (2002)	Provides statistical significance tests for the Sharpe ratio and corrects for serial dependence	Nonoverlapping return series
Selectivity	$\alpha_p = \bar{r}_p - \beta_p \bar{r}_m$	Jensen's alpha (1968)	Purpose: detect value added by portfolio manager via selectivity Problems: statistical power; market timing; changes in risk levels; oversimplification; benchmark efficiency	Nonoverlapping synchronized portfolio, benchmark, and risk-free returns
Selectivity	$\frac{\alpha_p}{\sigma_{ep}}$	Treynor and Black (1973): appraisal ratio	Purpose: measure value created by selectivity per unit of diversifiable risk. Implies an optimal way of forming portfolios. Problems: same as Jensen's alpha	Nonoverlapping synchronized portfolio, benchmark, and risk-free returns
Selectivity	$IR = \frac{ER}{\sigma_{ep}}$ $ER = R_{Pt} - R_{Bt}$	Goodwin (1998): information ratio	Purpose: measure value created by selectivity ignoring beta Problems: same as Jensen's alpha	Nonoverlapping synchronized portfolio and benchmark returns

Table 1 (continued)

A: Classical

Type	Statistic	Authors	Observations	Information Required
Market Timing	$r_p = \alpha_p + b_{0p} r_m + b_{lp}' r_m^2 + e_p'$	Treynor and Mazuy (1966)	Purpose: detect value added by portfolio manager via selectivity and market timing Problems: statistical power; changes in risk levels; oversimplification; benchmark efficiency; other functional forms for changes in risk levels	Nonoverlapping synchronized portfolio, benchmark, and risk-free returns
Market Timing	$r_p = \alpha_p' + b_{0p}' r_m + b_{lp}' r_m^+ + e'$ $r_m^+ = \max(0; r_m)$	Henriksson and Merton (1981)	Problems: statistical power; changes in risk levels; oversimplification; benchmark efficiency; other functional forms for changes in risk levels	Nonoverlapping synchronized portfolio, benchmark, and risk-free returns

B: Multiple Indices

Type	Statistic	Authors	Observations	Information Required
Selectivity	$\bar{r}_p = \alpha_p + \sum_k \beta_{pk} \bar{r}_k$	Elton et al. (1996) and Sharpe (1992): asset class indices; Lehman and Modest (1987), Connor and Korajczyk (1986), Grinblatt and Titman (1989), Brown and Goetzmann (1997): empirical indices; Carhart (1997)	Purpose: detect value added by portfolio manager via selectivity Problems: inefficient indices; incomplete specification; timing	Nonoverlapping synchronized portfolio, multiple benchmarks, and risk-free returns
Combines selectivity and market timing	$\bar{r}_{pt} = \alpha_{pt} + \sum_k \beta_{pk(t-q)} \bar{r}_k$ Rolling regression for estimating weights	Sharpe (1992)	Purpose: detect value added by portfolio manager via selectivity and market timing Problems: incomplete specification; in principle it represents a feasible strategy for the investor; assumes that changes in portfolio composition add value, even if they are based in public information, for example	Nonoverlapping synchronized portfolio, multiple benchmarks, and risk-free returns.

C: Conditional Performance

Selectivity corrected for seeming market timing based on public information	$\beta_p(Z) = b_{0p} + B_p' z$ $r_p = \alpha_p + b_{0p} r_m + B_p(z r_m) + u_p$	Ferson and Schadt (1996)	Purpose: detect value added via selectivity, correcting for seeming market timing based on public information Advantage: adjusts benchmarks on a timely basis. Disadvantages: asset-pricing model assumed; market efficiency; functional form of the portfolio adjustment	Nonoverlapping synchronized portfolio, multiple benchmarks, and risk-free returns and conditioning information

D: Other Performance Measures

Selectivity	$\alpha = \sum W_t r_{pt}$ subject to $0 = \sum W_t r_{It}$ (what proportions are needed over time to make the second equation true)	Grinblatt and Titman (1989): positive period weighting measure	Purpose: measure welfare-enhancing portfolio decisions Weights are interpreted as marginal utility of wealth for power utility.	Nonoverlapping synchronized portfolio, benchmark, and risk-free returns
Timing	$PCM = \frac{1}{T} \sum_t \sum_\tau \Delta W_{jt} r_{jt+1}$ $= \sum_t COV(\Delta W_j, r_j)$			

Table 1 (continued)

A: Classical

Type	Statistic	Authors	Observations	Information Required
		Grinblatt and Titman (1993): portfolio change measure	Purpose: measure whether portfolio changes add value; uses actual portfolio holdings; possible behavior involving taking increasing risks, combined with traditional measures	Actual portfolio holdings
Conditional timing measure	$CWM_i = E\left[\sum_{j=1}^{N}\left(\overline{W}_{j,t-1} - E\left[\overline{W}_{j,t-1}\right]\right)\left(\overline{R}_{j,t} - E\left[\overline{R}_{j,t}\middle\vert Z_t\right]\right)Z_{t-1}\right]$	Feldstein and Liebman (2002)	Purpose: decompose the Grinblatt-Titman PCM measure into components attributable to the manager and to public information	Actual portfolio holdings and conditioning information

Source: Walker and Iglesias (2010))

Table 2 PSP-Index

Country	$\Delta TFP'$	$\Delta T'$	PSP-Index	PSP-Index Level
Singapore	0.99	1.00	0.99	High
Malaysia	0.72	0.78	0.77	High
Indonesia	0.55	0.45	0.47	Low
Thailand	0.60	0.45	0.49	Good
Philippines	0.51	0.41	0.45	Low

Source: Asian Development Bank (ADB) (2018), World Bank (WB) (2018), United Nations (UN) (2018), Central Provident Fund Board (2018), (Singapore), Indonesia provident fund (BJPS Ketenagakarjaan) (2018), *Malaysia Employees Provident Fund* (*EPF*) (2018), Republic of Philippines Social Security System (2018), Thailand Social Security Office (SSO) (2018)

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