



**PBSS**  
**CANCUN MEXICO**  
COLLOQUIUM 2017  
DEFINING AMBITION

# A Financial Assessment of the Chinese Pay-As-You-Go Pension System

John A Turner – Pension Policy Center, Washington D.C. –  
[Jaturner49@aol.com](mailto:Jaturner49@aol.com)

Joint work with Jing Xu and María del Carmen Boado-Penas (University of Liverpool)



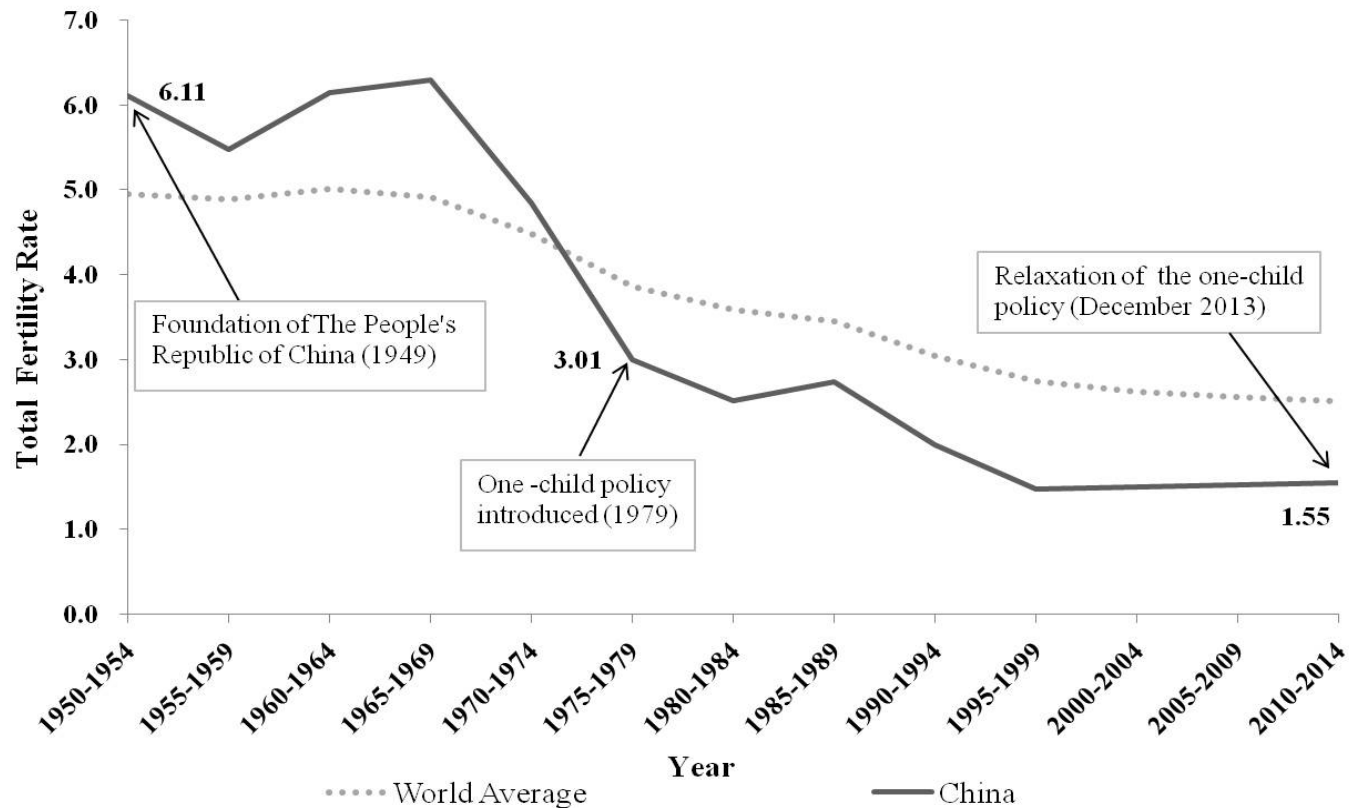
# This paper

- The is paper examines the financing of pay-as-you-go social security in China and the United States.

# Motivation

- Pay-As-You-Go (PAYG) pension systems are financed so that current workers pay pension benefits to current retirees.
- It requires a balance between the income from contributions and the expenditures on pension payments.
- Rapid ageing has led to serious concerns regarding the sustainability of the PAYG pension system.

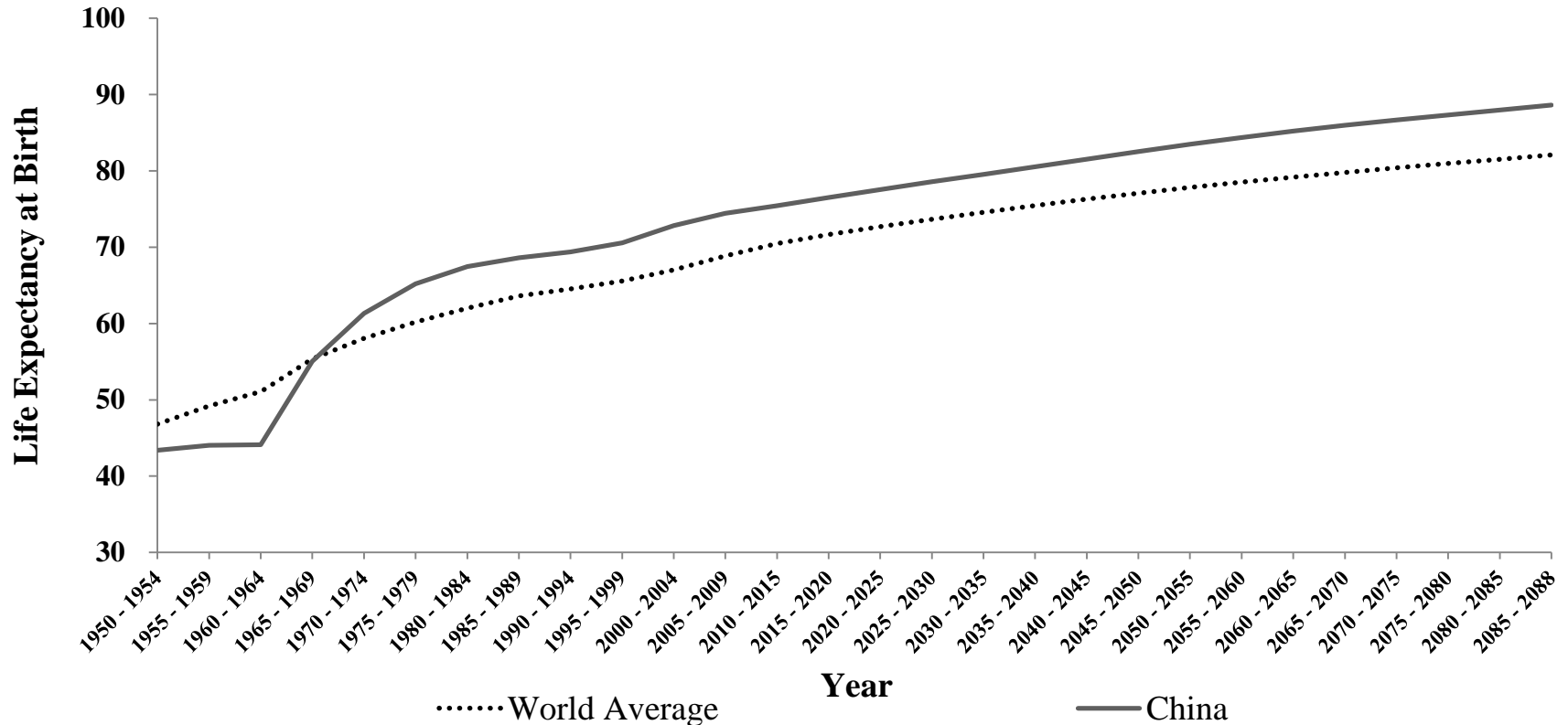
# Motivation – Low Fertility



Source: Authors' calculations based on the data from United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision.

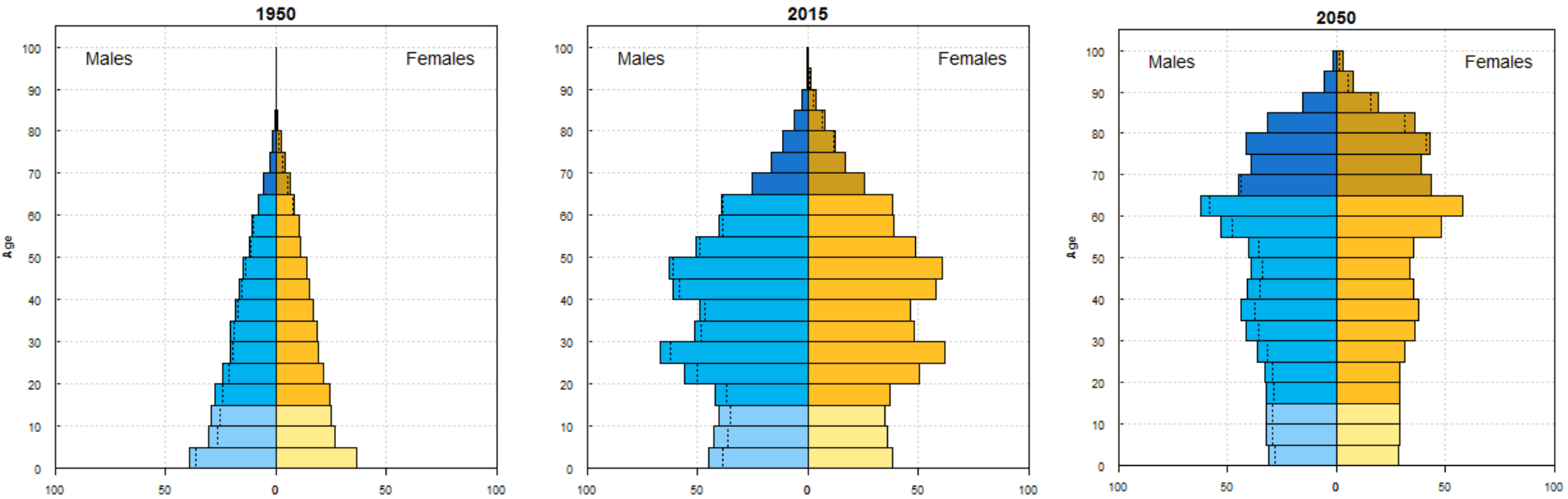


# Motivation – High Longevity



Source: Authors' calculations based on the data from United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision.

# Motivation – Population Pyramids in China



*Source:* United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision.



# Aim

- Analyse the sustainability of the Chinese PAYG pension system in urban areas over the 75-year period 2014-2088 following the actuarial approach used by the Social Security actuaries in the United States. It takes into account projected demographic and economic structure changes.
- To provide perspective on the results, the paper compares these results to the results for the Social Security program in the United States.
- The paper also provides advice on parametric reforms to restore the financial sustainability of the Chinese pension system.

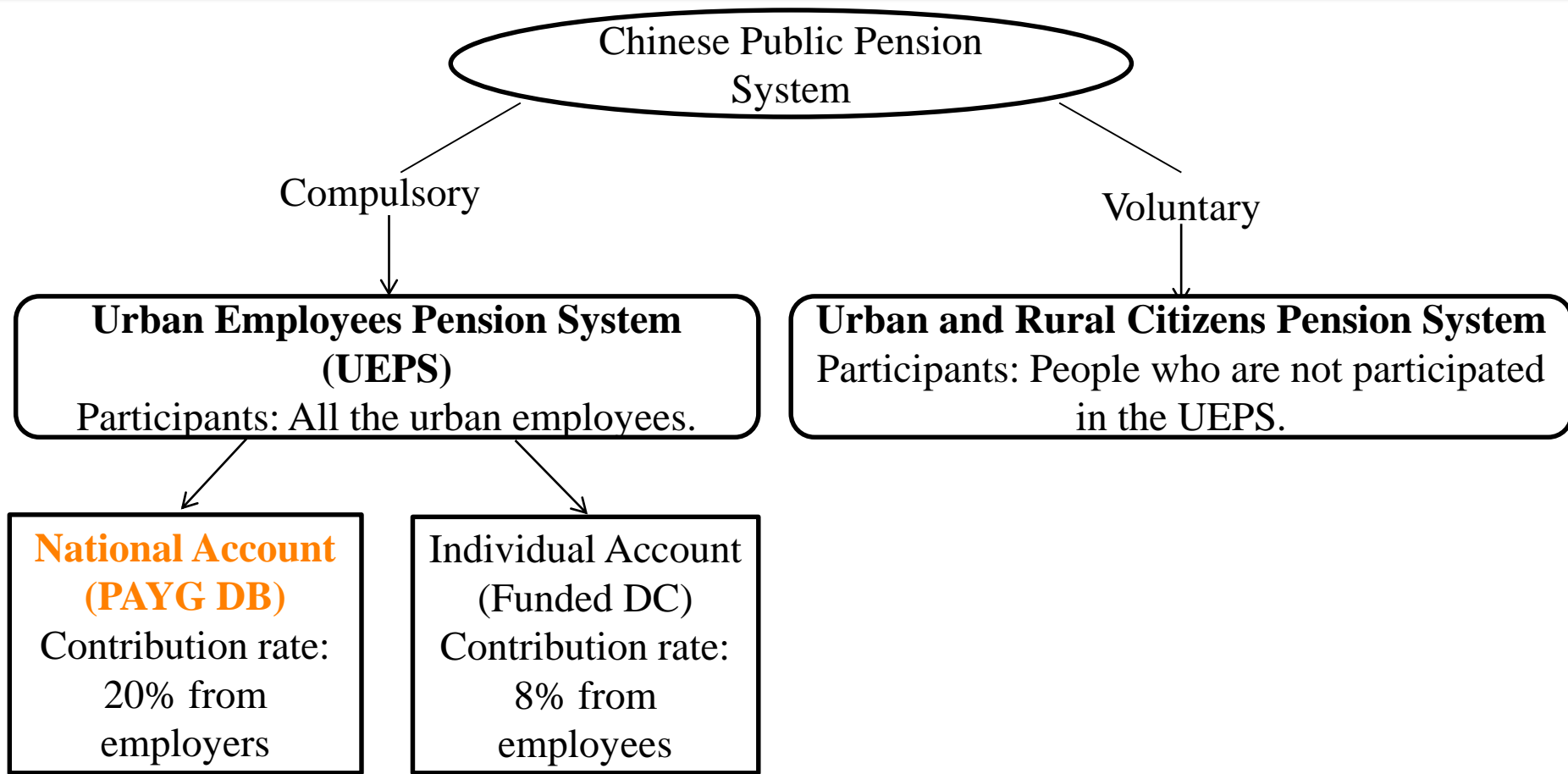
# Outline

1. Overview of the Chinese Public Pension System
2. Methodology to measure Sustainability
3. Results: China versus U.S. and Sensitivity Analysis
4. Parametric Reforms to restore Sustainability
5. Conclusions
6. References





# 1. Overview of the Chinese Public Pension System



## 2. Methodology for Sustainability

$$AB = \left[ \frac{\overbrace{TF_0 + y_0 \cdot \sum_{t=0}^{74} \theta_t \cdot N_t \cdot \prod_{k=1}^t \frac{(1+g_k)}{(1+r_k)}}^{\text{Present value of Contributions}}}{\underbrace{y_0 \cdot \sum_{t=0}^{74} N_t \cdot \prod_{k=1}^t \frac{(1+g_k)}{(1+r_k)}}_{\text{Present value of payrolls}}} \right] - \left[ \frac{\overbrace{B_0 \cdot \sum_{t=0}^{74} R_t \cdot \prod_{k=1}^t \frac{(1+\lambda_k)}{(1+r_k)} + \prod_{k=1}^{74} \frac{(TF_{74})}{(1+r_k)}}^{\text{Present value of benefits}}}{\underbrace{y_0 \cdot \sum_{t=0}^{74} N_t \cdot \prod_{k=1}^t \frac{(1+g_k)}{(1+r_k)}}_{\text{Present value of payrolls}}} \right]$$

Summarized Income Rate Summarised Cost Rate

- $TF_0$ : Value of assets in the trust fund at the beginning of the period.
- $\theta_t$ : Contribution rate at  $t$ .
- $y_0$ : Contribution base at year 0.
- $N_t$ : Number of contributors at year  $t$ .
- $g$ : Annual real wage growth rate.
- $r$ : Projected yield rate on trust fund.
- $B_0$ : Average pension at year 0.
- $R_t$ : Number of pensioners at year  $t$ .
- $\lambda$ : Annual real benefit growth rate.

# 3. China vs U.S.: Retirement Age

- In China, women can retire and collect benefits as young as age 50. Men can collect benefits at age 60, but many are able to qualify for exemptions to receive benefits at younger ages.
- In the U.S., men and women can receive social security benefits at age 62.

# China vs. US: Wage growth

- The growth rate of per capita wages is assumed to be 7.61 percent for China and 3.83 percent for the US.

# Results: China versus U.S.

Table : *Elements of the 75-year actuarial balance 2014-2088. Present value as of January 2014. (US \$1= 6.73 RMB)*

	Items	China (RMB in billions)	China (Dollar in billions)	US (Dollar in billions)
1	Income from contributions	792,358	117,735	50,969
2	Spending on pensions	2,198,122	326,615	64,299
3=1-2	Initial deficit	-1,405,764	-208,880	-13,330
4	Trust fund at start of period	2,680	398	2,764
5=3+4	Open group unfunded obligation	-1,403,084	-208,482	-10,565
6	Ending target trust fund	104,101	15,468	582
7=5-6	Results for the period	-1,507,158	-223,950	-11,148
8	Aggregate contribution bases	3,961,789	588,676	386,884
9=(1+4)/8	Summarised income rate	20.07%	20.07%	13.89%
10=(2+6)/8	Summarised cost rate	58.11%	58.11%	16.77%
11=9-10	Actuarial Balance (AB)	-38.04%	-38.04%	-2.88%
12	Year of first deficit	2030	2030	2014
13	Reserve fund exhausted (year)	2037	2037	2033

*Source:* Authors' calculations for China. The U.S. results are based on the Board of Trustees (2014).

## 3. Results: Sensitivity Analysis

Table : *Elements of the 75-year actuarial balance 2014-2088 for China under different scenarios. Present value as of January 2014. Unit: RMB in billions (US\$1= 6.73 RMB)*

	Items	Optimistic	Normal	Pessimistic
1	Income from contributions	1,187,007	792,358	629,429
2	Spending on pensions	1,668,693	2,198,122	2,103,738
3=1-2	Initial deficit	-481,686	-1,405,764	-1,474,309
4	Trust fund assets at start of period	2,680	2,680	2,680
5=3+4	Open group unfunded obligation	-479,006	-1,403,084	-1,471,629
6	Ending target trust fund	88,759	104,101	87,334
7=5-6	Results for the period	-567,766	-1,507,158	-1,558,963
8	Aggregate contribution bases	5,935,035	3,961,789	3,147,145
9=(1+4)/8	Summarised income rate	20.05%	20.07%	20.09%
10=(2+6)/8	Summarised cost rate	29.61%	58.11%	69.62%
11=9-10	Actuarial Balance (AB)	-9.57%	-38.04%	-49.54%
12	Dependency Ratio at year 2088	34%	127%	198%

Source: Authors' calculations



## 4. Parametric Reforms to restore Sustainability

Table : *Effect on the Chinese actuarial balance of two parametric reforms taken simultaneously*

Item		RR			$\lambda$			Retirement Age		
		31%	25%	20%	0%	-1%	-2%	62	64	66
CR	=	-38.0%	-27.4%	-17.9%	-38.0%	-14.8%	-1.3%	-22.6%	-9.5%	-0.5%
	10%	-28.0%	-17.4%	-7.9%	-28.0%	-4.8%	8.7%	-12.6%	0.5%	9.5%
	15%	-23.0%	-12.4%	-2.9%	-23.0%	0.2%	13.7%	-7.6%	5.5%	14.5%
	20%	-18.0%	-7.4%	2.1%	-18.0%	5.2%	18.7%	-2.6%	10.5%	19.5%
RR	31%				-38.0%	-14.8%	-1.3%	-22.6%	-9.5%	-0.5%
	25%				-27.4%	-8.4%	2.6%	-14.8%	-4.1%	3.3%
	20%				-17.9%	-2.7%	6.1%	-7.8%	0.7%	6.6%
$\lambda$	0%							-22.6%	-9.5%	-0.5%
	-1%							-5.5%	2.4%	7.8%
	-2%							4.4%	9.3%	12.6%

*Note:* Highlighted boxes are the results for the positive actuarial balance, i.e. measures that restore the sustainability of the Chinese pension system. CR is contribution rate, RR is replacement rate,  $\lambda$  is the reduction in the index rate for pensions in payment.

# 5. Conclusions

- The Chinese pension system faces serious financing problems in the future in the context of rapid ageing. In order to maintain the sustainability in the next 75 years, current contribution rate in China should be immediately increased by 38 percentage points for a total contribution rate for the PAYG system of 58% and a total rate for the compulsory public pension system, including the individual accounts, of 66%.
- Alternatively, other changes in the parametric reforms would be required simultaneously, such as raising the benefit eligibility age or decrease the pension in payment.
- By comparison, sustainability in the U.S. system can be restored with an increase in the contribution rate of 2.9%, to a total rate for the Social Security Old-Age and Survivors Insurance (OASI) program of 13.5%.



## 6. References

- Board of Trustees, Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds (2014). 2014 Annual Report. Washington, D.C.: Government Printing Office.
- Chen, T. and Turner, J.A. (2014) 'Social security individual accounts in China: Toward sustainability in individual account financing', *Sustainability (Switzerland)* 6(8): 5049-5064.
- Dorfman, M.C., Holzmann, R., O'Keefe, P., Wang, D., Sin, Y., and Hinz, R. (2013) *China's Pension System: A vision*. World Bank Publications, Washington D.C.
- Oksanen, H. (2010) 'The Chinese pension system-First results on assessing the reform options' (No. 412). Directorate General Economic and Monetary Affairs (DG ECFIN), European Commission, doi: 10.2765/42337
- United Nations, Department of Economic and Social Affairs, Population Division (2015) *World population prospects: The 2015 revision*.



# A FINANCIAL ASSESSMENT OF THE CHINESE PAY-AS-YOU-GO PENSION SYSTEM

John A Turner – Pension Policy Center, Washington D.C. – [Jaturner49@aol.com](mailto:Jaturner49@aol.com)

**THANK YOU! MUCHAS GRACIAS**