Measuring Pension Entitlements

Sergi Biletsky

World Bank

APEX Pension Models

- Apex (Analysis of Pension Entitlements across Countries) is a collection of country pension and tax models based on a **single set of economic assumptions** to ensure comparability across countries
- Apex includes user interface employing customized STATA dialogues, and STATA routines describing each country **pension, personal tax** and **social contribution systems** and calculation procedures
- Originally developed by Edward Whitehouse and used by the World Bank, OECD, and European Commission

Methodology and Assumptions(1)

- All calculations are done for **new pensioners** only and based on national pension and tax system **parameters and rules** at the year of modeling, including legislated reforms that are being phased in
- Pension entitlements are computed for individuals entering employment in that year, and as **if they had worked their entire career under currently legislated pension and tax regimes**

Methodology and Assumptions(2)

- The results are produced for **different levels of earnings and years of service** (earnings are conveniently presented as a fraction or multiple of the economy-wide average wage; and 30 years of service at normal retirement age of 60 is assumed for modeling, based on administrative data for Tanzania NSSF).
- Uniform **economic assumptions**: inflation (p=2.5%), real earnings growth (w=2%), real rate of return (r=3.5%), real discount rate (z=2%), and mortality rates (m) from the UN Population Data base.

Key Inputs

Benefit levels	…as a function of system parameters and economic variables
Defined Benefit Pension =	Accrual Rate * Years of Service * Reference Wage
Defined Contribution Pension =	Account Balance / Annuity Factor Account Balance = $C_1*(1+r)^N + C_2*(1+r)^{N-1} +…+ C_N*(1+r)$, where C_t = Contribution $Rate_t$ * $Wage_t$ and N are years of service. Annuity Factor is a function of mortality rates (m), indexation to wage growth (w) and/or inflation (p), and a discount rate (z)

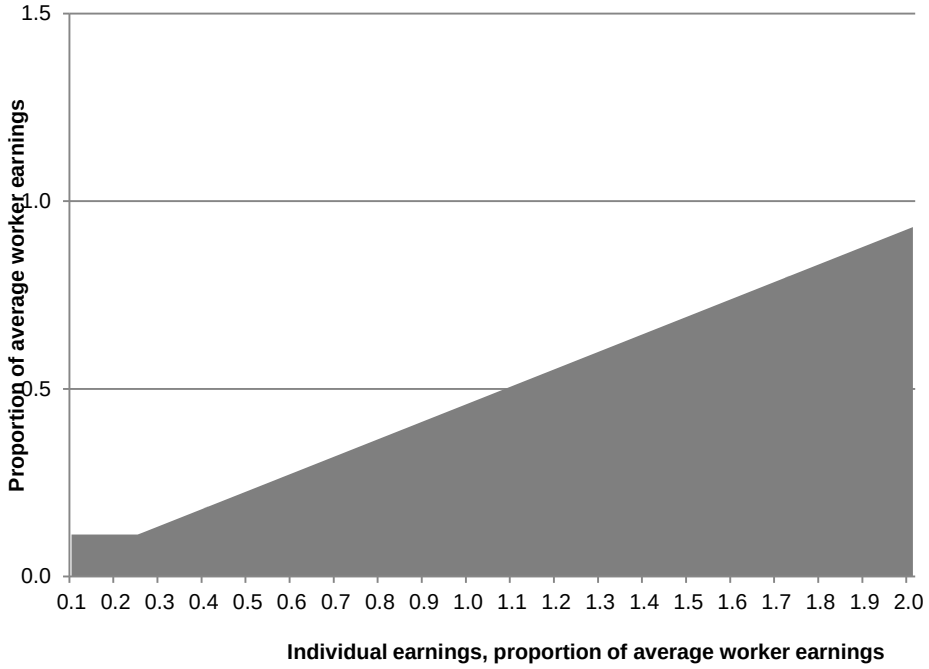
Key Outputs (1)

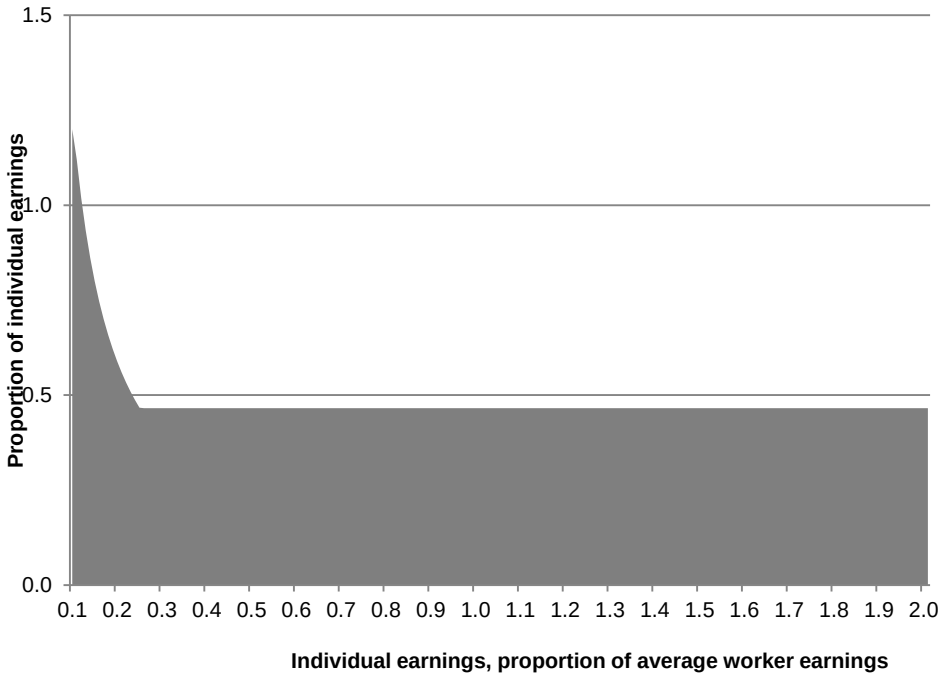
- $Gross\ Pension\ Level = \frac{Gross\ Pension}{Gross\ average\ economy\ wide\ wage}$
- $Gross\ RR = \frac{Gross\ Pension}{Gross\ individual\ wage}$
- $Gross\ Pension\ Wealth = Gross\ Pension\ Level * AF_{ret.age}$

Tanzania: NSSF Benefit Formula

	New rules	Old rules
Accrual rate	2.07%	2% for first 15 years, 1.5% for each year above (effective=2.12%)
Reference wage	Average of last 3 years, not valorized	Average of best 5 years over last 10 years, not valorized
Commutation/lump sums	Up to 25%, commutation factor=12.5	No commutation, lump sum=24*reference wage
Early retirement adjustment (age 55-59)	0.3% per year	0.5p.p. repl. rate reduction per year
Minimum pension	15% of minimum wage	15% of minimum wage
Vesting period	15 years	15 years

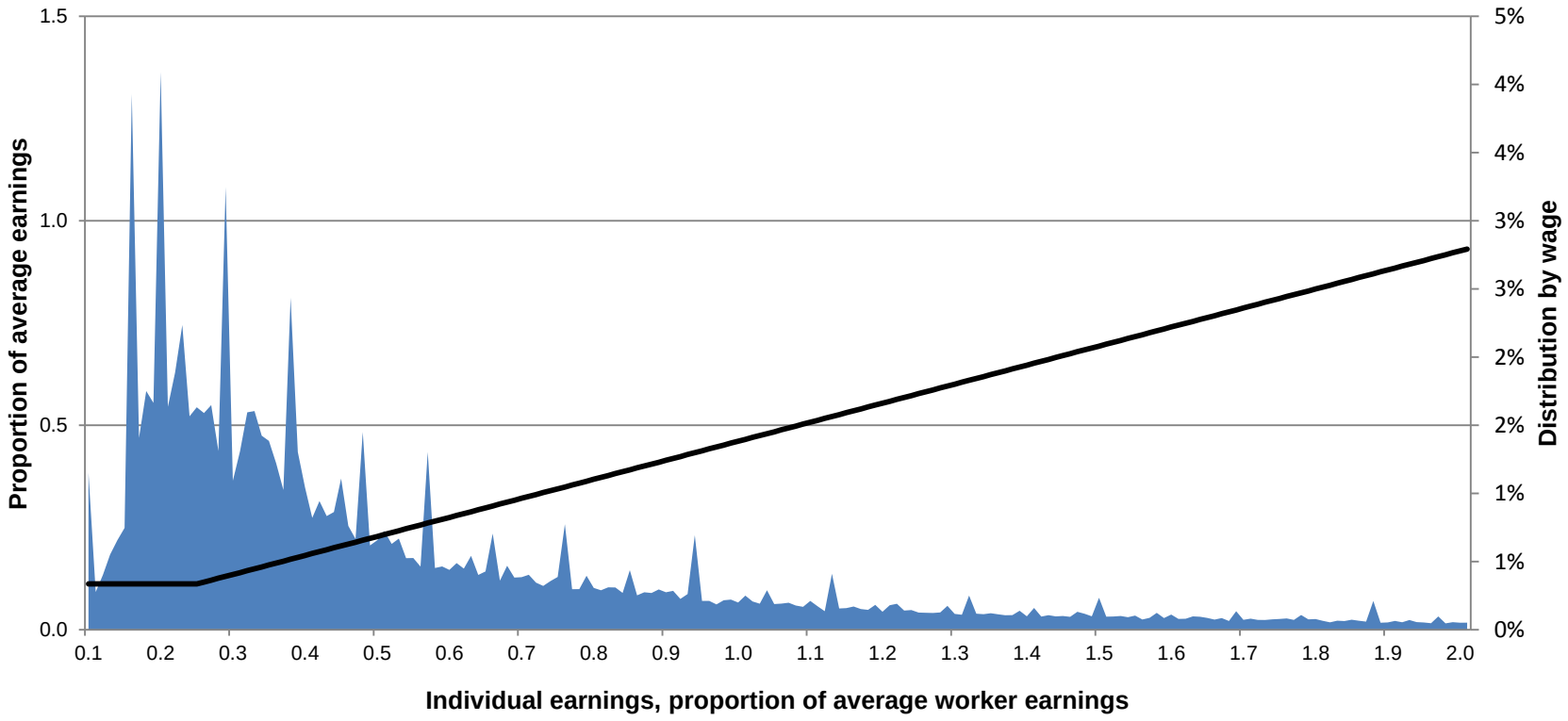
Relative Pension Levels and Replacement Rates



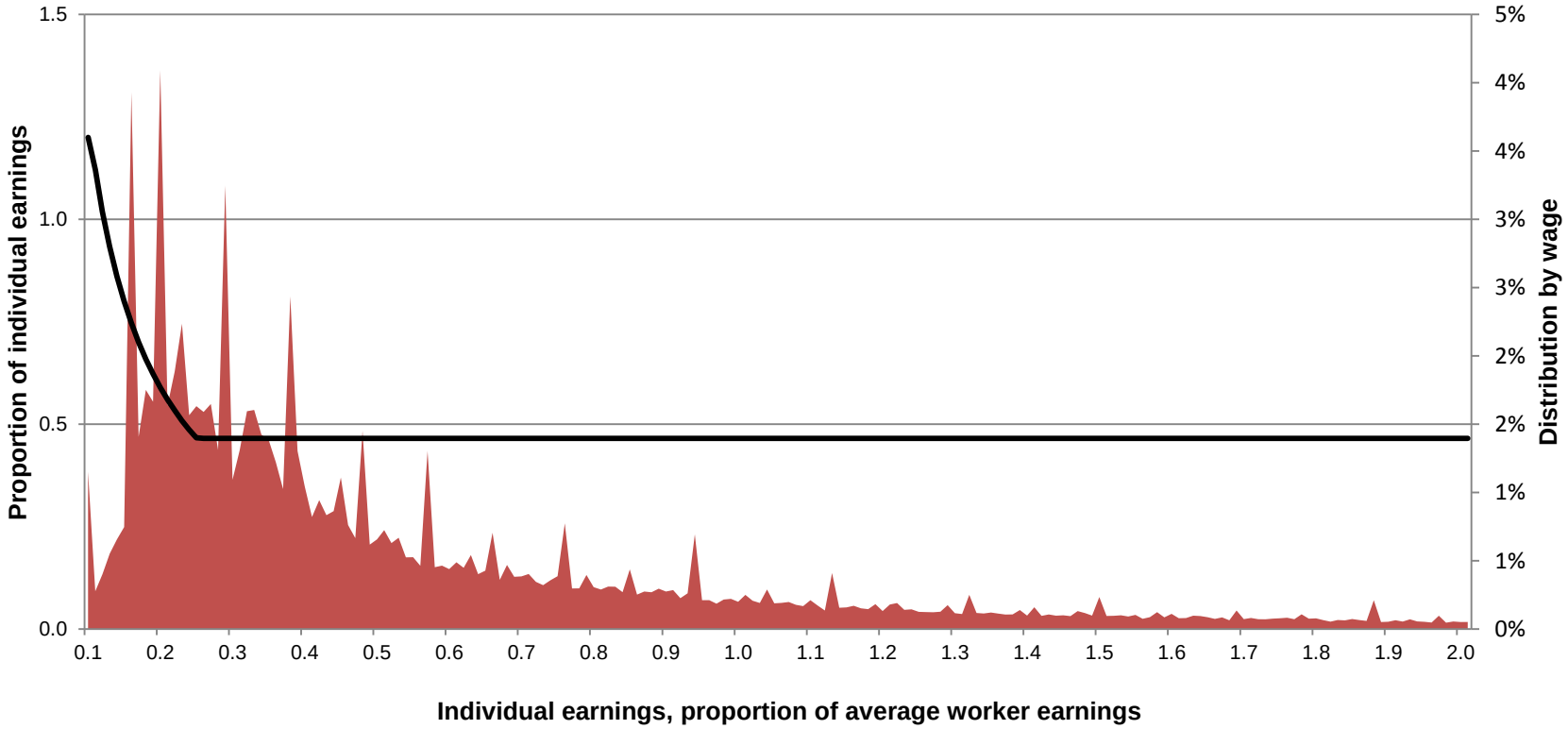


Men		Individual earnings, multiple of average				
	0.2	0.5	0.75	1	1.5	2
Gross relative pension level (% average gross earnings)	11.2	23.3	34.9	46.6	69.8	93.1
Gross replacement rate (% individual gross earnings)	56.0	46.6	46.6	46.6	46.6	46.6
Gross pension wealth (multiple of individual gross earnings)	8.3	6.9	6.9	6.9	6.9	6.9

Relative Pension Levels and Distribution by Wage

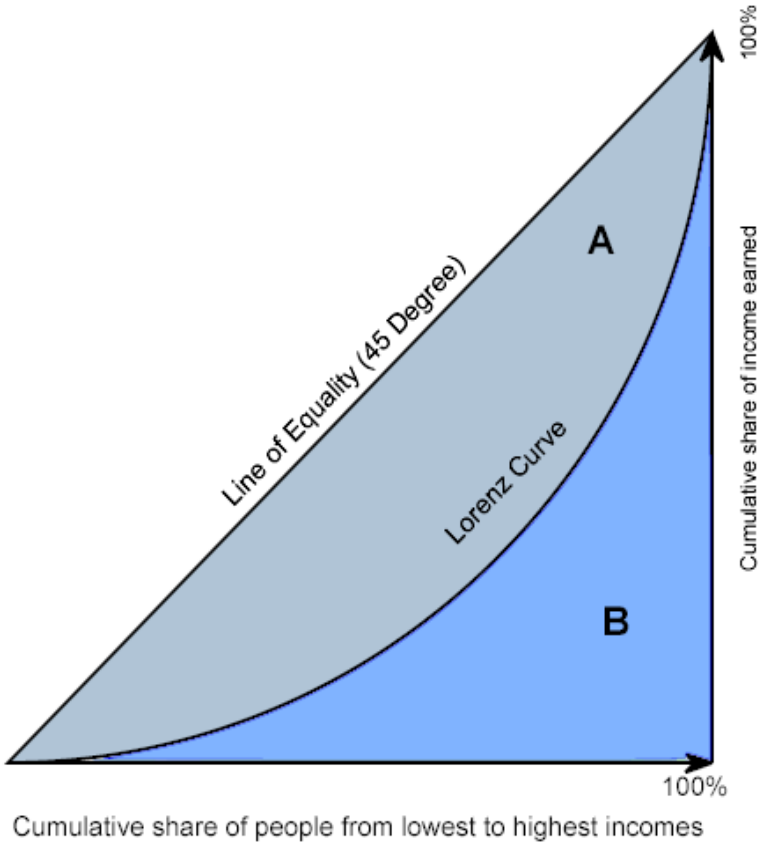


Replacement Rates and Distribution by Wage



Measuring Equity

- Gini = A/(A+B)



Key Outputs (2)

- $Gross\ Pension\ Level = \frac{Gross\ Pension}{Gross\ average\ economy\ wide\ wage}$
- $Gross\ RR = \frac{Gross\ Pension}{Gross\ individual\ wage}$
- $Gross\ Pension\ Wealth = Gross\ Pension\ Level * AF_{ret.age}$
- $Progressivity\ Index = 1 - \frac{Pension\ Gini}{Earnings\ Gini}$

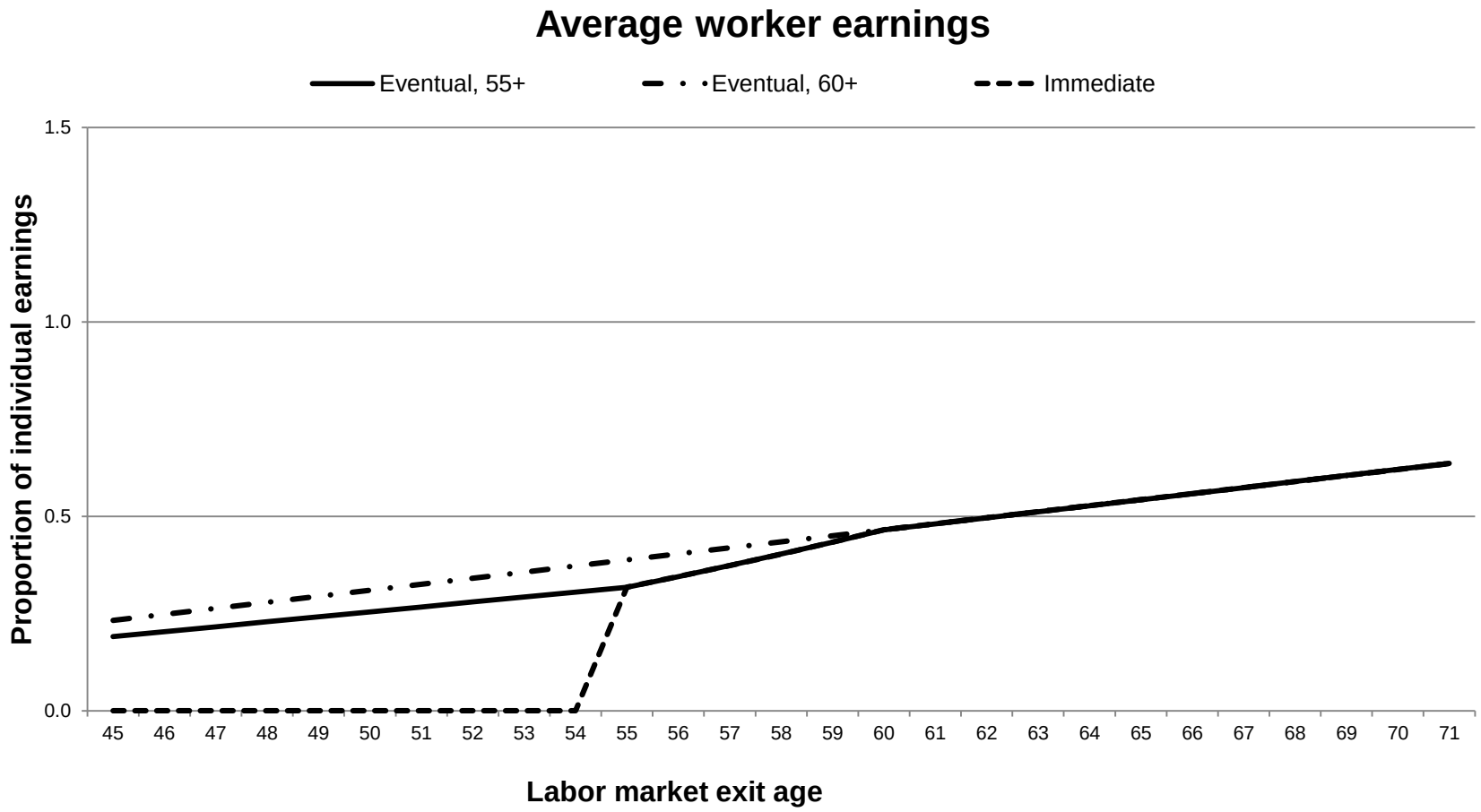
Progressivity of pension formulae

	Pension Gini	Progressivity index	Gini wage
Italy	23.3	1.8	23.7
Tanzania	**59.9**	**3.6**	**62.2**
Netherlands	24.3	5.7	25.7
Finland	22.6	5.9	24
Spain	25.7	17.1	31.1
Germany	19.8	24.7	26.3
Norway	13.6	38.1	22
Seychelles	23.2	43.2	40.9
Japan	14.3	46	26.4
United States	16.1	50.8	32.7
Belgium	10.2	52.6	21.6
Czech Republic	8.8	65.5	25.5
Korea	10.2	65.5	29.6
Australia	8.1	70.1	27.2
United Kingdom	5.1	82.4	28.9
Ireland	0	100	29.6
New Zealand	0	100	27.7
OECD 18	**16.2**	**39.8**	**27.2**

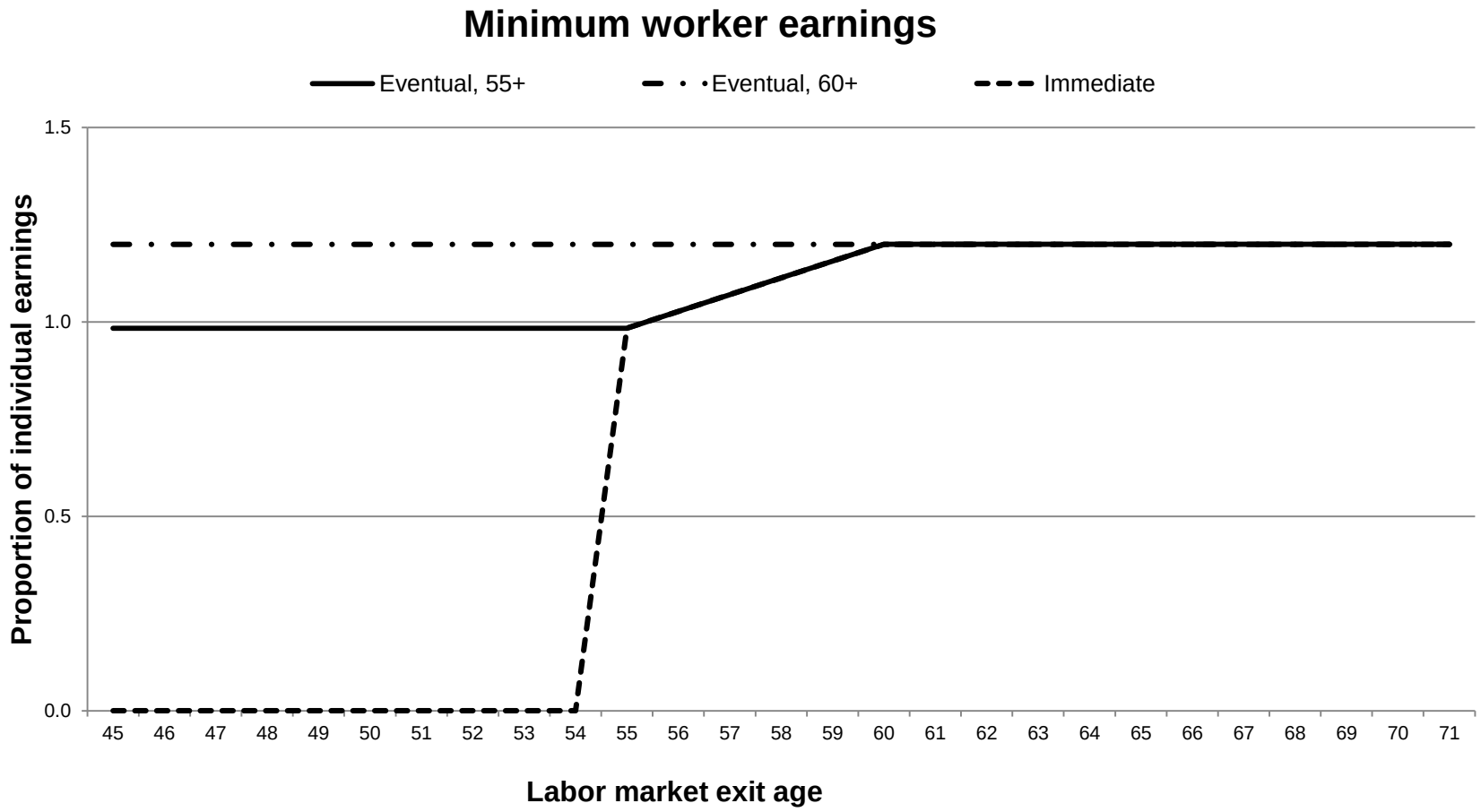
Key Outputs (3)

- $Gross\ Pension\ Level = \frac{Gross\ Pension}{Gross\ average\ economy\ wide\ wage}$
- $Gross\ RR = \frac{Gross\ Pension}{Gross\ individual\ wage}$
- $Gross\ Pension\ Wealth = Gross\ Pension\ Level * AF_{ret.age}$
- $Progressivity\ Index = 1 - \frac{Pension\ Gini}{Earnings\ Gini}$
- *Incentives measured as change in Replacement Rate and Pension Wealth*

Change Pension Replacement Rates by Age of Labor Market Exit: Average Earnings



Change in Pension Replacement Rates by Age of Labor Market Exit: Minimum Earnings



Change in Pension Wealth from Working an Additional Year