

ON INCOME AND WEALTH INEQUALITY IN TURKEY

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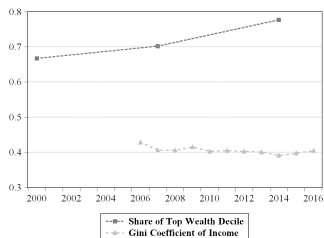
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Motivation

- Discussions on economic inequalities in Turkey have been predominantly confined to the study of *income* inequality.
 - ▶ Albeit above the OECD average, Turkey's income inequality estimates have been quite *stagnant* over the last decade
 - ▶ Turkey's *wealth* inequality estimates, however, have been displaying an ever-increasing time trend, ranking Turkey 2nd most unequal globally in 2014 (only to the Russian Federation)

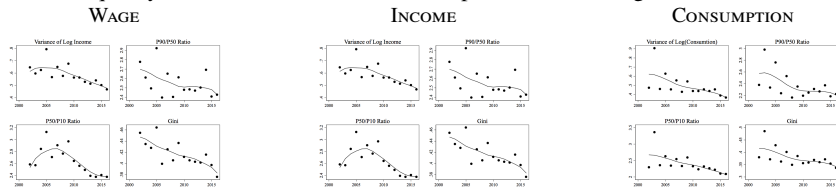


† Source: Turkish Statistical Institute and Credit Suisse Global Wealth Report 2014

Related Literature

● Economic inequalities in Turkey

- ▶ No earlier paper on Turkish *wealth* inequality other than Davies et al. (2011)
- ▶ Tamkoç and Torul (2018) on Turkey's Turkey's wage, income and consumption inequality between 2002-2016 via RED Special Issue 2010 guidelines



● Heterogeneous-Agent Incomplete-Market General Equilibrium Models

- ▶ Bewley (1986), Huggett (1993), and Aiyagari (1994) study economic inequalities by generating *endogenous* stationary distributions under the presence of uninsurable (or partly insurable) idiosyncratic yet no aggregate shocks.
- ▶ 2nd generation heterogeneous-agent incomplete-market models à la Krusell and Smith (1998) incorporate aggregate shocks into 1st the generation models
- ▶ 1st and 2nd generation models become academic workhorse models
 - ★ Castañeda et al. (2003) on income and wealth distribution in the United States

Contributions

First paper...

- to study Turkey's wealth distribution thoroughly via a model-based approach
 - ▶ Offers detailed metric predictions for Turkey's wealth distribution
 - ▶ Quantifies the welfare cost of inequality in consumption-equivalent units
- to study income and wealth distribution of a developing economy via heterogeneous-agent incomplete market general equilibrium models
 - ▶ introduce and study the role of endogeneity in labor supply choice
 - ▶ investigate the effects of developing-economy-consistent parametrization

Model Description

- A *modified* heterogeneous-agent incomplete-markets general equilibrium model *à la* Aiyagari (1994)
 - ▶ *Endogenous* labor supply choice
 - ▶ Developing-economy-consistent (Turkey) parametrization
- Infinitely-lived *ex-ante* homogeneous *ex-post* heterogeneous atomistic households face idiosyncratic labor productivity shocks
 - ▶ Face borrowing constraints
 - ▶ Rely on 1-period asset for precautionary motives
- Only idiosyncratic & no aggregate shocks
 - ▶ Economy inertial at the stationary equilibrium at all periods
 - ▶ Endogenous distribution of income and assets (wealth)

Model Environment

Households

- Households maximize present-discounted expected life-time utility subject to dynamic budget constraint and borrowing limit:

$$V(a, z) = \max_{\{c, h, a'\}} \left[u(c) - v(h) + \beta \sum_{z' \in Z} \Pi(z'|z) V(a', z') \right] \quad (1)$$

subject to

$$c + a' = (1 + r)a + zwh \quad (2)$$

$$z' \sim \Pi(z'|z) \quad (3)$$

$$a' \geq -b \quad (4)$$

$$c \geq 0, h \geq 0 \quad (5)$$

- Solution yields:

$$v'(h) = u'(c)zw \quad (6)$$

$$u'(c) = \beta \mathbb{E} [u'(c')(1 + r)] + \lambda \quad (7)$$

$$\lambda(a' + b) = 0, \lambda \geq 0 \quad (8)$$

Model Environment

Firm

- Representative neoclassical firm with CRTS production technology statically maximizes its profits for given factor prices:

$$\max_{\{K,L\}} F(K, L) - (r + \delta)K - wL \quad (9)$$

- Solution yields:

$$r = F_K(K, L) - \delta \quad (10)$$

$$w = F_L(K, L) \quad (11)$$

Stationary Distribution and Market Clearance

- **Stationary distribution:** $\mu(a, z)$ is the stationary distribution by the optimal decision rule $a'(a, z)$ and the stochastic process $z' \sim \Pi(z'|z)$ ensuring
 - ▶ $\mu(a', z') = \sum_{z \in Z} \Pi(z'|z) \int_{a: a' = a(a, z)} d\mu(a, z)$
- **Market clearance:** Resultant aggregate quantities are consistent with equilibrium factor prices
 - ▶ Aggregate physical capital demand by the firm equals aggregate total asset holdings by households
$$K = \sum_{z \in Z} \int_A a'(a, z) d\mu(a, z)$$
 - ▶ Aggregate effective labor demand by the firm equals aggregate effective labor supply by households
$$L = \sum_{z \in Z} \int_A z \times h(a, z) d\mu(a, z)$$

Parametrization and Calibration

Functional Forms

- Household preferences:

$$U(c, h) = u(c) - v(h) = \frac{c^{1-\gamma}}{1-\gamma} - \frac{h^{1+\frac{1}{\varphi}}}{1+\frac{1}{\varphi}} \quad (12)$$

- Production technology

$$F(K, L) = K^\alpha L^{1-\alpha} \quad (13)$$

Parameters

Table: Benchmark Parameters

Parameter	Symbol	Value	Source
Capital's Share in Production	α	0.560	Penn World Table 9.0
Subjective Discount Rate	β	0.890	Penn World Table 9.0
Depreciation Rate	δ	0.055	Penn World Table 9.0
Relative Risk Aversion	γ	1.500	Arrow (1999)
Frisch Elasticity of Labor Supply	φ	0.667	Fiorito and Zanella (2012)
Borrowing Constraint	b	0.000	Aiyagari (1994)

Table: Model's Fit with Data

	Measure	Data	Model
Wealth	Gini Coefficient	0.78	0.78
	Top 10%	77.7%	79.5%
Income	Gini Coefficient	0.39	0.39
	Theil's L Index $GE(0)$	0.28	0.28
	Theil's T Index $GE(1)$	0.30	0.31
	Atkinson Index $\epsilon = 0.50$	0.13	0.14
	Atkinson Index $\epsilon = 1.00$	0.24	0.24
Consumption	Gini Coefficient	0.38	0.38

† Source: Credit Suisse Global Wealth Report 2014 for top wealth decile, and author calculations for wealth Gini; TurkStat for income Gini; Tamkoç and Torul (2018) for Theil and Atkinson indices and non-durable consumption Gini coefficient in 2014 via TurkStat's Household Budget Survey.

Aggregate Results

Table: Aggregate Variables and Factor Prices

Variable Model	<i>K</i>	<i>H</i>	<i>Z</i>	<i>L</i>	<i>Y</i>	<i>C</i>	<i>r</i>	<i>w</i>	<i>rK</i>	<i>wL</i>
Aiyagari (End. Labor)	7.664	0.840	0.783	0.563	2.430	2.008	0.123	1.892	0.943	1.065
Aiyagari (Exo. Labor)	8.908	0.840	0.783	0.658	2.831	2.342	0.123	1.893	1.095	1.246
RBC (End. Labor)	7.189	0.683	0.783	0.535	2.293	1.897	0.124	1.884	0.889	1.009
RBC (Exo. Labor)	8.839	0.840	0.783	0.658	2.819	2.333	0.124	1.884	1.092	1.240

Distributional Results

Table: Distributional Properties of the Benchmark Model

	Wealth	Income	Consumption
Gini Coefficient	0.780	0.386	0.383
Theil's L GE(0) Index	2.189	0.277	0.276
Theil's T GE(1) Index	1.302	0.310	0.309
Atkinson Index $\epsilon = 0.50$	0.605	0.139	0.139
Atkinson Index $\epsilon = 1.00$	0.888	0.242	0.241

via Exogenous Labor Supply

Lorenz Curves

Histograms

Income Inequality by Country

Table: Income Inequality by Country

	Gini Coefficient	Theil L GE(0) Index	Theil T GE(1) Index	Atkinson Index ($\epsilon=0.5$)	Atkinson Index ($\epsilon=1.0$)
Austria	0.274	0.142	0.140	0.066	0.132
Belgium	0.257	0.115	0.113	0.055	0.109
Bulgaria	0.353	0.232	0.225	0.106	0.207
Croatia	0.300	0.164	0.148	0.074	0.151
Cyprus	0.347	0.204	0.253	0.106	0.184
Czech Republic	0.249	0.105	0.114	0.053	0.100
Denmark	0.266	0.129	0.145	0.065	0.121
Estonia	0.350	0.217	0.204	0.099	0.195
Finland	0.254	0.109	0.114	0.054	0.104
France	0.288	0.141	0.157	0.071	0.132
Germany	0.294	0.156	0.159	0.074	0.145
Greece	0.342	0.218	0.209	0.100	0.196
Hungary	0.285	0.139	0.145	0.068	0.130
Ireland	0.303	0.163	0.162	0.077	0.150
Italy	0.317	0.194	0.178	0.087	0.177
Latvia	0.351	0.222	0.211	0.101	0.199
Lithuania	0.348	0.212	0.209	0.099	0.191
Luxembourg	0.279	0.132	0.134	0.064	0.124
Malta	0.276	0.126	0.130	0.062	0.118
Netherlands	0.255	0.113	0.119	0.056	0.107
Poland	0.306	0.164	0.162	0.078	0.152
Portugal	0.343	0.215	0.203	0.098	0.194
Romania	0.342	0.230	0.201	0.100	0.206
Slovakia	0.259	0.125	0.124	0.059	0.117
Slovenia	0.249	0.107	0.104	0.051	0.101
Spain	0.340	0.220	0.193	0.097	0.198
Sweden	0.249	0.118	0.109	0.054	0.112
United Kingdom	0.308	0.164	0.170	0.079	0.151
Turkey (Data)	0.391	0.275	0.305	0.134	0.241
Turkey (Model)	0.386	0.277	0.310	0.139	0.241

† Source: European Commission Social Situation Monitor for European income inequality estimates in 2013, TurkStat for Turkey's income

Gini in 2014 and Tamkoç and Torul (2018) for Turkey's inequality indices in 2014 via TurkStat's Household Budget Survey.

Wealth Inequality by Country

Table: Asset Gini Coefficient by Country

	Gini Coefficient of Assets
Spain	0.542
Australia	0.567
United Kingdom	0.571
Italy	0.599
Luxembourg	0.614
France	0.651
Germany	0.725
United States	0.776
Turkey (Model)	0.780

† Source: Cowell et al. (2016).

Wealth Cost of Inequality

- Social Welfare (SW) under the benchmark Aiyagari regime

$$SW_{Aiyagari} = \frac{1}{I} \sum_{i=1}^I \sum_{t=0}^{\infty} \beta^t \left(u(\bar{c}_{i,t}^{Aiyagari}) - v(\bar{h}_{i,t}^{Aiyagari}) \right) = \frac{1}{1-\beta} \frac{1}{I} \left(\sum_{i=1}^I u(\bar{c}_i^{Aiyagari}) - v(\bar{h}_i^{Aiyagari}) \right) \quad (14)$$

- SW under the RBC (with *exogenous labor supply*) regime

$$SW_{RBC} = \sum_{t=0}^{\infty} \beta^t \left(u(\bar{c}_t^{RBC}) - v(\bar{h}_t^{RBC}) \right) = \frac{1}{1-\beta} \left(u(\bar{c}^{RBC}) - v(\bar{h}^{RBC}) \right) \quad (15)$$

- Consumption-equivalent welfare loss due to inequality:

$$\frac{1}{1-\beta} \left(u(\bar{c}^{RBC} \times [1 - \omega_1^c]) - v(\bar{h}^{RBC}) \right) = \frac{1}{1-\beta} \frac{1}{I} \left(\sum_{i=1}^I u(\bar{c}_i^{Aiyagari}) - v(\bar{h}_i^{Aiyagari}) \right) \quad (16)$$

Welfare Cost of Inequality

$$\omega_1^c = 43.24\%$$

Wealth Cost of Inequality

- Social Welfare (SW) under the benchmark Aiyagari regime

$$SW_{Aiyagari} = \frac{1}{I} \sum_{i=1}^I \sum_{t=0}^{\infty} \beta^t \left(u(\bar{c}_{i,t}^{Aiyagari}) - v(\bar{h}_{i,t}^{Aiyagari}) \right) = \frac{1}{1-\beta} \frac{1}{I} \left(\sum_{i=1}^I u(\bar{c}_i^{Aiyagari}) - v(\bar{h}_i^{Aiyagari}) \right) \quad (17)$$

- SW under the RBC (with *endogenous labor supply*) regime

$$\frac{1}{1-\beta} \left(u(c(\tilde{h}^{RBC})) - v(\tilde{h}^{RBC}) \right) = \frac{1}{1-\beta} \frac{1}{I} \left(\sum_{i=1}^I u(\bar{c}_i^{Aiyagari}) - v(\bar{h}_i^{Aiyagari}) \right) \quad (18)$$

where

$$\tilde{h}^{RBC} = \bar{h}^{RBC} \times [1 + \omega_2^h] \quad c(\tilde{h}) = \bar{c}^{RBC} \times [1 - \omega_2^c] \quad (19)$$

Welfare Cost of Inequality

$$\omega_2^h = 33.61\% \quad \omega_2^c = 25.16\%$$

Conclusions

- We study Turkey's economic inequalities by relying on canonical workhorse model *à la* Aiyagari (1994)
 - ▶ Our calibrated model matches Turkey's empirical economic inequality metrics with high accuracy in several dimensions, therefore can be used to infer about Turkey's wealth distribution, which lacks data and detailed analysis
- We quantify the welfare cost of inequality
 - ▶ ... a sizable 43.24% of steady-state consumption of representative-agent with exogenous labor choice
 - ▶ ... a sizable 33.61% of additional hours worked accompanied by a 25.16% lower steady-state consumption of representative-agent with endogenous labor choice
- Future research
 - ▶ via micro-level administrative data on personal finances in Turkey will be invaluable
 - ▶ *why* and *how* wealth concentration at the top decile in Turkey recently increases while income inequality remains stagnant is worthy of detailed investigation

Thank you

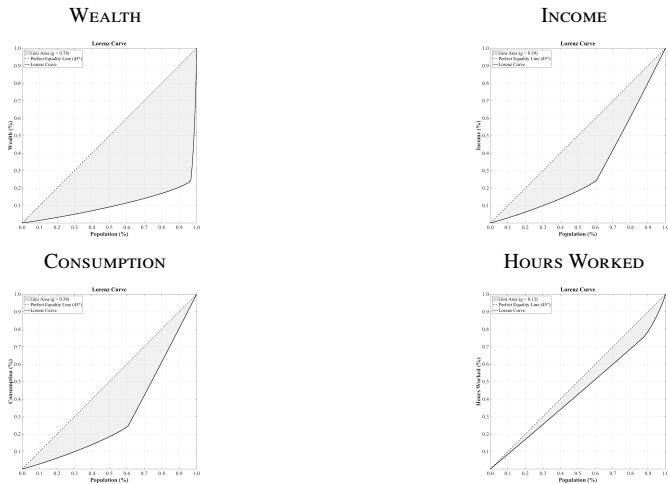
Table: Distributional Properties of the Aiyagari Model with Exogenous Labor Supply

	Wealth	Income	Consumption
Gini Coefficient	0.803	0.500	0.499
Hoover Index	0.736	0.464	0.464
Theil's L GE(0) Index	2.413	0.475	0.474
Theil's T GE(1) Index	1.398	0.515	0.513
Atkinson Index $\epsilon = 0.50$	0.639	0.226	0.226
Atkinson Index $\epsilon = 1.00$	0.910	0.378	0.377

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Lorenz Curves

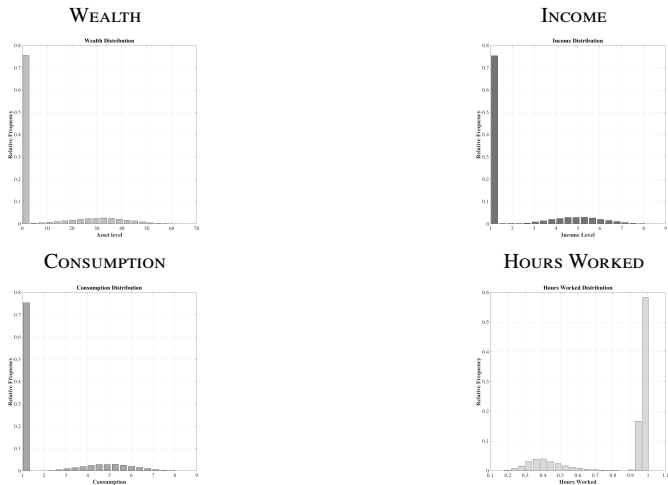
Figure: Lorenz Curve for Wealth, Income, Consumption and Hours Worked



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Histograms

Figure: Histogram for Wealth, Income, Consumption and Hours Worked



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