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# Distribution of wealth and incomplete markets: Theory and empirical evidence[☆]

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ABSTRACT

This paper analyses the equilibrium distribution of wealth in an economy where firms' productivities are subject to idiosyncratic shocks, returns on factors are determined in competitive markets, households have linear consumption functions and government imposes taxes on capital and labour incomes and equally redistributes the collected resources to households. The equilibrium distribution of wealth is explicitly calculated and its shape crucially depends on market incompleteness. With incomplete markets it follows a Paretian law in the top tail and the Pareto exponent depends on the saving rate, on the net return on capital, on the growth rate of population, and on portfolio diversification. The characteristics of the labour market crucially affects the bottom tail, but not the upper tail of the distribution of wealth in the case of completely decentralized labour market. The analysis also suggests a positive relationship between growth and wealth inequality. The theoretical predictions find a corroboration in the empirical evidence of United States in the period 1989–2004.



## 1. Introduction

There have been several attempts, in the economic literature, to explain the statistical regularities of the distribution of wealth from Pareto (1897) to the pioneering works by Sargan (1957), Wold and Whittle (1957) (for a review Atkinson and Harrison (1978) and Davies and Shorrocks (1999)). However, quoting Davies and Shorrocks (1999), "[these] models lack of an explicit behavioural foundation for the parameter values and are perhaps best viewed as reduced forms". This makes these models of the distribution of wealth useless both to understand the origin of wealth inequality and to provide some guide to public policy. Vaughan (1978) and Laitner (1979), and, more recently, Wang (2007) and Benhabib et al. (2011), represent an attempt to overcome this critique.[1]

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[1] Nirei and Souma (2007) represent the same type of attempt but with regard to the theory of income distribution.

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The present paper discusses a model where the aggregate behaviour of wealth is the result of market interactions among a large number of households and firms subject to idiosyncratic shocks. While taking the complexity of market interaction fully into account, our model takes a behavioural perspective on consumption/saving decision, by assuming a simple linear consumption function. Concerning the investing behaviour and the choice of occupation, our behavioural assumptions coincides with optimal choices of risk-adverse agents in markets with different degrees of incompleteness. The assumption on consumption/saving decision limits the possibility of using the model for policy analysis, but it allows us to explicitly calculate the equilibrium distribution of wealth in a general equilibrium framework. In this setting returns on factors are determined in competitive markets, and government taxes capital and labour incomes, and it redistributes the revenues to households equally. The shape of the equilibrium distribution crucially depends on market incompleteness (see Aiyagari (1994)). In particular, with capital markets without any friction and transaction costs but labour income subject to uninsurable shocks the equilibrium distribution of wealth is Gaussian, a result at odds with empirical evidence (see, e.g. Klass et al. (2006)). On the contrary when frictions and transaction costs impede full diversification of households' portfolios, the shape of the top tail of the distribution follows a Paretian law. The main determinants of the Pareto exponent, which represents an (inverse) index of the degree of inequality of the top tail of the distribution, are the tax rate on capital income, the diversification of households' portfolios, the saving rate, and the growth rate of population. The bottom tail of the equilibrium distribution of wealth is instead crucially affected by the characteristics of labour market and, in particular, by the cross-section distribution of wages. Finally, we show that, if the growth rate of the economy is endogenous, there is a negative relationship between the latter and the Pareto exponent, i.e. higher growth rates come with larger wealth inequality.

In the final section we compare our theoretical results with the empirical evidence, analysing the recent trends of wealth inequality in United States (1989–2004). In agreement with our model the top tail of the distribution of wealth follows a Pareto distribution, whose estimated Pareto exponent is decreasing in the considered period. Within the theoretical picture offered by our model, the factors at the root of this decline are (i) a decrease in taxation of capital income, and (ii) a decrease in the saving rate. We also argue that the increase in the size of the bottom tail of the distribution of wealth can be related to the increase in the cross-section variance of the distribution of earnings.

The paper is organized as follows: Section 2 presents the theoretical model; Section 3 shows the evolution of wealth distribution and characterises the properties of the equilibrium distribution of wealth. Section 4 discusses the empirical evidence supporting our theoretical results. Section 5 concludes. All proofs are relegated in the appendix.

## 2. The model

We model a competitive economy in which firms demand capital and labour. We assume all the wealth is owned by households, who inelastically offer capital and labour and decide which amount of their disposable income is saved. Wages and returns on capital adjust to clear the labour and capital markets, respectively. For the sake of simplicity we consider just one type of capital and no risk-free asset.[2] Hence human capital can be represented by different labour endowments and/or included in the capital stock (in the latter case it is accumulated at the same rate of physical capital).

From a technical point of view, we follow a standard approach to model a stochastic economy, see, e.g. Chang (1988) and Garcia-Peñalosa and Turnovsky (2005). In particular, we derive continuum time stochastic equations for the evolution of the distribution of wealth first specifying the dynamics over a time interval $[t, t+dt)$ and then letting $dt \to 0$.

### 2.1. Firms

Consider an economy with $F$ firms. Every firm $j$ has the same technology $q(\cdot)$. Its output over the period $[t+dt)$, $dy_j(t)$, is the joint product of its technology and of a random idiosyncratic component $dA_j(t)$:

$$dy_j(t) = q[k_j(t), l_j(t)]dA_j(t), \tag{1}$$

where $k_j(t)$ and $l_j(t)$ are respectively the capital and the labour of firm $j$ at time $t$ and $dA_j$ is a random shock to production. We assume that at time $t$ firm $j$ knows only the distribution of $dA_j$ (see Section 2.4 for the characteristics of the stochastic components of the economy).

The presence of a labour augmenting exogenous technological progress can be taken into account assuming that $l_j(t) = l_j^*(t)\exp(\psi t)$, where $\psi$ is the exogenous growth rate of technological progress. Here we shall confine our discussion to the $\psi = 0$ case. Indeed, all the following analysis remains the same, except for the meaning of the per capita variables, which are to be interpreted in efficient units of labour (see Chang (1988, p. 163)).

We make the standard assumption that $q(\cdot)$ is an homogeneous function of degree one (i.e. technology has constant returns to scale), with positive first derivatives and negative second derivatives with respect to both arguments. Hence:

$$q(k, l) = lg(\lambda) \quad \text{with} \quad g'(\lambda) > 0 \quad \text{and} \quad g''(\lambda) < 0, \tag{2}$$

where $q(k/l, 1) = g(\lambda)$ and $\lambda = k/l$ is the capital per worker.

[2] The inclusion of a risk-free asset does not modify in any substantial way the properties of the economy.