# Is Inequality Harmful for Innovation and Growth? Price versus Market Size Effects

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**Abstract**

We introduce non-homothetic preferences into an R&D based growth model. Inequality affects the incentive to innovate via a price effect and via a market size effect. When innovators have a large productivity advantage over traditional producers a higher extent of inequality tends to increase innovators' prices and mark-ups. When this productivity gap is small, however, a redistribution from the rich to the poor increases market sizes and speeds up growth.

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## 1 Introduction

The distribution of income and wealth across households may affect incentives to undertake R&D investments through price- and market-size effects. On the one hand, innovations are fostered if there are rich consumers willing to pay high prices for new products, i.e., if the society is sufficiently unequal. On the other hand, innovations become profitable when many consumers are willing to purchase new products which requires a sufficiently egalitarian society.

Many previous writers have mentioned the importance of price and market size effects for innovation and growth. A prominent advocate for the importance of price effects is von Hayek

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(1953) who argues that progressive taxation would be detrimental for innovation incentives by reducing rich consumers' willingness to pay for new goods. In contrast, Schmookler (1966) emphasizes the relevance of market size effect in fostering R&D investments.

Price effects versus and market-size effects are also potentially relevant to understand the ambiguous relationship between inequality and growth. The empirical literature on the inequality growth relation is generally ambiguous but it hints at a positive relationship for rich countries but a negative one for poor countries (Barro, 2000, 2008).

To study these competing forces of income inequality, we introduce non-homothetic preferences into a standard R&D based growth model. We assume that goods are indivisible and are either consumed or not consumed. This generates an equilibrium where the rich consume *more* varieties than the poor. The resulting effect of inequality on the composition of demand allows us to analyze the role of income distribution on growth in a tractable way.

Only a few previous papers have studied the role of income distribution on incentives to innovate via price- and/or market-size effects. In Murphy et al. (1989) a more egalitarian distribution increases the expenditure share for innovative goods and reduces the share of traditional products thus fostering industrialization. Their model emphasizes the *market size* effect, while potential effects on prices are ruled out by the assumption of constant prices and mark-ups. Foellmi and Zweimueller (2006) study the importance of *price* effects: a more unequal distribution increases the willingness to pay for new products. This leads in turn to a larger profit margins in all sectors thus increasing the incentive to innovate. Market size effects are ruled out by the assumption that households purchase only modern goods and a traditional sector does not exist.

Foellmi, Wuergler and Zweimueller (2014) extend this framework by assuming that monopolistic producers can supply their products in high and low quality (in "Cadillac" and "Model T" versions). In this model, innovations come in two steps. First, setting up a new firm requires a "product innovation", which introduces a new product that only rich consumers can afford. Later on, the firm make a "process innovation" which introduces a mass production technology that comes with a low-cost, low-quality ("Model T") version of the product. In such a framework, two main results emerge: first, inequality affects the direction of technical change: in a more egalitarian society, firms have a higher incentive to implement low-cost low-quality products affordable to lower income classes. This generates higher economy-wide prevalence of mass production technologies. The second result that emerges in such a framework is that the impact of inequality on growth become ambiguous. When technical progress is mainly by the introduction of products innovation, inequality is beneficial for growth. However, to the extent that technical progress is also driven by the introduction of mass production technologies, inequality may become harmful for growth. Depending the relative importance of product innovations and mass production technologies as the drivers of technical progress, the growth-maximising income distribution involves more or less inequality.

Our analysis presented in this paper looks the ambiguous effects of inequality on growth through a different perspective. In the present analysis we stick to the standard set-up of innovation that come in single quality (i.e. the only type of innovations are "production innovations"). In this context, inequality affects innovations through price- and market size-effects. The market-size effect of inequality is shut down in Foellmi and Zweimueller (2006) because monopolistic producers do not face any restrictions in their pricing behavior. However, when there are other products that substitute for innovative goods, the positive price effects of inequality are mitigated, by outside competition (modelled by a competitive fringe supplying traditional products at higher costs). We show that, in such a framework, high-inequality may reduce innovation incentives through a market size effect. In sum, our framework allows us to study the relative importance of price and market-size effects and determine conditions under which higher inequality speeds up or slows down long-run growth.[1]

In Section 2 we present the main assumptions of the model. Section 3 discusses price determination and market sizes and their implications for the incentives to undertake R&D investments. In Section 4 we look at the balanced growth path and Section 5 studies the impact of inequality on long-run growth.

## 2 The model

**Endowments and distribution.** Consider an economy with a unit measure of households whose aggregate supply of labor is $L$, constant over time. Households get income from wages and profits. At date $t$ there are $N(t)$ monopolistic firms generating positive profits. There is a nondegenerate distribution of income reflecting both skill differences and differences in capital

[1] Non-homothetic preferences have turned out important to explain the structural changes in employment and output in long-run growth, see Matsuyama (1992, 2008), Buera and Kaboski (2006), Foellmi and Zweimueller (2008), and Boppart (2014). Other papers have studied how inequality affects growth via non-homotheticities have also emphasized market size effects. In Matsuyama (2002) technical progress is driven by learning by doing and an intermediate degree of inequality is required to realize the full learning potential. Falkinger (1994) studies the impact on inequality on market sizes under the assumption of exogenously given profit-margins. In Chou and Talmain (1996) consumers have non-homothetic preferences over a homogenous consumption good and a (CES) bundle of differentiated goods which affects the market size (but not mark-up) of innovators. Zweimueller (2000) provides a dynamic version of Murphy et al. (1989). In Galor and Moav (2004) non-homotheticities affect growth via savings rates that differ by income.

ownership. A household is endowed with $\theta$ units of labor and $\theta N(t)$ shares of profitable firms, where $\theta$ is distributed across households with the cdf $G(\theta)$ with support $\left[\underline{\theta}, \bar{\theta}\right]$. A household with endowment $\theta$ earns labor income $\theta w(t) L$ and capital income $\theta r(t) V(t)$ where $w(t)$ is the wage rate per unit of effective labor, $r(t)$ is the interest rate, and $V(t)$ is the aggregate value of assets (i.e. the capitalized value of all existing firms). The resulting distribution is shown in the Lorenz curve of Figure 1 below.[2]

Figure 1

**Preferences and consumption choices.** All households have the same preferences. There is an infinitely large number of potentially producible goods, $j \in [0, \infty)$. All goods are equally valued by the household. Goods are consumed in discrete amounts and the household is saturated after consuming one unit. We denote by $x(j,t)$ the indicator function such that $x(j,t) = 1$ if good $j$ is consumed at date $t$, and $x(j,t) = 0$ if not.

Households have an infinite horizon. A household with endowment $\theta$ chooses $\{x(\theta, j, t)\}_{j=0,t=\tau}^{j=\infty,t=\infty}$ to maximize

$$\int_{\tau}^{\infty} \log\left[\int_{0}^{\infty} x(\theta, j, t) dj\right] e^{-\rho(t-\tau)} dt$$

subject to

$$\int_{\tau}^{\infty}\left[\int_{0}^{\infty} p(j,t) x(\theta, j, t) dj\right] e^{-R(t,\tau)} dt \leq \theta\left[\int_{\tau}^{\infty} w(t) L e^{-R(t,\tau)} dt + V(\tau)\right]$$

where $p(j,t)$ is the price of good $j$ at date $t$, and $R(t,\tau) = \int_{\tau}^{t} r(s) ds$ is the cumulative interest factor.[3] The optimal solution to this intertemporal choice problem satisfies the first-order condition

$$x(\theta, j, t) = \left\{\begin{array}{ll} 1, & p(j,t) \leq z(\theta, t) \\ 0, & p(j,t) > z(\theta, t) \end{array}\right\} \text{where } z(\theta, t) \equiv \frac{e^{R(\tau,t)-\rho(t-\tau)}}{\mu(\theta) N(\theta, t)}, \tag{1}$$

where $z(\theta, t)$ is the household's willingness to pay. Here $z(\theta, t)$ is inversely related to $\mu(\theta)$, the household's time-0 marginal value of wealth (the Lagrangian multiplier), and to $N(\theta, t) \equiv \left[\int_0^\infty x(\theta, j, t) dj\right]$, the optimal quantity consumed at date $t$. Equation (1) represents a simple consumption rule: A household with endowment $\theta$ purchases good $j$ at date $t$ if the price of this good, $p(j,t)$, does not exceed the consumer's willingness to pay at that date. Consequently,

[2] The assumption that labor and capital endowments are perfectly correlated and identically distributed is made for analytical convenience. Below we assume additive and logarithmic *intertemporal* preferences generating equal optimal savings rates for all households. This assumption (and the absence of income shocks) ensures that the initial distribution of $\theta$ persists over time. Hence time indices for $\theta$ are omitted.

[3] The log intertemporal utility is used for ease of exposition. The same results would hold true (in particular the invariance of distribution) if the utility would be CRRA in the consumption aggregator $\int_0^\infty x(\theta, j, t) dj$.

individual demand is a simple step function, see Figure 2.

Figure 2

**Production and technical progress.** The supply side of the model is very simple. All goods are produced with identical technologies and labor is the only production factor. Each good can be produced in two different ways, with a traditional and innovative technology. The *traditional* backstop technology has productivity $\beta(t)$ and operates under constant returns to scale. and the *innovative* technology has productivity $\alpha(t)$ with $\beta(t) < \alpha(t)$. Unlike the traditional technology (that produces under constant returns to scale), the innovative technology requires an initial (one-time) set-up effort equal to $\Phi(t)$ units of labor. A firm that incurs this set-up cost makes an "innovation". Think of an innovation as a completely new good that crowds out traditional products or, alternatively, as an improved way to produce an already existing good.[4] (Both interpretations are valid as both existing and new goods enter the utility function symmetrically). In line with endogenous growth theories, we assume that the knowledge stock of this economy equals the number of innovations that have taken place up to date $t$, denoted by $N(t)$. It is assumed that $\Phi(t) = F/N(t)$, $\alpha(t) = aN(t)$ and $\beta(t) = bN(t)$ where $F > 0$ and $a > b > 0$ are exogenous parameters. We normalize labor costs in the traditional sector to unity $w(t)/\beta(t) = 1$. Under our assumption on the knowledge stock, this implies that the growth rate of wages equals the rate of innovation, $w(t) = bN(t)$. This implies that production costs in the innovative sector are $w(t)/\alpha(t) = b/a < 1$, and the innovation cost are $w(t)\Phi(t) = bF$, constant over time.

# 3 Prices, market sizes, and innovation incentives

**Price setting of monopolistic firms.** There is a measure of $N(t)$ monopolistic firms, equal to the number of innovations, on the market. By symmetry, all firms face the same cost- and demand-curves. The representative firm faces a trade-off between setting a high price and selling to a small group of consumers (and vice versa). The traditional technology is freely accessible, hence the innovative firm has to choose a price lower than (or equal to) unity to prevent the competitive fringe from entering the market. Consumers purchase the goods with the lowest prices until they exhaust their budget.

The equilibrium outcome is most easy to grasp when there are only two groups, rich and poor. The representative firm faces the choice between selling only to the rich at a high price; or

[4] An isomorphic case would the situation where innovative firms produce a better product, yielding higher utility, with the same production technology as traditional firms (or some combination of productivity/quality gain).

selling to all households at a price low price. For obvious reasons, a situation where *all* firms sell to *all* consumers or where *all* firms sell *only to the rich* can not be an equilibrium. In the former case, both groups would have identical expenditures and in the latter case, the poor would have no expenditures implying that one of the two groups does not exhaust its budget. As left-over budgets are associated with very high willingnesses to pay for the marginal good, firms have an incentive to deviate in both cases. In equilibrium, an (endogenous) fraction of firms sells exclusively to the rich and the remaining fraction of firms sells to all households. The former set a price that equals the willingness to pay of the rich and the latter set a price that equals the willingness to pay of the poor. In equilibrium, both types of firms make the same profit and both types of households exhaust their budget. Obviously, these arguments generalize to $K > 2$ discrete groups.[5]

A continuous distribution $G(\theta)$ generates a continuous distribution of prices and firm sizes. We label of a firm as type $\theta$ when it sells to all households with endowment $\theta$ or richer (and has market size $[1 - G(\theta)]L$). A firm of type $\theta$ charges a price $p(\theta) = z(\theta)$, the willingness to pay of household $\theta$.[6] Notice that $p(\theta)$ is increasing in $\theta$, reflecting the basic trade-off that firms face: either they sell at low prices and high quantity (the market size $[1 - G(\theta)]L$ is decreasing in $\theta$) or they set higher prices but have a smaller market size. Due to the competitive fringe, modern firms are limited to types $\theta \in [\underline{\theta}, \hat{\theta}]$ where firm $\hat{\theta}$ charges a price $p(\hat{\theta}) = 1$ and has profits $[1 - G(\hat{\theta})]L[1 - b/a] = \pi$.

The equilibrium firm size distribution is given as follows: A measure $n(\underline{\theta})$ of monopolistic firms sells to all consumers and produces $L$ units. The firm size distribution is continuous and determined by the endowment distribution $G(\theta)$ (see Lemma 1 below). Each firm makes the same profit $\pi = [1 - G(\theta)]\, L\, [p(\theta) - b/a]$ for all $\theta \in [\underline{\theta}, \hat{\theta}]$. Consumers with $\theta < \hat{\theta}$ consume only innovative goods and consumers with $\theta > \hat{\theta}$ consume all innovative goods and some traditional products supplied by the competitive fringe. Our analysis below treats $\hat{\theta}$ as the crucial endogenous variable (in addition to the endogenously determined growth rate).

[5] With $K$ groups of consumers, there are $K$ firm types such that type 1 sells to the richest group (and charges their willingness to pay), the second type sells to the richest and second richest (and charges the willingness to pay of the second richtest group), ...., and the $Kth$ type sells to all households (charging the willingness to pay of the poorest group). In equilibrium the distribution of firms across types is endogenous and satisfies conditions (i) and (ii) mentioned in text.

[6] Instead of writing consumption expenditures of a household with endowment $\tilde{\theta}$ as $\int_0^{N(\tilde{\theta})} p(j)dj$ we can write $\int_{\underline{\theta}}^{\tilde{\theta}} p(\theta)dN(\theta) + p(\underline{\theta})N(\underline{\theta})$ where $N(\underline{\theta})$ and $p(\underline{\theta})$ are the menu and the price of the goods that the poorest household can afford.

**Zero profit condition.** The costs of an innovation are $bF$, constant over time (see above). The value of an innovation equals the profit flow associated with a monopoly position. We assume an innovator gets a patent that lasts forever. The profit flow is equal to $\pi = [1-G(\hat{\theta})]L[1-b/a]$, independent of $t$ as long as $\hat{\theta}$ is time-invariant which is the case along a balanced growth path. Along this path the interest rate is constant, $r(t) = r$, and the value of the innovation is given by $\int_t^\infty \pi \exp(-r\,(s-t))dt = \pi/r$. In equilibrium, the value of an innovation may not exceed innovation costs, $\pi/r \leq bF$. This condition holds with equality when innovation takes place. The zero-profit condition can then be written as

$$rbF = [1 - G(\hat{\theta})]L[1 - b/a]. \tag{2}$$

# 4 The balanced growth path

Along the balanced growth path, the economy's resources are fully utilized. Labor demand in research is $\dot{N}(t)\Phi(t)$. Using $\Phi(t) = F/N(t)$ and the definition $g \equiv \dot{N}(t)/N(t)$ we get $\dot{N}(t)\Phi(t) = gF$. Labor demand in production comes either from innovative monopolistic producers or from traditional competitive producers. A consumer with endowment $\theta \leq \hat{\theta}$ purchases $N(\theta,t)$ goods supplied by innovative producers which requires $N(\theta,t)/\alpha(t) = [N(\theta,t)/N(t)]/a$ units of labor. A consumer with endowment $\theta > \hat{\theta}$ purchases all $N(t)$ goods by innovative producers and $N(\theta,t)-N(t)$ goods by traditional producers which requires $[N(\theta,t) - N(t)]/\beta(t)+N(t)/\alpha(t) = 1/a+[N(\theta,t)/N(t) - 1]/b$ units of labor. In a steady state, where the distribution of income and wealth is stationary, consumption $N(\theta,t)$ grows at the same constant rate $g$ for all consumers. Defining $n(\theta) \equiv N(\theta,t)/N(t)$, we see that $n(\theta)/a$ units of labor are needed to produce the goods consumed by household $\theta \leq \hat{\theta}$; and $1/a + (n(\theta) - 1)/b$ for household $\theta > \hat{\theta}$. Summing up labor demands and setting them equal to aggregate labor supply yields the full employment condition

$$L = gF + \frac{L}{a}\left(\int_{\underline{\theta}}^{\hat{\theta}} n(\theta)dG(\theta) + 1 - G(\hat{\theta})\right) + \frac{L}{b}\int_{\hat{\theta}}^{\bar{\theta}} (n(\theta) - 1)\,dG(\theta).$$

**Lemma 1** *Along the balanced growth path a) the stationary distribution of endowments $G(\theta)$ is associated with stationary prices $p(\theta)$; consumption expenditures equal to $N(t)\theta b\,[1 + \rho F/L]$ and consumption growth $g = r - \rho$; b) the optimal consumption levels are:*

$$n(\theta) = \begin{cases} a\underline{\theta}\frac{L+\rho F}{(g+\rho)aF+L} & \theta = \underline{\theta} \\ a\int_0^\theta \frac{(L+\rho F)(1-G(\xi))}{(g+\rho)aF+L(1-G(\xi))}d\xi & \underline{\theta} < \theta < \hat{\theta} \\ 1 + (L+\rho F)\,(\theta - \hat{\theta})b/L & \theta \geq \hat{\theta} \end{cases} \tag{3}$$

**Proof.** a. Differentiating $z(\theta,t)$ with respect to $t$, using $\dot{N}(\theta,t)/N(\theta,t) = g$, yields $\dot{z}(\theta,t)/z(\theta,t) = r - \rho - g$. Guess that $g = r - \rho$ so $z(\theta)$ is stationary. In that case household $\theta$ purchases all goods with prices lower than or equal $p(\theta)$ at all times and pays average price $\bar{p}(\theta)$, constant over time, and has expenditures $\bar{p}(\theta)N(\theta,t)$. Notice further that wages evolve according to $w(t) = bN(\tau)e^{-(r-g)(t-\tau)}$ and that $V(\tau) = bFN(\tau)$ (since the value of each firm is $\pi/r = bF$). This allows us to rewrite the household's lifetime budget constraint as $\bar{p}(\theta)N(\theta,t) = N(t)\theta b(1+\rho F/L)$, confirming our guess that $N(\theta,t)$ and $N(t)$ grow pari passu.

b. The budget constraint of the poorest consumer is $p(\underline{\theta})N(\underline{\theta},t) = N(t)\underline{\theta}b(1+\rho F/L)$. We calculate $p(\underline{\theta})$ using $p(\underline{\theta}) - b/a = [1-G(\hat{\theta})][1-b/a]$ (all firms make the same profit), equation (2) and $r = g+\rho$. This yields $p(\underline{\theta}) = (g+\rho)bF/L + b/a$. Substituting into the budget constraint and solving for $N(\theta,t)$ yields the first claim of part b). The budget constraint of household $\theta \in (\underline{\theta},\hat{\theta})$ is $p(\underline{\theta})N(\underline{\theta},t) + \int_{\underline{\theta}}^{\theta} p(\xi)dN(\xi,t) = N(t)\theta b(1+\rho F/L)$. Differentiating with respect to $\theta$ yields $p(\theta)\left[dN(\theta,t)/d\theta\right] = N(t)b(1+\rho F/L)$. Solving for $dN(\theta,t)/d\theta$ and integrating yields $N(t)b(1+\rho F/L)\int_{\underline{\theta}}^{\theta}(1/p(\xi))d\xi + N(\underline{\theta},t)$. Calculating $p(\xi) = b\left[(g+\rho)aF + (1-G(\xi))L\right]/\left[a(1-G(\xi))L\right]$ from equation (2) and substituting into the previous equation yields the second claim of part b). By definition, household $\hat{\theta}$ purchases all goods produced by monopolistic firms but no goods produced by the competitive fringe. A household $\theta > \hat{\theta}$ spends $N(t)\hat{\theta}b(1+\rho F/L)$ for the $N(t)$ monopolistic goods and $N(t)(\theta-\hat{\theta})b(1+\rho F/L)$ for the remaining $N(\theta,t) - N(t)$ goods produced by the competitive fringe. This yields the third claim of part b). ■

In steady state, consumers with relative wealth $\hat{\theta}$ consume all innovative goods, hence $n(\hat{\theta}) = 1$ or

$$1 = a\int_0^{\hat{\theta}} \frac{(L+\rho F)(1-G(\theta))}{(g+\rho)aF + L(1-G(\theta))}d\theta. \tag{4}$$

The resulting consumption structure of innovative goods is depicted in Figure 3. The poorest consumers buy a fraction $n(\underline{\theta})$, households with wealth $\theta > \hat{\theta}$ but all innovative products.

Figure 3

This gives rise to a firm type and size distribution (Figure 4). Denote the poorest consumer served by a distinct firm as critical consumer. There is a continuum of firm where the critical consumers have wealth $\theta > \underline{\theta}$,/instead a positive mass firms sell to all consumers. Correspondingly, there is a positive mass of firms with size $L$ (Figure 4b.).

Figure 4a. and b.

The general equilibrium of the model is characterized by the two equations (2) and (4) in the two unknowns $g$ and $\hat{\theta}$. Note that resource constraint holds when both (2) and (4) simultaneously are satisfied. We analyze the equilibrium graphically (Figure 3).

Figure 5

The zero profit condition is a decreasing curve in the $(g, \hat{\theta})$-space. If $\hat{\theta}$ increases, market size is smaller (recall that $p(\hat{\theta}) = 1$ which is constant), hence the real interest rate $r = \rho + g$ must be smaller such as to guarantee a zero profit equilibrium. The consumption equation (4) is an increasing curve in the $(g, \hat{\theta})$-space. In general equilibrium, higher growth rates must go hand in hand with larger prices and therefore lower expenditures. Therefore, the relative wealth $\hat{\theta}$ must be larger such that $n(\hat{\theta}) = 1$ holds.

## 5 The impact of inequality on growth

We concentrate on the relevant case where only sufficiently rich consumers are able to purchase *all* modern products. Such an equilibrium emerges when $\underline{\theta}\,(1 + \rho F/L) < 1/b$. To see this, notice that an equilibrium with $\hat{\theta} > \underline{\theta}$ (such that some households cannot afford to buy all goods) requires that, at $\theta = \underline{\theta}$, the value of $g$ that satisfies the zero profit constraint (2) has to exceed the value of $g$ in the consumption equation (4). If this condition is violated even the poorest consumer buys all innovative products. In such an equilibrium, the prices of all innovative goods are unity (all monopolistic firms have to charge a price that deters entry from competitive producers) and market size is at its highest possible level. In such an equilibrium, changes in inequality do not have an impact on growth.

Assuming $\underline{\theta}\,(1 + \rho F/L) < 1/b$, we are now ready to analyze the effect of more inequality.

**Proposition 1** *a. A regressive transfer among consumers with $\theta < \hat{\theta}$ increases the growth rate. b. A regressive transfer from a consumer with $\theta < \hat{\theta}$ to a consumer with $\theta > \hat{\theta}$ reduces the growth rate. c. A regressive transfer among consumers with $\theta > \hat{\theta}$ leaves the growth rate unaffected.*

**Proof.** a. The integrand in (4) is a concave function of $G(\bullet)$. If $G(\bullet)$ undergoes a second order stochastically dominated transfer, where $\int_0^{\hat{\theta}} G(\theta)d\theta$ remains unchanged, the value of the integral in (4) must increase due to Jensen's inequality. Hence, the consumption curve (4) shifts up at $\theta = \hat{\theta}$. Further, with $G(\hat{\theta})$ unchanged, the zero profit constraint does not change at $\theta = \hat{\theta}$, therefore the equilibrium growth rate rises.
b. The integrand in (4) takes lower values at the values of $\theta$ involved in the transfer. Hence the value of the integral in (4) decreases meaning that less purchasing power is left in the hands of households with $\theta < \hat{\theta}$. Around $\theta = \hat{\theta}$, the consumption curve shifts down and the zero profit constraint remains unaffected, the growth rate decreases.
c. Neither (2) nor (4) are affected for $\theta \leq \hat{\theta}$. ■

The reason behind part a. of the above proposition is the dominance of the *price effect*. A regressive transfer among consumers with $\theta < \hat{\theta}$ is a transfer from consumers who pay a lower average mark-up to consumers who pay on average a higher mark-up. Therefore a regressive transfer among consumers with $\theta < \hat{\theta}$ increases average prices and mark-ups. In the new equilibrium the profit flow $\pi$ of innovative producers is larger which increases the incentive for further innovation. Figure 6a. characterizes part a. of the proposition graphically.

Part b. of the proposition reflects the dominance of the *market size effect*. A regressive transfer from a consumer with $\theta_0 < \hat{\theta}$ to a consumer with $\theta_1 > \hat{\theta}$ implies an decrease in demand for monopolistic producers and an increase in demand for traditional producers. In particular, household $\theta_0$ has a lower willingness to pay and hence firm $\theta_0$ experiences a fall in its price. In equilibrium all firms earn the same profit. Hence the reduction in the price for one firm must decrease the prices for other firms. The result is a reduced incentive to innovate. Figure 6b. shows the change in the equilibrium curves for a regressive transfer from the consumer of the "middle class" with $\theta_0 < \hat{\theta}$ to a rich consumer with $\theta_1 > \hat{\theta}$.

Finally, part c. of the proposition results from the fact that a redistribution among households with $\theta > \hat{\theta}$ does not affect the demand for innovative products at all and leave prices and market size of innovative firms unaffected.

Figure 6a. and b.

How do our results relate to existing demand explanations of the relationship between inequality and growth? It is crucial for the inequality-growth relationship to which innovative firms are constrained in their price setting behavior. In the polar case where no competitive fringe exists (as in Foellmi and Zweimueller, 2006), only price effects are at work. In that case the market size channel is shut down and monopolistic producers are not restricted in their price setting behavior by the presence of substitutable goods. In such a situation, inequality is beneficial for growth. This is no longer the case in the presence of a competitive fringe. In that case the scope of price setting is limited by the cost advantage of innovators towards competitive producers. If this cost advantage is small, price effects are weak and market size effects dominate. In such as situation inequality becomes harmful for growth.

Our model encompasses both scenarios. When the productivity gap between the innovative sector and the traditional sector $a/b > 1$ is very high, $\hat{\theta}$ approaches $\bar{\theta}$. In that case, only the very rich can afford all innovative products, all households (except the richest) consume only a subset of innovative goods, and the competitive fringe has only a tiny market share. Consequently, regressive transfers increase growth.

Our model can also capture the situation studied in Murphy et al. (1989). Similar to their model, a regressive transfer from households who cannot purchase all innovative goods to consumers who can afford all these goods, decreases innovators' market size and depresses growth. However, in Murphy et al. (1989) only the market size effect is at work, as price effects are ruled out by assumption. Hence a redistribution among consumers $\theta < \hat{\theta}$ (all of whom cannot purchase the entire menu of innovative goods) leaves the the number of industrializing sectors unaffected in their model as the market size effect is at work only. In contrast, in our analysis such a redistribution generates price effects that lead to a positive impact of inequality on growth. In sum, our model predicts that redistributions towards consumers just below $\hat{\theta}$, both from below and from above, increases in growth.

As changes in inequality affect the growth rate, it is interesting to ask whether growth-increasing redistributions can lead to Pareto-improving outcomes. Interestingly, the answer is a qualified yes for both types of redistributions. The group of donating households loses on impact but gains from a steeper consumption path in the long run. Pareto-improvements may occur if the rate of time preference is very low, so that the donators values dynamic gains more strongly than static losses. Pareto-improvements are also more likely the higher the standard of living of the donators. In that case, static losses are smaller (due to lower marginal utilities).

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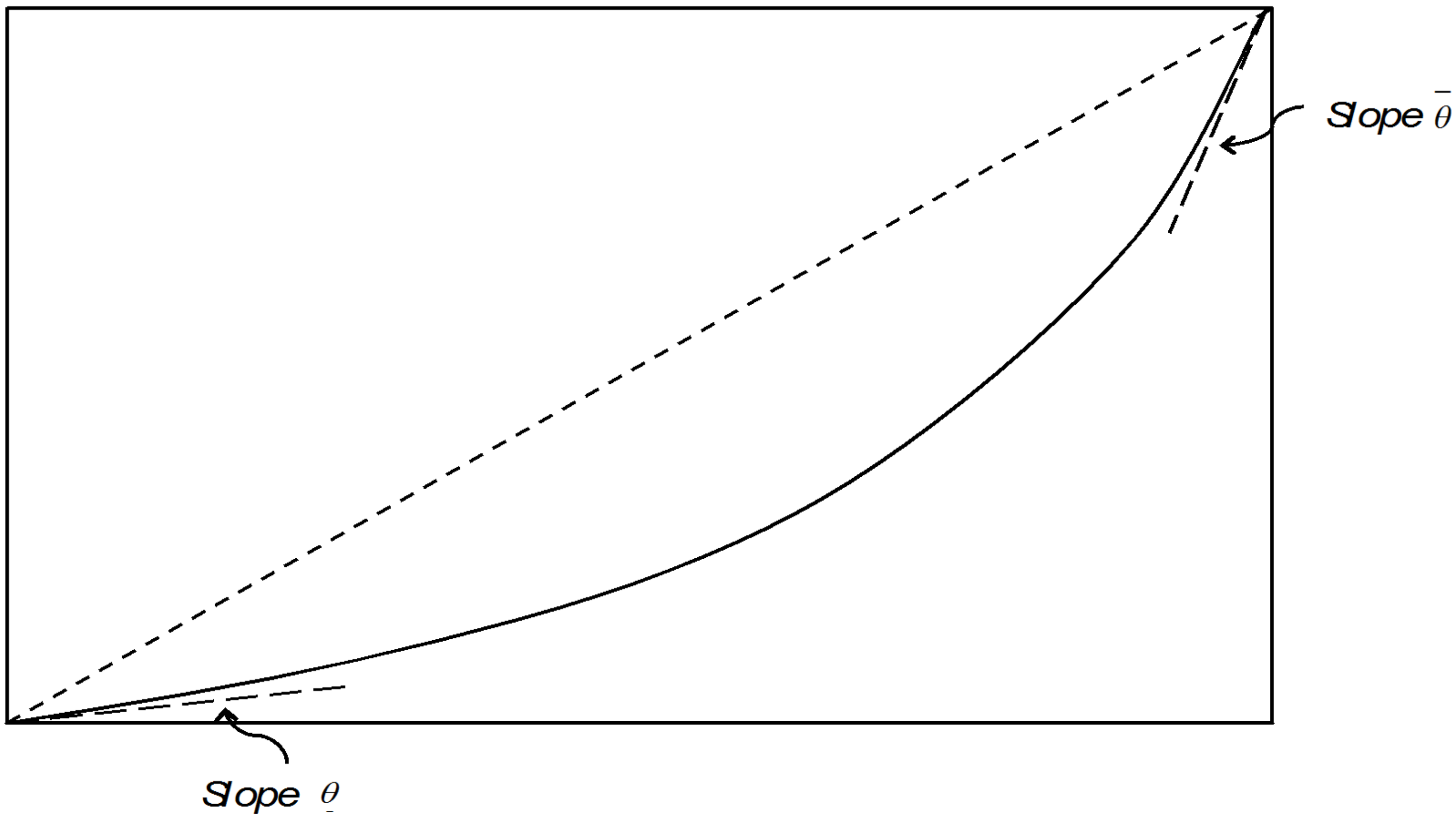


Figure 1: Lorenz Curve

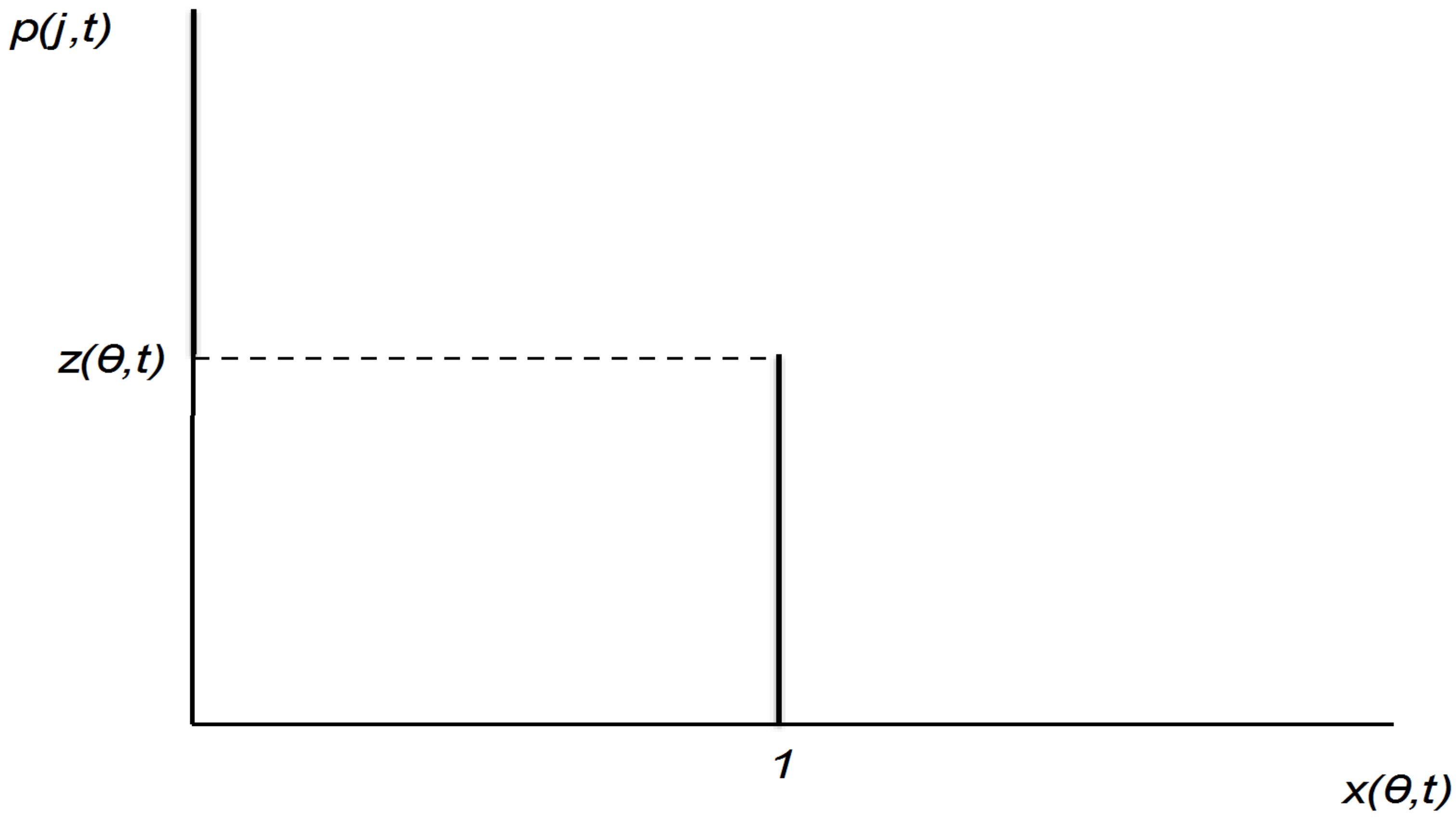


Figure 2: Individual Demand

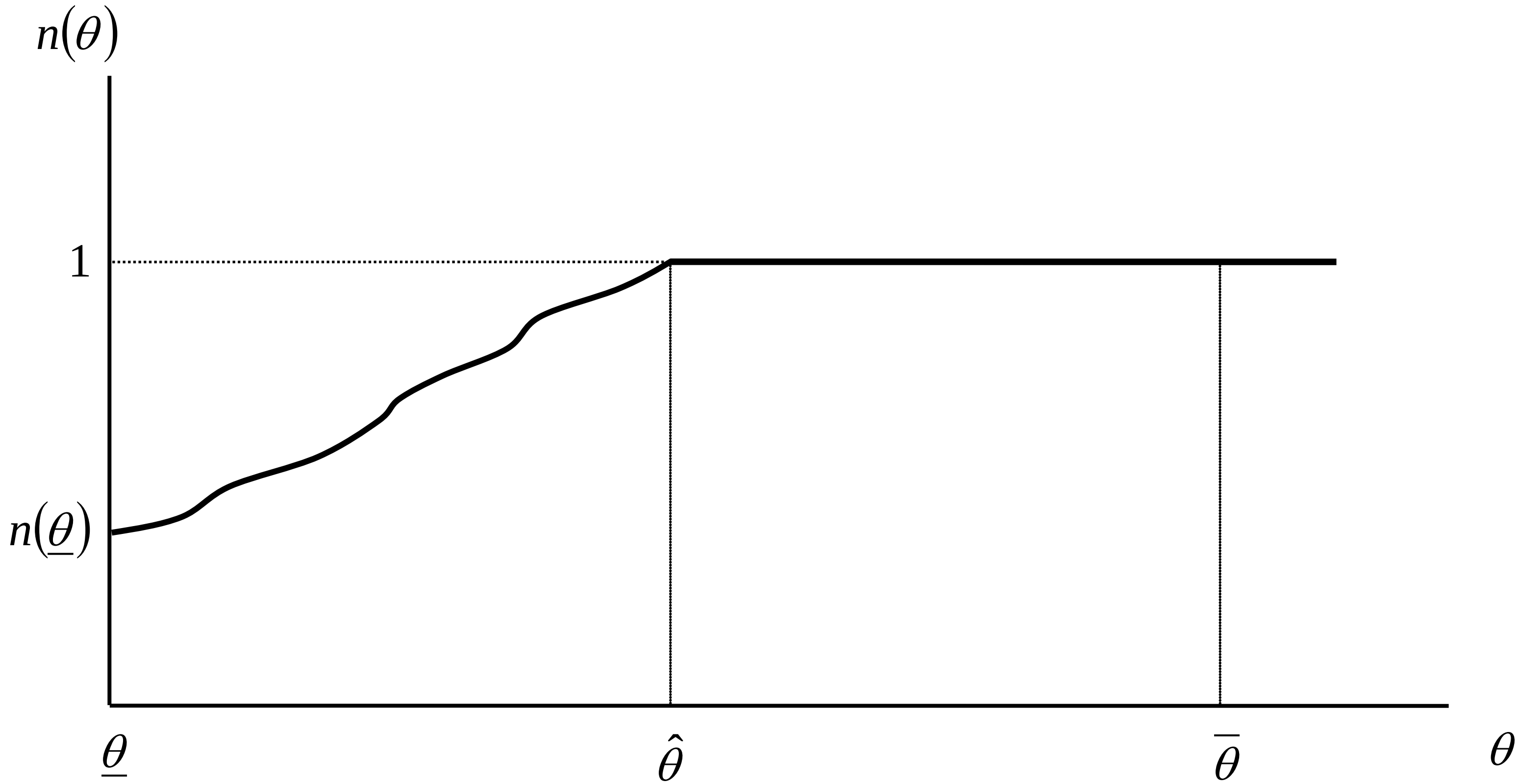


Figure 3: Share of innovative products consumed

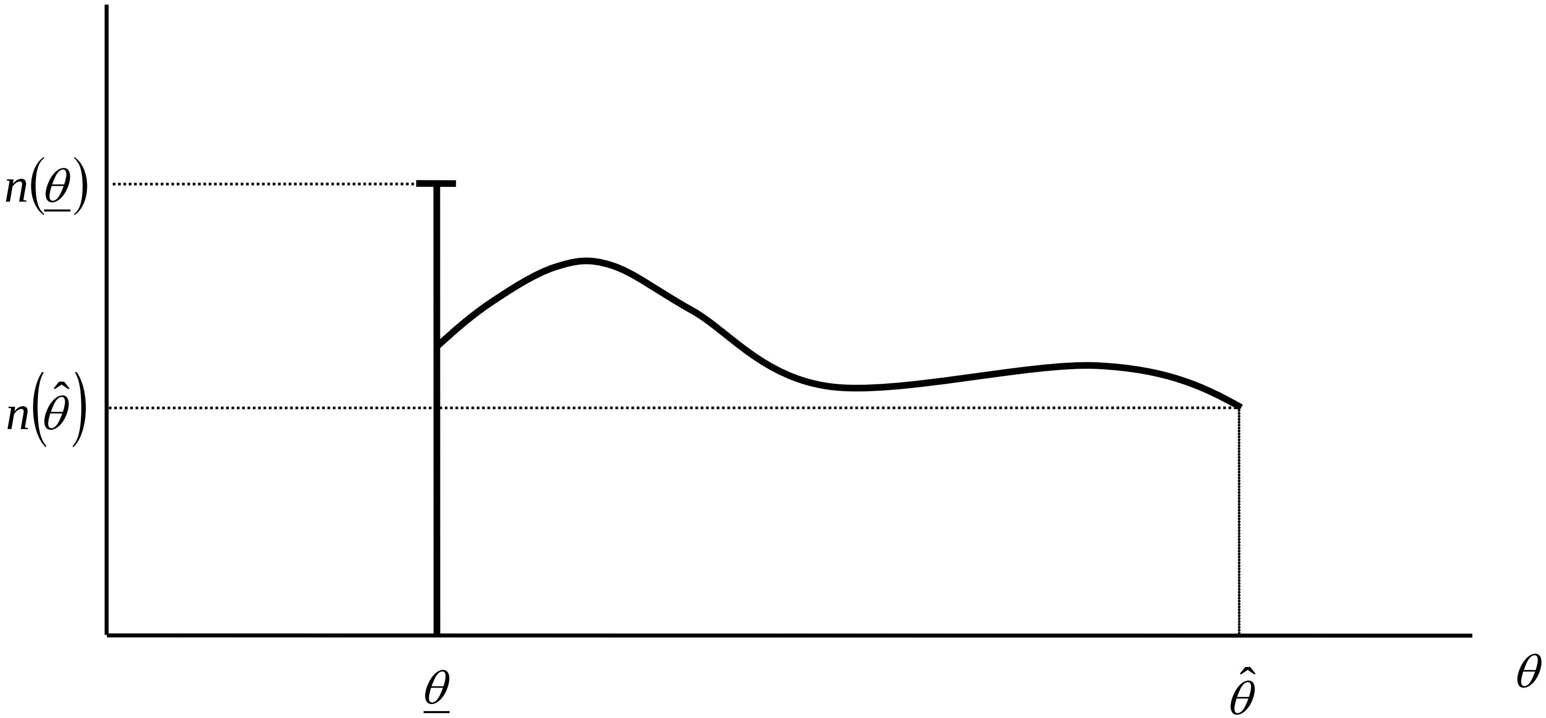


Figure 4a: Firm-type distribution

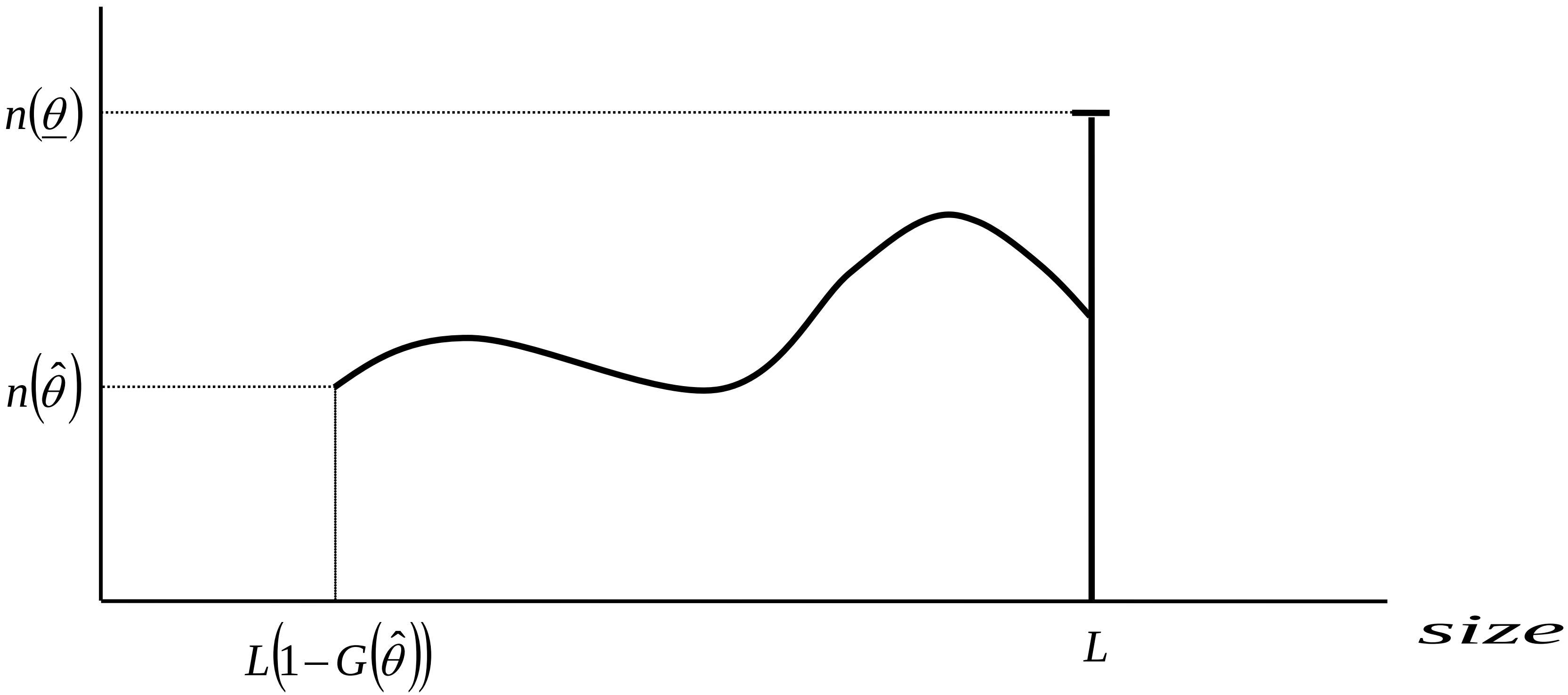


Figure 4b: Firm-size distribution

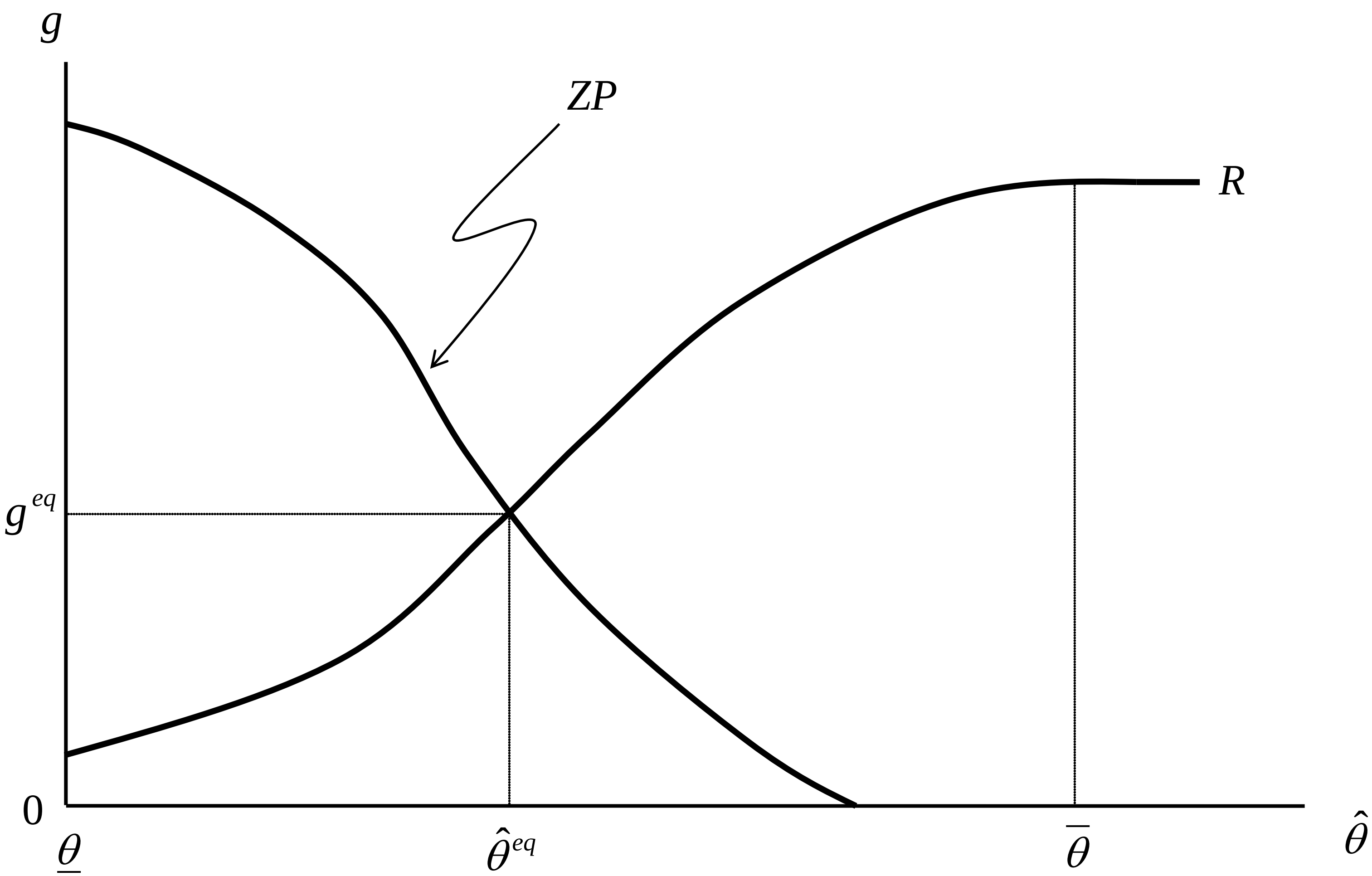


Figure 5: General equilibrium

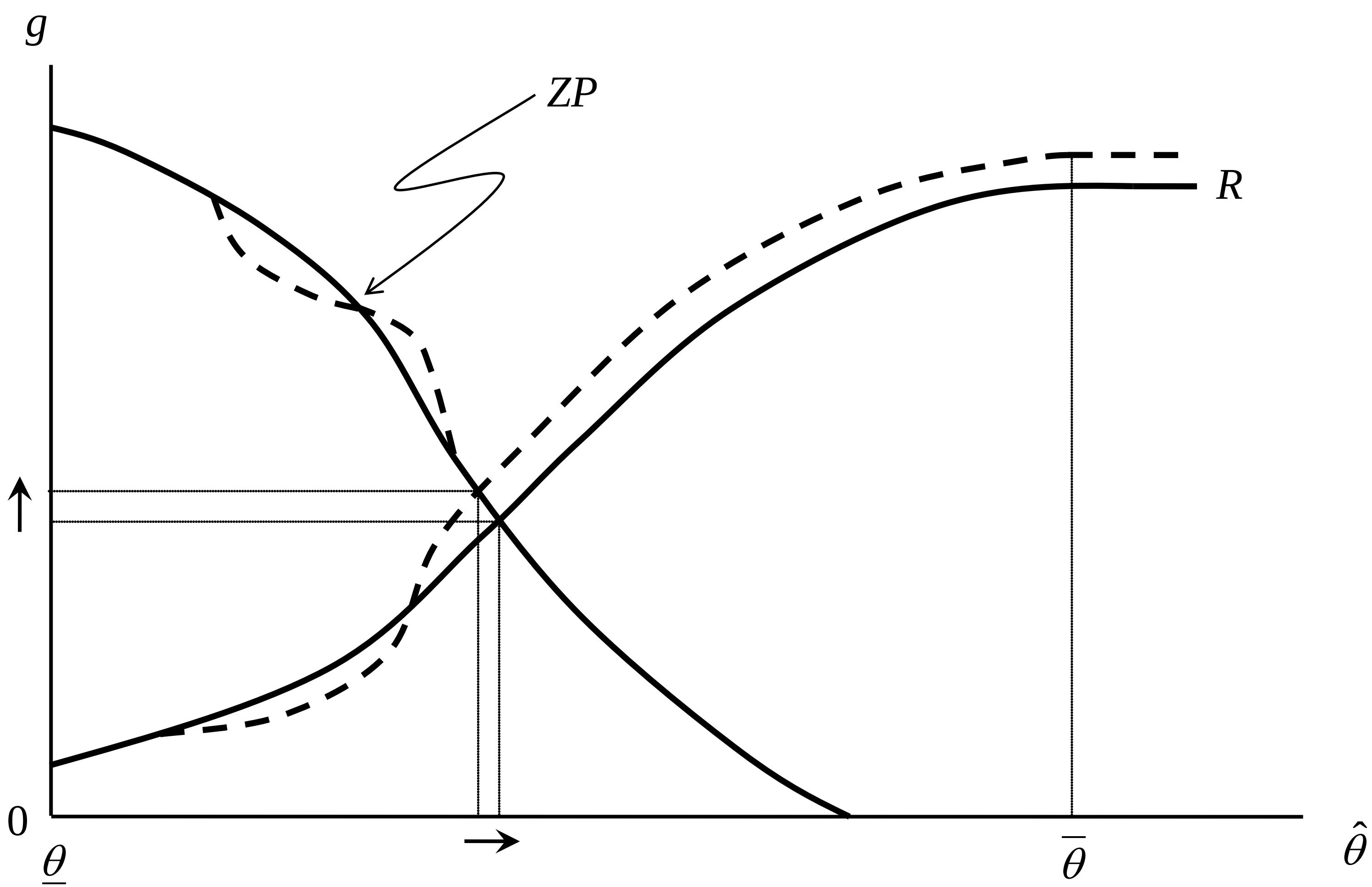


Figure 6a: Regressive redistribution among the middle class

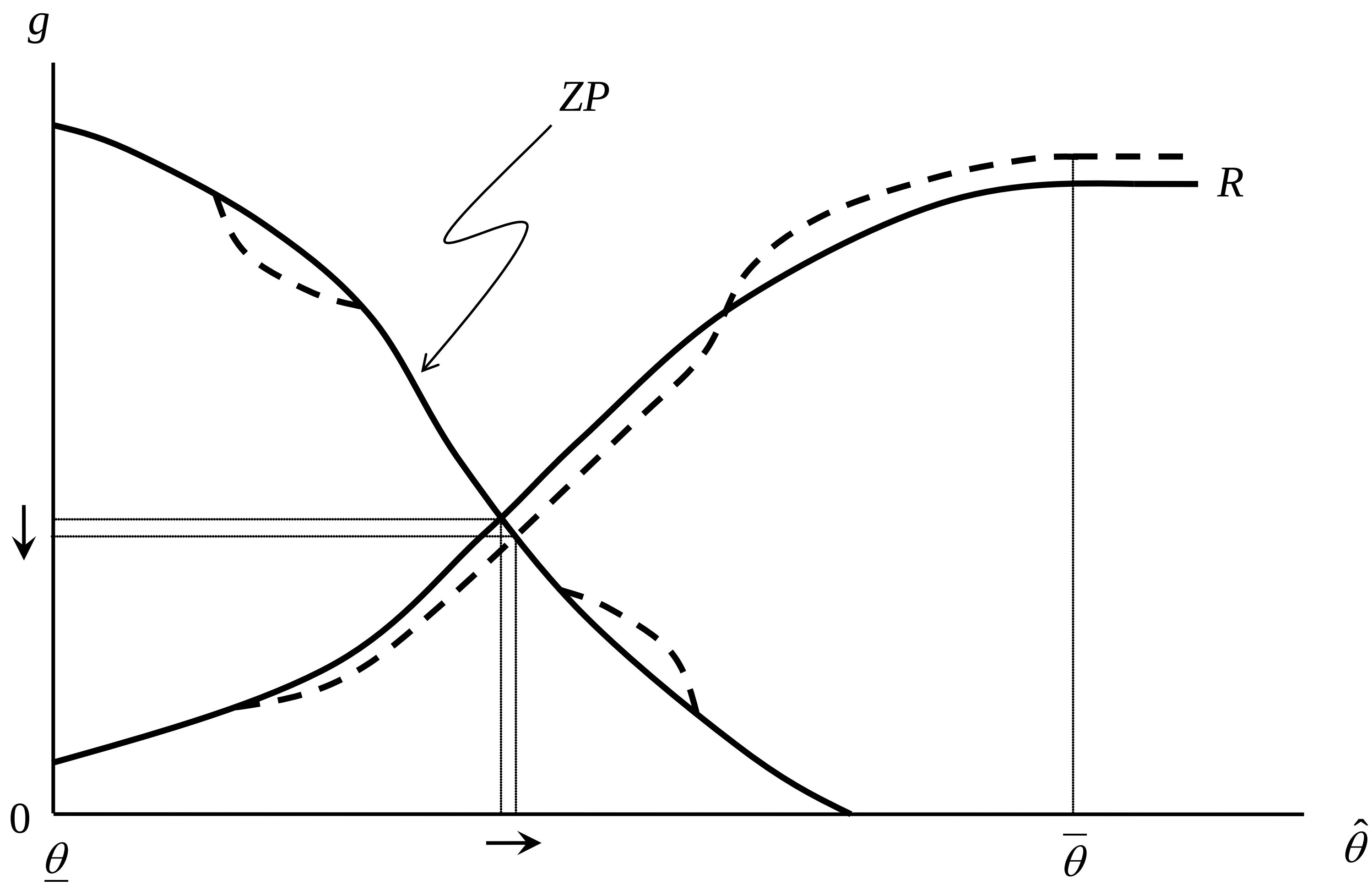


Figure 6b: Redistribution from the middle class to the rich