Do Taxes on Large Firms Impede Growth?
Evidence from Ghana

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ABSTRACT
Many developing countries pursue policies that impose different effective tax rates on firms of different sizes. For example, the self-employed, who account for large fractions of the workforce, may pay little or no tax, while larger firms pay higher tax rates. This paper uses a span-of-control model in the spirit of Lucas (1978) to examine the general equilibrium consequences of such policies, which distort the size distribution of firms. The model is calibrated to data from Ghana to ask whether such policies pose a major impediment to growth and development. In the model economy, a switch to a uniform rate of taxation, affecting all firms equally, would yield modest efficiency gains, but it would not greatly reduce the prevalence of small firms.

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1. Introduction

Many developing countries pursue policies that treat large and small firms differently. Tax rates, labor regulations, and social security contributions — to name a few examples — may differ explicitly with firm size. In addition, selective policy implementation and enforcement may create implicit or *de facto* differences in the environment facing large and small firms. For example, governments often find it impractical to collect taxes from the smallest enterprises; instead, they are likely to set higher tax rates and to enforce compliance only among larger firms.¹

Such policies clearly affect the size distribution of firms. But how great is the impact on firm size? How large are the resulting inefficiencies? And what are the dynamic effects on capital accumulation and economic growth?

A number of authors have argued that discrimination against large firms forms a major obstacle to economic growth. Most notably, de Soto (1989) argued that policy distortions have frustrated would-be entrepreneurs in Peru, creating a huge mass of small enterprises and constraining them to the "informal" sector. By liberalizing its policies and eliminating unnecessary regulations, de Soto contended, Peru could unleash the energies of its informal entrepreneurs, allowing their businesses to grow and stimulating the whole economy.

To date, however, little analysis has attempted to model the impacts of policies discriminating against large firms. Numerous studies have sought to measure the

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¹ Many rich countries also pursue policies that have different effects on large and small firms; however, there is seldom the pronounced dualism between large and small firms that is characteristic of poor countries.
size of the informal sector in different countries, but these studies have not attempted to quantify efficiency losses or to assess dynamic implications.

To provide more satisfying answers, it is necessary to use a richer theoretical framework. This paper draws on a dynamic general equilibrium model to assess the importance of policies that impose different tax rates on firms of different sizes. The model is based on the span-of-control framework developed by Lucas (1978) but adds a self-employment technology and explicit dynamics. As a quantitative experiment, the parameters of the model are chosen based on data from Ghana, and the model's predictions are then compared with Ghana's firm size distribution and other macro variables. The current policy environment is then contrasted with an alternative scenario in which taxes are the same for all business establishments.

Ghana offers an interesting test of the model because its economy is characterized by extremely high levels of self-employment and small enterprise; over 85 percent of the manufacturing labor force is employed in establishments with fewer than 10 workers (Republic of Ghana 1989, 1991, 1993).

The second section of the paper briefly reviews relevant literature. The third section presents a model in which differential tax rates on small and large firms lead to distortions in the size distribution of firms. The fourth section explains how the model is used to perform a quantitative experiment in which parameters are selected to model key features of the Ghanaian economy. The fifth section then compares the output of the model with data from Ghana and presents the results of policy experiments. Finally, the paper concludes with a discussion of policy implications.
1. **Background and relevant literature**

In most poor countries, small businesses and own-account enterprises dominate economic activity.\(^2\) As suggested by Kuznets (1966), small firms account for significantly higher percentages of employment and output in poor countries than in rich countries. In part, the relative importance of small enterprises in developing countries reflects the sectoral composition of output — chiefly the large share of family farming in total GDP. Even within the manufacturing sector, however, small establishments represent a more significant feature of poor economies than of rich ones. For some developing countries, as much as 90 percent of the manufacturing workforce reports being self employed or working unpaid in a family firm. These establishments serve multiple and complex functions; good summaries can be found in Liedholm and Mead (1999) and Tybout (2000).

Why are small enterprises so prevalent in poor countries? And why might it matter? After all, in a world characterized by constant returns to scale, the size of firms is irrelevant.

One school of thought holds that structural factors account for the pattern. Kuznets (1966), for example, maintained that the transition from own-account enterprises to larger firms was a fundamental feature of economic development. Similar views can be found in the writings of many early development economists, including Rostow (1960), Lewis (1965), and Hirschman (1958). In this view, small

\(^2\) Own-account work is a term commonly used in national accounting to refer to various forms of self-
firms may be efficient in poor countries, given the prevalent technology and institutions. Gollin (2002) explores and tests this proposition further.

A related view holds that the firm size distribution in poor countries reflects imperfections in legal and financial institutions, typically operating through credit market failures. Some papers see legal protections as critical (e.g., Kumar et al., 1999; Quintin 2003; Laeven and Woodruff 2004). Others view financial market imperfections as key determinants of the size distribution of firms, (e.g., Banerjee and Newman 1993, Lloyd-Ellis and Bernhardt 2000, Cabral and Mata 2001, and Amaral and Quintin 2003).

More recently, however, researchers have suggested that in poor countries, the pervasiveness of small enterprises may owe much to a desire for entrepreneurs to avoid costly taxes and regulations. An informal sector, in this view, arises as a response to policies that inhibit the growth and development of small enterprises.

De Soto (1989) provided a powerful initial expression of this argument, charging that government policies and bureaucratic regulations in many developing countries have effectively forced enterprises into the informal economy. In this view, taxes, labor laws, registration fees, and similar state controls affect businesses that are visible to the state; i.e., those that enter the formal sector. Where the costs of these state controls are high, it is argued, many businesses will choose to remain small, informal, and underground. In support of this hypothesis, de Soto collected data on the costs facing Peruvian entrepreneurs who wished to start or expand their employment.
businesses in the formal sector. In many cases, the costs were substantial. Subsequent work by other researchers (e.g., Chickering and Salahdine 1991, for five countries in Asia and the Middle East) documented similar disincentives in numerous other countries.

But even if policies skew the size distribution of firms, is it necessarily bad? Many authors implicitly assume that large firms are more productive than small ones – perhaps because they have better access to capital markets or improved technologies. In the micro development literature, it has been suggested that many small enterprises not productive at all, but are instead “acting as a sponge, soaking up excess workers in marginal activities” (Liedholm et al., 1994). Although the empirical evidence for this view is mixed, some studies suggest that one-person firms gain in efficiency if they are able to expand (Liedholm and Mead 1987; Parker and Torres 1994; Parker et al. 1995). The authors usually see this as evidence of limited scale economies. From this perspective, implicitly, there may be costs associated with policies that cause enterprises to remain small.

At a more macro level, the static costs of taxes and policies that distort the size distribution of firms have been analyzed in a theoretical framework by Rauch (1991) and in an empirical context by Schivadi and Torrini (2003). In a dynamic setting, the

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3 This particular quote was used to refer to small rural enterprises, rather than to the entire population. Other studies that typify this literature are Haggblade and Liedholm (1992), Liedholm and Kilby (1989), Daniels (1994), and Mead (1994).

4 Note, however, that other studies suggest that the productivity of small and micro firms is higher than that of larger firms (e.g., Liedholm 1993) or at least comparable with that of larger firms (e.g., Tybout 2000).
question has been considered by Restuccia and Rogerson (2003), Ihrig and Moe (2004), and Guner et al. (2005).

The current paper differs from these by focusing on the case of a single developing country and by seeking to quantify the impact of distortionary policies within a single developing economy. It builds on the existing literature by explicitly modeling the impact of policies that effectively impose different tax rates on firms of different size. Furthermore, it uses a dynamic general equilibrium approach to explore the impact of policies that distort the size distribution of firms on the long-run pattern of income per capita.

The model used here is drawn from Lucas (1978), in which heterogeneity in managerial ability among people in the economy leads some people to manage businesses while others work for wages. A number of subsequent papers use related structures to generate a size distribution of firms. A common feature of these models is that they depend on heterogeneity of some fixed factor of production, which is inelastically supplied. Some examples include Jovanovic (1982), Evans and Jovanovic (1989), Hopenhayn (1992), and Jovanovic (1994). This approach differs from alternative explanations for heterogeneity in firm size, such as skill-level complementarities (as in Kremer 1993), fixed costs (as in Luttmer 2004), or industry-specific human capital (as in Rossi-Hansberg and Wright 2004).
3. A Model of Firm Size under Distortionary Taxes

The main question posed in this paper is whether policies that affect the size distribution of firms can have a quantitatively important effect on economic growth in a developing economy. To address this question effectively, I need a model in which there is a non-trivial size distribution of firms. The model must also incorporate policy variables. Finally, it must be a model in which economic growth occurs – at least in the sense of accumulation – and in which changes in policies can be mapped into changes in outcomes.

This paper uses a dynamic general equilibrium model in which the distribution of firm size can evolve over time and is sensitive to policy changes. The model is based on Lucas (1978), but it extends the Lucas framework to an infinite time horizon and explicitly includes consumers, self-employed people, and tax policies.

There is a single sector of the economy, producing one composite good that can be consumed or used as capital. People inhabiting this economy differ only in their entrepreneurial ability. In each period, people can choose among three alternative forms of employment: wage work, self-employment, and full-time management. Workers receive the market wage, $w$, while full-time entrepreneurs receive the rents from operating a firm. The self-employed divide their time between direct production activities and entrepreneurial activities; they receive some rents as well as a return to time spent in production. Individuals make their employment decision in such a way as to maximize earnings (since they are indifferent, in terms
of utility, between the three uses of their time).

In equilibrium, people with high levels of entrepreneurial ability have a comparative advantage in full-time management of firms; people with low levels of entrepreneurial ability have a comparative advantage in wage work, and people with intermediate levels of entrepreneurial ability may have a comparative advantage in self-employment.

Formally, the environment is characterized by the following features. There is a measure one of infinitely-lived people, who are indexed on the interval $[0,1]$ by entrepreneurial ability, $x$. There is a distribution $\Delta(x)$ over skill types.

Preferences

People in the model economy have identical preferences defined over their lifetime consumption streams $\{c_t(x)\}_{t=0}^{\infty}$ by:

$$U = \sum_{t=0}^{\infty} \beta^t u(c_t(x)).$$ (1)

Endowments

In addition to skills, individuals are endowed with one unit of labor in each time period, which is supplied inelastically; and with $k_0$ units of initial capital, also supplied inelastically.

Technology

At each date, a single good is produced; this can be consumed or saved as
capital. The production process involves three factors: labor, capital, and entrepreneurial ability. A firm operated by a full-time manager of type $x$ and employing $n$ workers and $k$ units of capital will produce output according to the production function:

$$y = Ax[m^\rho + (1-\gamma)k^\rho]^{\theta/\rho}.$$  \hspace{1cm} (2)

This production function is a CES form; following Lucas, we impose the restriction that $0 < \theta < 1$. This implies that there are decreasing returns to scale in labor and capital. Together with the fixed factor, $x$, this determines the optimal firm size for each manager.

Not all firms will be operated by full-time managers in equilibrium. In the model, people may instead choose to operate single-person enterprises; i.e., to engage in self-employment. In this economy, I define single-person enterprises as those in which $n \leq 1$. For simplicity, I assume that firms in this category have access to the same technology as larger firms.\(^5\) There is a time cost to being self employed; non-labor activities consume some of an entrepreneur’s time (e.g., contracting with suppliers and customers. I denote the time required for this activity by $\alpha$. Thus, production for a self-employed person of type $x$ is given by:

$$y_{se} = Ax[m^\rho + (1-\gamma)k^\rho]^{\theta/\rho} \bigg/ (n + \alpha \leq 1).$$  \hspace{1cm} (3)

\(^5\) This is a strong assumption; it might be reasonable to assume that larger firms have access to better technologies. In a developing country, however, “larger” firms may have only 2-10
**Government**

The government in this model collects taxes $\tau$ from firms and converts them into a composite government good, $G_t$, which enters production and consumption in a perfectly separable manner and thus has no impact on equilibrium outcomes.\(^6\) The tax schedule for firms has three tiers.

Tax rates are:

- $\tau_0$ for the self-employed
- $\tau_1$ for firms with $n \leq n^*$
- $\tau_2$ for firms with $n > n^*$

This system implies two thresholds in the tax code: between self-employment and small firms, and between firms with fewer than $n^*$ workers and those with more than $n^*$ workers. The second of these thresholds reflects the fact that “very large” firms are often treated differently from other firms with full-time managers.

**Individual's problem**

An individual in this economy must choose the type of employment that will maximize his or her income. The returns from working for a wage are simply $w$, which the individual takes as given. The individual compares this wage with the income derived from self-employment and from full-time management, and chooses the occupation that gives the highest income. Individuals also hold and accumulate capital, but this will not affect their occupational choices. Since capital markets work employees. It is hard to see why these firms should have very different technology.
perfectly in the model economy, an individual’s capital holdings do not affect his or her decision about where to work.

**Income from self-employment**

The returns from self-employment consist of entrepreneurial rents as well as the market value of time \( n \) devoted to production. Thus, a self-employed individual of ability \( x \) at date \( t \) earns \( \pi_t^{SE}(x) \), where this income includes wages as well as rents:

\[
\pi_t^{SE}(x) = \max_{\{n, k\}} \left( 1 - \tau_0 \right) x A \left[ n^\rho + (1 - \gamma) k^\rho \right]^{\frac{1}{\rho}} - r_t k_t + w_t (1 - \alpha - n_t)
\]

(4)

This formulation assumes that the self-employed are free to sell their “excess” labor on the wage labor market, subject to the time constraints imposed by the requirements of managing a firm. In other words, people are free to operate single-person enterprises on a part-time basis. This seems to be consistent with the ways in which many such enterprises are operated.

In equilibrium, individuals with sufficiently low levels of \( x \) would only choose to operate extremely small firms that would earn too little to compensate for the lost opportunities in the wage labor market. Individuals with sufficiently high levels of \( x \) will prefer full-time management.

**Income from full-time management**

An individual who operates a firm as a full-time manager will receive only the

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6 For convenience in notation, I omit the public good from the utility function.
entrepreneurial rents. This is a straightforward problem except for the distortion created by tax policy: the tax rate that the manager will face depends on the level of labor input. Thus, the full-time manager’s income is given by:

$$\pi_{i}^{FT} (x) = \max_{\{n, k_{i}\}} \left(1 - \tau\right) x A \left[m^\rho + (1 - \rho)k_{i}^{\rho}\right]^{\rho/N} - r_{i}k_{i} - w_{i}n_{i}$$

s.t. \( k_{i}, n_{i} \geq 0 \)

and

$$\tau = \begin{cases} \tau_{1}, & \text{if } n_{i} \leq n^{*} \\ \tau_{2}, & \text{if } n_{i} \geq n^{*} \end{cases}$$

**Consumer’s problem**

Having chosen an employment option to maximize income, the individual faces a straightforward problem in allocating this income to current-period consumption and to savings.

Denote the individual's maximum income from employment as:

$$\pi_{i} (x) = \max \left\{w, \pi_{i}^{SE} (x), \pi_{i}^{FT} (x)\right\}$$

Let \( m_{i} (x) = 1 \) if the individual earns maximum income from full-time management, and let \( m_{i} (x) = 0 \) otherwise. Similarly, let \( s_{i} (x) = 1 \) if the individual earns maximum income from self-employment, and let \( s_{i} (x) = 0 \) otherwise.

For notational simplicity, let \( a \) denote the consumer’s asset holdings. The only asset here is physical capital, which depreciates at a rate \( \delta \). The problem of a consumer with entrepreneurial ability \( x \) can then be written as:
\[
\max_{\{c_t, a_t\}_{t=0}^\infty} \sum_{t=0}^\infty \beta^t u(c_t(x))
\]
\[
\text{s.t.}
\]
\[
c_t(x) + a_{t+1}(x) \leq (1 + r_t - \delta) a_t(x) + \pi_t(x)
\]
\[
c_t(x), a_t(x) \geq 0 \quad \forall t.
\]\(\text{(7)}\)

**Equilibrium**

An equilibrium for this economy consists of sequences:

\[
\{c_t(x), a_t(x), k_t(x), n_t(x), s_t(x), m_t(x)\}_{t=0}^\infty \quad \forall x \in [0, 1],
\]
along with prices \(\{r_t, w_t\}_{t=0}^\infty\), such that:

**i.** The consumer’s problem is solved for all individuals.

**ii.** All establishments are maximizing profits, taking prices as given.

**iii.** The usual feasibility conditions are satisfied, at all dates.

Specifically, the market-clearing condition for the goods market is given by:

\[
\int_0^t c_t(x) d\Delta(x) + \int_0^t a_{t+1}(x) d\Delta(x) + G_t
\]
\[
\leq \int_0^t m_t(x) x A \left[ \gamma(n_t(x))^{\rho_t} + (1 - \gamma)(k_t(x))^{\rho_t} \right] d\Delta(x)
\]
\[
+ \int_0^t s_t(x) x A \left[ \gamma(n_t(x))^{\rho_t} + (1 - \gamma)(k_t(x))^{\rho_t} \right] d\Delta(x) + \int_0^t a_t(x) d\Delta(x)
\]

Market-clearing in the wage labor market requires that:
The market for capital services clears when:

\[
\int_0^r n_i(x) d\Delta(x) \leq \int_0^r (1-m_i(x))(1-s_i(x)) d\Delta(x) + \int_0^r (1-\alpha) s_i(x) d\Delta(x)
\]  

(9)

Finally, the government budget is balanced when:

\[
\int_0^r k_i(x) d\Delta(x) \leq \int_0^r a_i(x) d\Delta(x)
\]  

(10)

where

\[
\tau = \begin{cases} 
\tau_1, & \text{if } n_i \leq n^* \\
\tau_2, & \text{if } n_i \geq n^* 
\end{cases}
\]

The structure of the model immediately implies that people's work choices, \( m_i(x) \) and \( s_i(x) \), will be (weakly) monotonic in \( x \); in other words, at each date, there will be two cutoff levels of entrepreneurial ability \( z_{1t} \) and \( z_{2t} \in [0, 1] \) such that everyone with a skill level below \( z_{1t} \) will work, and everyone with a skill level above \( z_{2t} \) will be a full-time manager, while individuals with intermediate levels of entrepreneurial ability will be self-employed. It is worthwhile to note, however, that for some parameter values, there may be no self-employed people in the economy. Alternatively, for
some parameterizations, there may be no full-time managers.

4. Quantitative Application of the Model: The Case of Ghana

The model described above offers a framework for considering the effects of policies that skew the efficient size distribution of firms in an economy. To evaluate the usefulness of the model, we can consider an application to the manufacturing sector in Ghana.

Ghana offers an interesting case for an analysis of the effects of policies on firm size. To begin with, Ghana continues to rank among the world's poorest countries, with real 2000 GDP per capita of $1,351, according to the Penn World Tables (v. 6.1). Like many poor countries, it has a very large sector of small-scale firms. Household survey and census data indicate that around 80 percent of Ghanaians are either self-employed or work without pay in family business (Republic of Ghana 1987, 1989, 1994). If distortionary policies are responsible for skewing the size distribution of firms, we might expect to find the impact in Ghana – and by extension in other poor countries – to be large.

I will restrict my focus to the manufacturing sector. Ghana has many small firms and single-person establishments in agriculture and services, but these are sectors in which small establishments are fairly common even in rich countries; thus, we might not need to look for policy impacts. Even within Ghana's manufacturing sector, however, 73 percent of workers report being self-employed. (See Table 1.) Industrial Census data indicate that under 15 percent of the manufacturing workforce is employed by establishments with 10 or more
Appiah-Koranteng (1994) reports estimates from 1963-74 and from 1989 suggesting that the value added in small-scale firms ranged from 22-37 percent of manufacturing sector value added. These estimates are reinforced by data from household surveys, which show that non-farm self-employment income was 24.3 percent of total household income in the first round of the Ghana Living Standards Survey and 31.0 percent in the second round (Republic of Ghana 1989, 1993). This lends support to the idea that small enterprises and self employment probably account for 25-30 percent of value added for the economy as a whole, excluding agriculture. Since small-scale enterprises and self-employment seem especially prevalent in manufacturing, it is reasonable to imagine that well over 30 percent of manufacturing output may originate in firms with fewer than 10 employees.

A number of surveys of small enterprises have been undertaken in Ghana in recent years (e.g., Appiah-Koranteng 1994; Aryeetey et al. 1994; Dordunoo 1994; Sowa et al. 1992; Steel and Webster 1991; Stryker et al. 1990; Teal 1994 and 1995; Thomi and Yankson 1985). These provide a rich source of primary data. In addition, several rounds of the Ghana Living Standards Survey — a detailed household survey — include a great deal of indirect information about employment and income, as does the 1984 Census. Finally, the Industrial Census of 1987 reports complete data for a relative handful of large enterprises.

7 Total household income included the imputed value of owner-occupied housing as well as the values of in-kind wage income, food produced for home consumption, and home consumption of output produced by family businesses.
Assigning functional forms and parameter values

Given the relatively simple structure of the model, it remains to choose functional forms and parameter values. The only remaining functional specification is for utility. In the analysis that follows, I take \( u(x) = \log(x) \).

The model has twelve parameters. Of these, a number can be taken from sources such as the 1987 Ghanaian Industrial Census (Republic of Ghana 1991) or from surveys of small enterprises (Teal et al. 1994, 1995).

Parameters of the model are:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>( A )</td>
<td>scaling constant</td>
</tr>
<tr>
<td>( \beta )</td>
<td>discount factor</td>
</tr>
<tr>
<td>( \delta )</td>
<td>depreciation rate</td>
</tr>
<tr>
<td>( \gamma )</td>
<td>labor share in CES production function</td>
</tr>
<tr>
<td>( \theta )</td>
<td>exponent on CES function; corresponds to combined labor and capital share in total output</td>
</tr>
<tr>
<td>( \rho )</td>
<td>parameter corresponding to elasticity of substitution between capital and labor</td>
</tr>
<tr>
<td>( \alpha )</td>
<td>Time cost of operating a single-person establishment.</td>
</tr>
<tr>
<td>( \tau_0, \tau_1, \tau_2 )</td>
<td>Tax rates on different sized firms</td>
</tr>
<tr>
<td>( \Delta(x) )</td>
<td>Distribution of managerial skill</td>
</tr>
</tbody>
</table>

I take \( \beta = 0.95 \), with a period defined as one year. A value of \( \delta = 0.072 \) can be obtained by using the Industrial Census figure for depreciation over the book value of fixed assets.

The technology parameters \( \rho, \gamma, \) and \( \theta \) can be derived from micro estimates.
Teal (1995) presents several alternative estimates of elasticities of substitution between K and L for small manufacturing firms in Ghana. Using a CES specification of the production function, similar to the one in this model, he arrives at four alternative estimates of $\sigma$, ranging from 0.43 to 1.13 and averaging 0.78. Allowing for firm fixed effects and using differenced equations, rather than level equations, Teal arrives at an estimate of 0.86. This appears to be the most convincing estimate of $\sigma$, although all four estimates are within the plausible range. It implies a value of $\rho = -0.1628$.

Teal's approach to estimating the CES production function also yields estimates for the labor coefficient $\gamma$ in Ghana’s small manufacturing firms. The range of estimates is between 0 and 0.6. For $\sigma = 0.86$, the corresponding value is $\gamma = 0.532$.

The third parameter of the production function is $\theta$. This parameter implicitly determines the entrepreneurial share, which is given by $1 - \theta$. In the national income and product accounts, these entrepreneurial rents are not measured directly. However, a recent paper by Bigsten et al. (2000) reports returns to capital and labor in the manufacturing sectors of five African countries, based on firm-level surveys. Using the data presented in this paper, it appears that the entrepreneurial rents for a median firm – defined as value added less wages less rental costs of capital – were about 15 percent, averaged across the five countries. On this basis, I take $\theta = 0.85$.

Next, I need to parameterize the skill distribution, $\Delta(x)$. I set this to be a

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8 These figures are broadly consistent with the estimates obtained by Baah-Nuakoh (1981).
beta distribution, with the two parameters equal to 4. This generates a symmetric
bell-shaped curve, which seems appropriate for a trait like managerial ability. A
truncated normal distribution gives similar quantitative results.

The tax rates $\tau_0$, $\tau_1$, and $\tau_2$ are central to the policy experiments undertaken
here. These taxes, in terms of their function in the model, should be viewed as
effective tax rates, rather than as the nominal rates quoted in the tax code. Many
policies affect the size distribution of firms in Ghana and hence could be viewed
as effective taxes. In addition to nominal tax rates, Appiah-Koranteng (1994)
points out a partial listing of policies that implicitly affect firm size: provision of
infrastructure; monopolistic or monopsonistic marketing boards; export and
import controls; centralized registration and licensing of enterprises; regulatory
procedures; and controls on financial institutions. Parker et al. (1995) cite
"minimum wage laws and burdensome hiring and firing procedures" as important
constraints on large formal sector firms. Working in the other direction are
policies that favor large firms, such as preferential access to credit or grants of
market power.

Ideally, we would construct an effective rate of taxation that would measure the
combined effects of these policies on firms of different sizes.\(^9\) No such measure
exists, however. I use the Industrial Census of 1987, which includes data on total
indirect taxes paid by large manufacturing firms — including custom duties, excise

\(^9\)Such a measure would also need to include extra-legal costs, such as bribes and kickbacks demanded
by regulators.
duties, and sales taxes. These amounted to about 28 percent of value added for large firms. I take this to be the effective tax burden for large firms; i.e., \( \tau_2 = 0.28 \).

Data from household surveys and from surveys of enterprises usually indicate that formal taxation is very low. Small firms undoubtedly pay some licensing and regulatory fees, however, along with some bribes and kickbacks, and other bureaucratic overheads. I assume here that they pay tax at a rate half that of the larger firms; in other words, \( \tau_1 = 0.14 \).

It is unclear to what extent the self-employed in the manufacturing sector face taxation. These individuals may pay some bribes or kickbacks, but they presumably face the lowest effective tax rates. For this paper, I assume that they bear only one tenth the tax burden of large firms; i.e., I take \( \tau_0 = 0.028 \).

Having chosen these parameters, I finally choose values for two unobserved parameters, the scaling constant \( A \) and the self-employment time cost, denoted by \( \alpha \), so that steady-state output in the model economy is normalized to one and so that the fraction of self-employed workers in the model economy matches the proportion observed in the data, which is 0.73. This gives a value of \( A = 1.27 \) and a value for \( \alpha = 0.10 \). The value for \( \alpha \) implies that the self-employed devote 10 percent of their time to managing firms, as opposed to actually conducting physical labor. There are no time use data available to validate this number. Clearly, a larger value would increase the cost of self employment and, ceteris paribus, would decrease the number of people choosing to be self-employed.
5. Quantitative Experiment

Using the parameterized model, I will first ask whether the model offers a useful representation of the Ghanaian macro economy. Second, I will see how the model responds to changes in the tax structure – and in particular to a change in effective rates such that the current discrimination against large firms is removed.

5.1 Evaluating the model

Although the model is highly simplified, it reflects certain pertinent features of the Ghanaian economy. By construction, the model accurately matches the data in assigning 73 percent of the workers to self-employment. But in other respects, too, the model does a reasonable job of replicating Ghana’s economy along certain dimensions of interest. Table 2 (second and third columns) compares data from the actual economy with the output of this baseline model economy.

One dimension in which the model does quite well is in reproducing the remainder of the firm size distribution for Ghana. (See Figure 1.) In the model economy, for example, firms with more than 10 employees account for 11.7 percent of the workforce in the model economy – not far from the figure in the data (14.9 percent).
The model also generates a steady-state capital-output ratio in the model economy of 2.61. By comparison, several studies of Ghanaian data suggest capital-output ratios for the 1980s and 1990s between 2.25 and 3.18.\textsuperscript{10}

Similarly, the steady-state gross investment share for the model economy is just under 19 percent. This compares with a figure of 20 percent in the World Development Indicators 10-year average for Ghana’s gross investment share, 1990-99.

Ghana’s aggregate employee compensation share of GDP, based on U.N. National Accounts Statistics (electronic data files), averaged about 0.045 for the period 1977-86. The model shows that employees working in large firms (those with 10 or more employees) earned 0.030 of the economy’s output. Within these large firms, of course, employee compensation shares are higher. Firm-level survey data suggest an employee compensation share of output of 0.42 for Ghana in the 1990s (Bigsten et al. 2000, Table 3). In the model economy, employees earn 0.33 of the output of establishments with employees.

In the model economy, the government collects 8.0 percent of output through its taxes on firms; in the data, Ghana’s government collected an average of 8.1 percent of GDP in revenue from 1971-86 (United Nations National Accounts Statistics, electronic data files).

In the model economy, output per worker is higher in firms operated by full-time managers – about 14 percent higher than in single-person establishments. This is consistent with Tybout (2000) who suggests that there are modest productivity gains associated with crossing the threshold from single-person firms to those employing small numbers of people.

However, in the model economy, the distortionary taxation system creates a bulge of firms that are constrained from growing. A number of firms hover below the size threshold at which they would face higher taxes – and they substitute capital for the workers whom they would otherwise like to employ. Thus, the capital-labor ratios in these firms are higher than for the economy as a whole. These firms would like to hire more workers, but because tax rates are based on the numbers of workers, they instead expand by hiring more capital. Figure 2a shows the output for firms operated by managers with different levels of entrepreneurial ability, and Figure 2b shows the levels of capital and labor inputs used in these firms. Note that as firms reach the size thresholds at which tax rates will rise (i.e., at $n = 0.9$ and $n = 3.0$), firms hold employment steady but capital inputs continue to rise.
This distortion suggests that there might, in fact, be significant negative effects of tax policies that distort the size distribution of firms. The model is stylized, but it appears to offer a reasonable framework for thinking about the effects of policies that impose different tax rates on firms of different sizes.

5.2 Conducting a policy experiment: neutral taxes

How much would the model economy change if the tax system did not distort the efficient firm size distribution? In other words, what would be the effects of switching Ghana's tax system to one that imposes the same tax rate on all establishments, regardless of size. Under such a policy, the self-employed would pay the same tax rate as small firms, and both would pay the same rate as larger firms. This is not necessarily a realistic scenario: there would be political difficulties associated with such a shift, and there are fixed costs to tax collection that might make it inefficient to collect taxes from the smallest firms. Nonetheless, the comparison with a costless shift to a “flat” tax is a useful one, and it puts an upper bound, of sorts, on estimates of the impact of tax-induced distortions in firm size.

Suppose first that the level of the new tax is set so that the tax change is “revenue-neutral.” In other words, suppose that the new tax system raises the same total tax revenue as the current tax regime.

Using the model to calculate the tax revenues under alternative neutral tax rates, it turns out that a rate of 0.075, levied on all firms, can generate the same tax revenue as the three-tiered scheme described above.
Table 2 (columns 2, 3, and 4) summarizes the results of this experiment and offers comparisons of key variables with the baseline economy and the actual data.

One key change is that self employment falls substantially as a source of income. The fraction of people operating own account businesses falls from 0.73 to 0.55, and the labor used in these businesses falls from 0.61 of the total available to 0.39. Correspondingly, the “flat tax” results in more production moving into large firms, defined as those with more than 10 employees. These large firms would triple their share of national output – from 11 percent of output to 31 percent. Smaller firms would also expand in size, so that firms with 0 to 10 workers would produce 23 percent of output.

Other notable changes include a doubling of the fraction of the population working for a wage, from 0.21 to 0.40. Employee compensation would correspondingly rise from 9 percent of GDP to 24 percent.

The change in tax rates thus introduces substantial changes in the size distribution of firms. But what does it do to aggregate output? Clearly output must be higher under the flat tax. The model suggests that Ghana’s steady-state income per capita would rise 6.5 percent if the government were able to collect its revenue in such a way that it did not distort firm size decisions. This is a substantial amount, but it is clearly a far smaller distortion than de Soto and others (e.g., Stiglitz 2001) have suggested. Given that the additional costs of tax collection would be substantial, it is not clear that a move to a flat tax would be a significant net gain. Certainly, the model does not suggest that policies distorting the size distribution of firms play a
major role in reducing income or slowing growth.

It is also interesting to note that, even under a non-distortionary tax regime, Ghana’s economy would most likely still include a large number of very small firms. The model predicts that 55 percent of the workforce would remain self employed even with no difference in tax rates from expanding their firms. The reason is that switching to a larger firm requires an entrepreneur to become a full-time manager – giving up the labor income that a self-employed person can earn. As a result, only those individuals with very high levels of ability would earn more by managing full-time. It is the time cost of becoming a full-time manager, rather than differential tax rates, that prevents most entrepreneurs from expanding their businesses.

Simply put, the current tax structure does not appear to be the principle force keeping average firm size small in Ghana today.

6. Conclusions and implications

Several conclusions emerge from this research. First, distortions in the structure of indirect and corporate taxes have the potential to create modest effects on economic efficiency and growth. Under a plausible set of parameter values, the model suggests that the Ghanaian economy would benefit from a change to tax collection systems that do not distort firm size – and particularly from collection systems that do not discriminate against large firms.

The model’s output suggests, however, that the overall effects are not large – approximately 6.5 percent of steady-state income. This distortion is not a major
reason why countries are poor, nor does it explain why poor countries fail to grow rapidly. Some have argued that the prevalence of self employment and small-scale firms in developing countries provides ipso facto evidence of inefficiencies. But in fact, it seems possible that firm size is itself driven by a country’s level of productivity. Gollin (2002) uses a similar model to show that poor countries are likely to have smaller average firm size than rich countries, even without distortionary taxes. Others have suggested that credit market imperfections – perhaps related to low productivity – could account for the prevalence of small firms. Taxes alone, however, do not appear to be a sufficient explanation.

The relatively small size of the output effect depends on a few key features of the model. In particular, it depends on the total factor productivity of small firms being little different from that of large firms, so that policies altering the size distribution of firms do not have huge impacts on productivity. The empirical literature suggests that this is a reasonable assumption. Söderbom and Teal (2001, Table 1) find that output per employee does not differ much across firms of different size classes in Ghana. Nor do capital-output ratios or capital-labor ratios differ vastly across different size classes of firms.

This paper thus suggests that distortions in firm size are thus of secondary importance, at best, in explaining large and persistent gaps in income or growth rates across countries.
References


31.

and results. Accra, Ghana: Statistical Service.


Table 1: Number of workers by sector and type of employment, Ghana, 1984.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Total Employed</th>
<th>Public Sector Employees</th>
<th>Private Sector Employees</th>
<th>Self-employed and employers</th>
<th>Unpaid family workers</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, Hunting, Forestry, and Fishing</td>
<td>3,310,967</td>
<td>80,773</td>
<td>95,018</td>
<td>2,486,240</td>
<td>622,782</td>
<td>26,154</td>
</tr>
<tr>
<td>Mining and Quarrying</td>
<td>26,828</td>
<td>23,691</td>
<td>2,060</td>
<td>1,189</td>
<td>54</td>
<td>14</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>588,418</td>
<td>27,587</td>
<td>65,516</td>
<td>451,299</td>
<td>18,684</td>
<td>25,332</td>
</tr>
<tr>
<td>Electricity, Gas &amp; Water</td>
<td>15,437</td>
<td>14,623</td>
<td>595</td>
<td>165</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Construction</td>
<td>64,686</td>
<td>25,590</td>
<td>16,174</td>
<td>21,175</td>
<td>407</td>
<td>1,340</td>
</tr>
<tr>
<td>Trade, Restaurants &amp; Hotels</td>
<td>792,147</td>
<td>23,608</td>
<td>36,641</td>
<td>698,889</td>
<td>32,580</td>
<td>429</td>
</tr>
<tr>
<td>Transport, Storage &amp; Communication</td>
<td>122,806</td>
<td>36,040</td>
<td>39,583</td>
<td>37,215</td>
<td>1,878</td>
<td>8,090</td>
</tr>
<tr>
<td>Finance, Insurance, Real Estate &amp; Bus. Services</td>
<td>27,475</td>
<td>21,059</td>
<td>4,824</td>
<td>1,469</td>
<td>13</td>
<td>110</td>
</tr>
<tr>
<td>Community, Social &amp; Personal Services</td>
<td>473,716</td>
<td>304,521</td>
<td>59,179</td>
<td>80,034</td>
<td>3,006</td>
<td>26,976</td>
</tr>
<tr>
<td><strong>ALL SECTORS</strong></td>
<td><strong>5,422,480</strong></td>
<td><strong>557,312</strong></td>
<td><strong>319,590</strong></td>
<td><strong>3,777,675</strong></td>
<td><strong>679,422</strong></td>
<td><strong>88,481</strong></td>
</tr>
</tbody>
</table>

### Table 2. Model economy: baseline and with undistorted taxes, compared with actual data.

<table>
<thead>
<tr>
<th>Variable of Interest</th>
<th>Ghana, Actual Economy</th>
<th>Model Economy, Baseline</th>
<th>Model Economy, Undistorted Taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steady-State Output</td>
<td>1.00</td>
<td>1.00</td>
<td>1.064</td>
</tr>
<tr>
<td>Steady-State Capital</td>
<td>2.25-3.18</td>
<td>2.63</td>
<td>2.74</td>
</tr>
<tr>
<td>Labor Force</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wage workers</td>
<td>na</td>
<td>0.21</td>
<td>0.40</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.73</td>
<td>0.73</td>
<td>0.55</td>
</tr>
<tr>
<td>Full-time managers</td>
<td>na</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>Labor available to the self-employed</td>
<td>na</td>
<td>0.66</td>
<td>0.50</td>
</tr>
<tr>
<td>Labor used in self-employment</td>
<td>na</td>
<td>0.61</td>
<td>0.39</td>
</tr>
<tr>
<td>Labor hired out to firms</td>
<td>na</td>
<td>0.05</td>
<td>0.11</td>
</tr>
<tr>
<td>Employment shares by firm size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workforce (incl. managers) employed</td>
<td>0.12</td>
<td>0.20</td>
<td>0.23</td>
</tr>
<tr>
<td>in firms with fewer than 10 employees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workforce (incl. managers) employed</td>
<td>0.15</td>
<td>0.12</td>
<td>0.33</td>
</tr>
<tr>
<td>in firms with 10 or more employees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output shares by firm size</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self Employed</td>
<td>na</td>
<td>0.68</td>
<td>0.47</td>
</tr>
<tr>
<td>Firms with fewer than 10 employees</td>
<td>na</td>
<td>0.22</td>
<td>0.21</td>
</tr>
<tr>
<td>Firms with 10 or more employees</td>
<td>na</td>
<td>0.11</td>
<td>0.31</td>
</tr>
<tr>
<td>Income Shares</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Employee Compensation</td>
<td>0.04</td>
<td>0.09</td>
<td>0.24</td>
</tr>
<tr>
<td>Labor Income of Self Employed</td>
<td></td>
<td>0.21</td>
<td>0.18</td>
</tr>
<tr>
<td>Capital Income</td>
<td></td>
<td>0.35</td>
<td>0.34</td>
</tr>
<tr>
<td>Self-Employed Rents</td>
<td></td>
<td>0.21</td>
<td>0.09</td>
</tr>
<tr>
<td>Managers' Rents</td>
<td></td>
<td>0.07</td>
<td>0.07</td>
</tr>
</tbody>
</table>
Figure 1. Size Distribution of Firms, Model Economy and Actual Economy

- **Self-Employed**: 0.00, 0.10, 0.20, 0.30, 0.40, 0.50, 0.60, 0.70, 0.80, 0.90, 1.00
- **< 10 Workers**
- **10 + Workers**

- **Fraction of Workforce Actual Economy**
- **Fraction of Workforce Model Economy**
- **Fraction of Firms Model Economy**
- **Fraction of Firms Actual Economy**
Figure 2a. Output per firm as a function of entrepreneurial ability, baseline model economy

Figure 2b. Labor and capital inputs per firm, as function of entrepreneurial ability, baseline model economy