

MACRO DEVELOPMENT WITH MICRO DATA[‡]

Macro-Perspective on Asset Grants Programs: Occupational and Wealth Mobility[†]

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In economies where access to credit is limited, productive but poor individuals are constrained from choosing the most profitable occupations. In such situations, poverty can be a persistent state. Poor individuals choose low-paying occupations and do not accumulate wealth. That is, poverty begets poverty. This simple logic motivates a large number of poverty alleviation programs around the world in which asset grants are made to the very poor.¹ Recently, a number of these programs have been evaluated using randomized control trials. Significant impacts on the occupational choices and income in the short run have been documented, but little is known about the aggregate and long-run effects of these programs (Bandiera et al. 2013; Banerjee et al. 2011; Morduch, Ravi, and Bauchet 2012).

The clearest long-term evidence on the impact of wealth redistribution has been provided by Bleakley and Ferrie (2013) using a large natural experiment: the 1832 Cherokee land lottery. They found that, 18 years after the land lottery, “winners are on average richer [...] but mainly due to a (net) shifting of mass from the middle to the upper tail of the wealth distribution,” while “[t]he lower tail is largely unaffected.” The authors interpret these results as inconsistent with the simple logic of wealth-based poverty traps discussed above.

The disparate evidence from recent experimental studies and historical natural experiments motivates the need of an explicit quantitative theory to interpret these findings and, more broadly, to evaluate the role of redistribution policies as long-term development strategies.

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¹ In this paper, we abstract from training and motivational treatments, which are common components of these programs.

I. A Quantitative Model of Credit Market Imperfections

Building on Buera and Shin (2013) and Buera, Kaboski, and Shin (2011), we use a quantitative general equilibrium model of occupational choice with frictions in credit markets to analyze the aggregate and distributional impacts of a one-time, economy-wide redistribution of wealth toward the poorest. In this benchmark model, occupational choices and savings decisions depend critically on wealth.

Consider a small open economy populated by individuals that are heterogeneous in terms of their productivity as workers x and entrepreneurs z . As entrepreneurs, agents use capital and hire labor to produce a common final output according to a diminishing returns to scale production function $z k^\alpha l^\theta$. Worker productivity

and entrepreneurial productivity follow independent Markov processes.²

In this economy, access to capital is limited by the enforceability of contracts. Entrepreneurs have the option to default on their credit contracts and keep a fraction $1 - \phi$ of the period's output net of the labor payments and the same fraction of the undepreciated capital. We assume that defaulting individuals regain access to credit markets in the following period, which implies that the limited commitment constraint has a simple static representation. In this representation, ϕ is the unique parameter indexing the enforceability of contracts across countries. As ϕ varies from zero to one, the model spans the spectrum of cases from financial autarky to perfect credit markets.

Given the interest rate r , exogenously determined by world asset markets, and the domestic equilibrium wage per efficiency unit of labor at time t , w_t , the problem of an individual with wealth a and worker/entrepreneurial productivity x and z at time t is summarized by the Bellman equation

$$v_t(a, x, z) = \max_{c, a', k, l \geq 0, e \in \{0, 1\}} \left\{ \frac{c^{1-\sigma}}{1-\sigma} + \beta \mathbb{E}_{x', z'} [v_{t+1}(a', x', z') | x, z] \right\}$$

$$\text{s.t. } c + a' + T_t(a) - S_t(a) \leq e[zk^\alpha l^\theta - (r + \delta)k - w_t l] + (1 - e)xw_t + (1 + r)a,$$

$$\text{and } zk^\alpha l^\theta - w_t l - (r + \delta)k + (1 + r)a \geq (1 - \phi)[zk^\alpha l^\theta - w_t l + (1 - \delta)k],$$

where c is consumption and e is the discrete occupational choice.

² In particular, we assume that the value of the entrepreneurial productivity remains constant from one period to the next, $z' = z$, with probability γ , and, with probability $1 - \gamma$, it is a random draw from a Pareto distribution, $z' = \zeta \sim -\eta\zeta^{-\eta-1}$. A worker's productivity or efficiency units of labor is assumed to follow a two-state symmetric Markov chain, $x \in \{x_l, x_h\}$. The probability of the shocks remaining in its current value is π and $\mathbb{E}[x]$ is normalized to one.

We study the transitional dynamics of this small open economy following an unexpected redistribution of wealth from the wealthiest toward the poorest. The redistribution establishes, at that point in time, a minimum wealth in the economy equal to double the average annual wage in the initial stationary equilibrium and is funded in an extreme fashion by instituting a one-time, 100 percent tax on wealth above a particular threshold, \bar{a} . In particular, we implement in the initial period the wealth grant $S_0(a) = \max\{2w\mathbb{E}[x] - a, 0\}$, which is financed by a one-time tax over the wealthiest individuals, $T_0(a) = \max\{a - \bar{a}, 0\}$, where \bar{a} is chosen to satisfy the static government budget constraint.

A. Mapping the Model to Data

The calibration relies on a set of standard values or moments from the United States, but when possible we target moments from developing countries. The coefficient of risk aversion $\sigma = 1.5$, the capital share $\alpha = 0.3$, and the depreciation rate $\delta = 0.06$ are set to standard values. Following Buera, Kaboski, and Shin (2012) we choose $\alpha + \theta = 0.79$, $\gamma = 0.89$, and $\beta = 0.94$ so that a closed economy model with perfect credit markets ($\phi = 1$) matches the top income concentration, exit rate of establishments and the level of the real interest rate in the US, a relatively undistorted economy. For the other parameters, we attempt to target Bangladesh (to assist in the comparison in Section III), but data availability often forces us to rely on evidence from other South Asian economies. We set $\eta = 5.56$, so that the model economy with financial frictions matches the right tail of the distribution of establishments in India, the most representative firm-level data for a developing country. The parameter indexing contract enforceability ($\phi = 0.14$) is set so that the credit to GDP ratio in the model matches the average value of this ratio for Bangladesh and India in the 2000s. We set the parameters of the symmetric Markov chain governing the evolution of the worker productivity ($x_l = 0.43$, $x_h = 1.57$, and $\pi = 0.70$) to match the autocorrelation and standard deviation of income in the IFPRI dataset for rural Pakistan. Finally, to capture the poor saving opportunities in developing countries, we set the interest rate faced by agents in the small open economy to zero, a value that

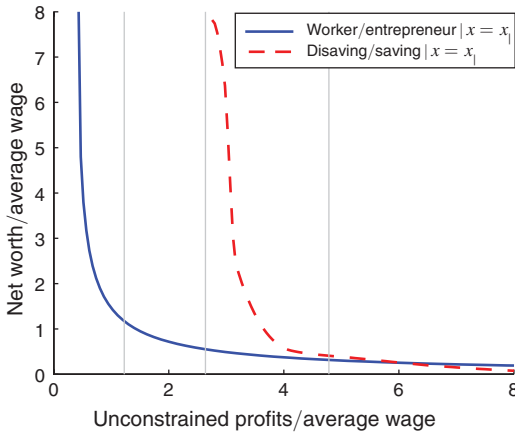


FIGURE 1. OCCUPATION AND SAVING MAP

is 2 percentage points lower than the historical average in developed economies.³

B. Behavior in the Initial Stationary Equilibrium

Figure 1 illustrates the occupational and saving choices of individuals as a function of their entrepreneurial productivity and wealth. The figure focuses on individuals with low worker productivity (x_1) since their occupational choices are more sensitive to the wealth grants. The horizontal axis shows the entrepreneurial productivity of individuals, measured as the unconstrained profits of an entrepreneur relative to the average wage, while the vertical axis shows individual wealth relative to the average wage.

The two downward sloping thresholds capture the optimal behavior. The solid line is the threshold combinations of entrepreneurial productivity and wealth for the static decision of whether to be an entrepreneur or worker at that point in time (i.e., given current wealth). Relatively unproductive and/or poor agents, i.e., those to the southwest of the solid line, choose to be workers, while productive and/or wealthy individuals are entrepreneurs. The dashed line is a forward-looking threshold: the combination of entrepreneurial ability and wealth such that individuals are indifferent between running down their assets or saving to become (remain) entrepreneurs. Individuals with entrepreneurial

productivity and wealth to the southwest of this threshold are in a poverty trap. The utility cost of saving and investing to run the business at an efficient scale outweighs the expected gains. These are the individuals that would be affected by the wealth grants in a relatively permanent fashion, i.e., the wealth transfer will put them in an upward wealth trajectory that will last until they are hit by a sufficiently negative entrepreneurial productivity shock.

The three vertical lines in the figure show the location of the seventy-fifth, ninetieth, and ninety-fifth percentiles (left to right) of the entrepreneurial productivity distribution and help illustrate the narrow segments of the population whose occupational and saving choices are affected by the policy. Only individuals with (i) entrepreneurial productivity in the top quartile of the distribution, (ii) low worker productivity, and (iii) low wealth have their occupational choices affected. (A much smaller group of those with high working productivity is affected.) These amount to 4.8 percent of the overall population or 16.8 percent of the treated population. Even a smaller fraction of the population would have their saving behavior affected by the wealth grants. In our model economy, these are individuals with low worker productivity and wealth who have an entrepreneurial productivity between the ninety-second and ninety-eighth percentiles, representing less than 0.3 percent of the treated population.

II. Dynamic Effects of Wealth Grants

Figure 2 illustrates the impact of the wealth grants on aggregate output, capital, and TFP for the first 20 years following the policy. Each series is normalized by the level of the variable in the initial stationary equilibrium (year 0 on the horizontal axis). From year 1 on, a positive (negative) deviation from 1 means a positive (negative) impact of the wealth grants on the aggregate variables.

The wealth grants have a positive effect on aggregate TFP but a relatively larger negative impact on aggregate capital. The net effect on per capita income is negative but small. The increase in TFP is due to the net entry of productive entrepreneurs and the capitalization of poor entrepreneurs with relatively large marginal products of capital. On impact, the decline in capital arises for the following reasons. The

³ In the small open economy benchmark with a zero interest rate, a fraction of the domestic wealth is invested abroad.

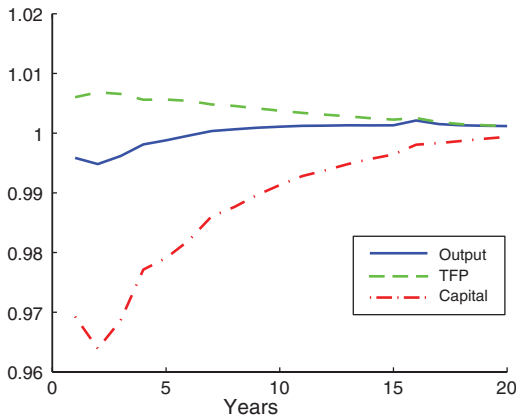


FIGURE 2. EVOLUTION OF AGGREGATE VARIABLES

funds for the wealth grants come from rich, active entrepreneurs who decrease their capital input by more than the drop in their wealth, since the acquisition of capital is based on leveraging wealth as collateral. This decrease is not completely offset by the grant recipients, because not all of them choose to become active entrepreneurs. In a small open economy, the redistribution of wealth therefore leads to a drop in the capital used in production and a capital outflow.

For the first five periods, the aggregate wealth (not shown) declines, since the wealth grants redistribute wealth and income from individuals with high saving rates to those with low saving rates. Eventually aggregate wealth recovers, however, as the wealth distribution reverts to its initial stationary distribution.

Figure 3 shows the evolution of the wealth distribution, starting from the initial stationary equilibrium (solid line, $t = 0$) and for different horizons up to ten years after the one-time wealth redistribution, $t = 1, 4, 10$. On impact ($t = 1$, dashed line), the wealth grants move the mass with wealth below double the average annual wages to 2, at the expense of the wealthiest 0.01 percent of the population.⁴ After four years, we observe a shift of mass to the right of the initial wealth grants and a relatively fast convergence of the left tail of the wealth distribution toward its

⁴ In our experiment 38 percent of the population receives some asset transfer and, therefore, this is the mass at 2 in the $t = 1$ distribution. Notice that this probability mass cannot be appreciated from Figure 3 because the vertical axis is truncated from above.

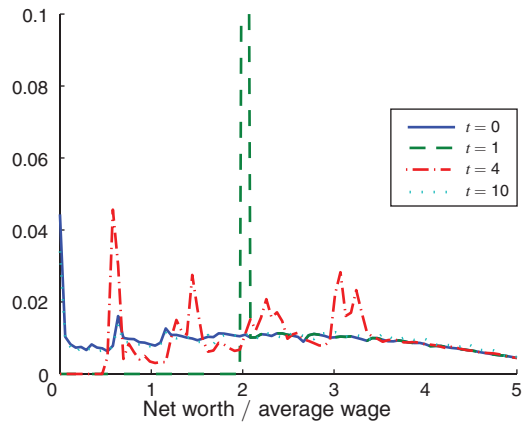


FIGURE 3. EVOLUTION OF THE WEALTH DISTRIBUTION

original shape. By the tenth year following the one-time redistribution, the wealth distribution has already overwhelmingly converged to the original shape: the $t = 10$ dotted line is practically indistinguishable from the $t = 0$ solid line.

III. Comparing with the Evidence

We can compare the effects of the wealth grants on the distribution of wealth with the historical evidence presented by Bleakley and Ferrie (2013), who evaluate the long-term consequences of the 1832 Cherokee land lottery in the US state of Georgia. Quantitatively, the lottery differed somewhat from our experiment. First, the lottery was not targeted toward the poor exclusively, and about 19 percent of the eligible population won. Second, the size of the typical winning was substantially larger, about ten times the average low-skilled (annual) wage at the time. Qualitatively, our results are consistent with their estimates of little movement in the left tail of the distribution in the long run, i.e., 18 years later. They did detect a persistent shift in mass from the middle to the upper tail of the distribution as a result of the lottery, however. In our model, after four years ($t = 4$ in Figure 3), there is a noticeable increase in the mass of individuals whose wealth is twice the size of the original grant, but the effects disappear by the tenth year (dotted line). Through the lens of our quantitative model of wealth-based poverty traps, it is not surprising that we do not observe persistent effects of wealth grants on the left tail. Instead, the puzzle is why the 1832

Cherokee land lottery's effects on the right tail were so persistent.

A natural extension of the model that will bring the theory more in line with the Georgia evidence is to add a sector where production requires a larger minimum efficient scale (Buera, Kaboski, and Shin 2011). In this extension, wealth becomes an even more important determinant of occupational and saving choices for individuals with profitable entrepreneurial opportunities in the large-scale sector. In terms of the occupational and saving maps described in Figure 1, the curves shift upward and become flatter. In addition, to the extent that transfers to individuals who start poor are not enough to allow them to operate in the large-scale sector, the model will still be consistent with the transient effects on the left tail of the wealth distribution.

The randomized control trial of Bandiera et al. (2013) in Bangladesh gives us more empirical evidence with which to compare our model. Our experiment is quite comparable to their study in terms of the size of the wealth grants, and also to others that are most policy relevant today, which involve grants 1.2 to 2.5 times annual wages, depending on the annual hours used. It is a controlled experiment, where only a fraction of those eligible receives the transfer. They find an increase in entrepreneurship rates of 15 percentage points after two years. Similarly, the annual earnings of the treated poor goes up by about 33 percent. These impacts persist (or even grow somewhat) four years after treatment. If the transfer is invested, the increase in earnings amounts to about a 20 percent annual return on that investment. We find the impacts on these dimensions largely remain four years out, but our average impacts are significantly smaller, especially for earnings. The entrepreneurship rate increases 8 percentage points and earnings increases just 3 percent. The impacts in our model are very heterogeneous across different individuals, with the earnings of the treated individuals in the ninetieth (ninety-fifth) percentile of the entrepreneurial productivity distribution increasing by 11 (15) percent in the second year.

One possible explanation for the gap between the effects in our model and those in the randomized control trial in Bangladesh is the differences in the distribution of entrepreneurial/worker productivity among the treated individuals, especially since we did not explicitly target moments that closely correlate with

marginal entrepreneurs. Alternatively, the difference could be attributed to the training and motivational components in the Bangladesh intervention, which are absent in our model.

IV. Alternative Policy Intervention: Microfinance

We also compare the results with the simulated impacts of introducing microfinance in our related work, Buera, Kaboski, and Shin (2012). In that paper, microfinance is modeled as a permanent innovation that makes it feasible to provide uncollateralized loans of a small size. The impacts of microfinance differ from those of wealth grants in two important ways. First, since microfinance is targeted toward financing capital, it increases the value of becoming an entrepreneur more directly, generating a larger effect on occupational choices and a more persistent decline in wage work. The associated decline in the supply of labor and the increased labor demand have large general equilibrium effects on the wage and, hence, large effects on poverty. Second, to the extent that microfinance innovations have a permanent effect in the working of credit markets, this policy will have an effect on the new stationary equilibrium. By contrast, the one-time wealth transfers that we analyze in this paper do not have an effect in the long run: in the examples we considered, the economy eventually converges back to the initial stationary equilibrium. While it is possible to construct theoretical examples with multiple equilibria (Banerjee and Newman 1993; Galor and Zeira 1993), to the best of our knowledge multiple stationary equilibria do not arise in quantitatively-oriented versions of these models (Giné and Townsend 2004; Buera, Kaboski, and Shin 2011).

V. Conclusion

We provide a simple, quantitative general equilibrium model of occupational choice with credit market frictions to analyze the aggregate and distributional effects of asset transfer programs. More broadly, this simple exercise illustrates the large gains from trade between micro- and macro-development. The wealth of recent micro-experimental evidence provides invaluable information with which to evaluate the predictions of macro-models, while quantitative theory is a natural guide to interpreting and extrapolating the micro-evidence.

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