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Do training funds raise the pace of training? The case of Mauritius

Oluyemisi Kuku
IFPRI

Peter F. Orazem
Iowa State University, pfo@iastate.edu

Sawkut Rojid
The World Bank

Milan Vodopivec
University of Primorska and International School for Social and Business Studies, Celje

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Disciplines
Economics

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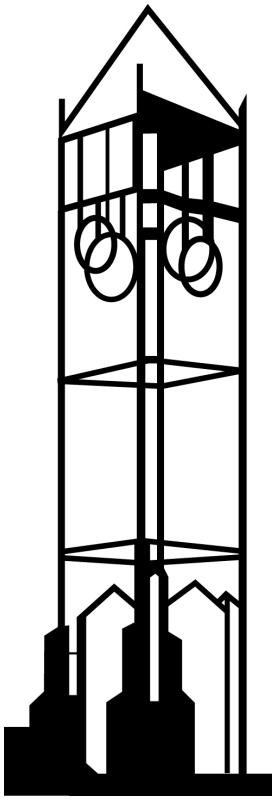

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IOWA STATE UNIVERSITY
Department of Economics
Ames, Iowa, 50011-1070

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JEL: M53; O15; O2; O55

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corresponding author: Peter F. Orazem, Department of Economics, Iowa State University, Ames, IA, 50011-1070, USA. pfo@iastate.edu (515) 294 8656.

Do Training Funds Raise the Pace of Training? The Case of Mauritius

I. Introduction

One of the most intensively studied issues in labor economics over the past twenty years is whether active labor market policies improve economic outcomes. While the earliest studies reviewed by Heckman et al (1999) generally failed to find positive results, more recent reviews by Betcherman et al (2004) and Card et al (2010) have found more supportive evidence for the most common intervention, training.[1] The most successful training programs in both developed and developing countries appear to focus on on–the-job or firm-based training.

A common funding source for the training programs is to tax the firms that are also targeted for training programs. The earliest programs in Belgium, Cyprus, Denmark, France and the Netherlands began as narrowly focused sectoral training programs in the 1960s and 1970s. All represented some form of partnership between unions and firms in a specific sector accompanied by government coordination. The rationale for these funds is a presumption that firms under-invest in training in the absence of government intervention. The most common argument is that training increases the value of a worker in many firms and not just one, meaning that the firm that invests in training risks losing the investment if the worker is hired away by another firm. Using Becker's (1993) terminology, the greater the share of the training that is general rather than firm-specific, the greater the incentive for firms to free ride on the other firms' investment by raiding their trained workers rather than investing directly. This rationale makes the most sense when there are many firms using similar skills such as in a single industrial sector. The sectoral training agreements common in Europe allow all the firms to agree to pay

[1] Classroom and workplace training represent 42% of all active labor market policy in developed countries (Card et al , 2010, table 3) and in developing and transition economies (Betcherman etal, 2004, table 4).

equally for training through the payroll tax and then share in the benefits, forcing all firms to internalize the training externality.

In developing countries, it is more common for central governments to impose training fund programs across sectors without the explicit participation by labor collectives or firms.[2] These policies have been most popular in Latin America and Sub-Saharan Africa who each represent 27% of the total programs reviewed by Johanson (2009). Because these programs are not focused on a common set of skills, they invariably involve cross–subsidization of training intensive firms by others and so the justification for the European training programs does not hold. Nevertheless, these programs could address a second possible externality if there are returns to scale in the provision of generally valued skills. By pooling funds through the tax system and coordinating training through approved providers or direct government provision, the government can lower the unit cost of training. Absent that coordination, individual firms would end up paying much higher prices per unit of training and many would simply forego undertaking that expense.

The rationale for government intervention in the provision of training is much weaker if the skills are specific to a single firm.[3] There is no incentive for other firms to poach trained workers whose skills have no added value outside the firm that provided the training, and so the free-rider problem does not exist. Because the skills are unique, there are no returns to scale in the provision of training. The only plausible rationale remaining for government intervention is that firms face liquidity constraints that prevent them from investing efficiently in their workers. In that case, it is possible that the public training subsidy will cause firms to invest efficiently in their workers.

[2] See CEDEFOP(2008) for a summary of European training fund programs.
[3] Even with general skills, the firm might still provide training without government intervention if informationa asymmetries or other labor market rigidities make workers immobile (Acemoglu and Pischke, 1998, 1999).

Even if these market failures exist, it is not clear that they are sufficiently large to outweigh the inefficiencies caused by a payroll tax that lowers the return to investment if the tax is borne by the firm, or returns to labor supply if the tax is borne by the worker. Additionally, costs associated with collecting taxes and administering the training funds are unnecessary if the firms would have invested in training without the program. However, past studies have not examined whether these training fund programs are cost effective. Johanson's (2009) comprehensive review of 62 national training funds concludes that despite vast amounts spent on training, evaluation has been largely anecdotal and limited to assessments of outcomes against targeted levels. This is particularly true in developing countries where studies have yet to establish that firms face lower marginal costs of training or increase their training investments as a result of the training funds.

The need for evaluations of training funds is particularly urgent in Sub-Saharan Africa which faces the need to accommodate the fastest growing labor force in the world.[4] There are numerous areas where public dollars could be used to enhance job growth, and so investments in training carry a high opportunity cost. When asked what factors hinder business growth, African firms rank insufficient job skills as 11th most important, behind such factors as transportation, access to electricity, input costs, access to financing, and political instability. It is not obvious that training is the best use of scarce resources.

This paper use the Mauritius Training Fund as a case study of the performance of training funds. We examine whether the firms that engage in training are those that would be predicted to train in a standard Becker(1993) model of training or if the training fund alters the incentives to train. Next, we examine the implied patterns of cross-subsidization from the firms paying into the system to the firms receiving the training subsidies. That analysis shows which industries are

[4] Statistics cited here are from McKinsey and Company (2012).

taxed in order to subsidize others and whether small firms subsidize large firms or vice versa. Finally, we examine whether there is any evidence that the training raises labor productivity.

We find that the training subsidy does increases training for the smallest firms that would not otherwise train without the subsidy. However, large, capital-intensive, high-wage firms that would be expected to have the greatest incentive to train without the subsidy end up paying more in taxes than they receive in subsidies. Furthermore, the subsidies focus on classroom training that has the lowest returns rather than on in-house training that has the highest returns in evaluations. We conclude that in Mauritius, for medium and large firms, the adverse effect of the tax on training outweighs the incentive effect of the subsidies. As a result, the training fund may well lower rather than raise the incidence of training in the country.

II. The Mauritius Training Fund

Following the Human Resource Development Act of 2003, all registered firms in Mauritius are required to pay a training levy. The tax is proportional to the firm's total base wage bill, the aggregate of wages paid workers excluding overtime, bonus and benefits. The government then uses this money to reimburse firms for a portion of their training costs. In principle, firms can be reimbursed up to ten times the tax they pay into the training fund. The reimbursement rate falls as the total expenditure on training increases, but the reimbursement can still be as high as five times the training levy paid for the most training intensive firms.

The stated objectives of the training fund are to (i) promote human resource development in line with national economic and social objectives, (ii) stimulate a culture of training and lifelong learning at the individual, organizational and national levels for employability and increasing productivity; and (iii) provide the necessary human resource thrust for successful transformation of the economy into a Knowledge Economy. Only the last of these is sufficiently

concrete to enable an evaluation, suggesting that the program should atypically induce training in the technology sector or other sectors that use information technologies.

Table 1 presents summary information for firm training using our industry and firm size cells. In all 9 sectors, training intensity rises with firm size. Propensity to train varies by sector between 6-10% for the smallest firms to 23-47% for the largest firms. Consistent with the stated objective to encourage the growth of the knowledge economy, training intensity is highest in Information Technology and Finance.

Nevertheless, one might expect that such a policy should have induced most firms to invest at least modestly in training every year, and yet only 9% participated in FY2008. One problem is that the training subsidy requires substantial paperwork, use of approved trainers, and prior approval of the training curriculum. The training is also subject to minimum participation of 10 workers if the training is offered in the workplace. These restrictions clearly limit the potential participation of smaller firms that may not have enough workers to train or sufficient expertise to manage the paperwork, consistent with the pattern of training by firm size found in Table 1.

However, the training fund is not necessarily geared to benefit large firms either. The program focuses on reimbursement for formal training with greater restrictions on training offered in firms rather than classrooms. However, the most common forms of training in Mauritius as in other countries are on-the-job and/or in house training (see Figure 1). Training provided by institutions has been declining in importance with firms complaining the skills are too generic to meet their needs. Other types of training such as reimbursement for tuition from overseas institutions, for domestic Master's training, or for bringing in a foreign expert represent a small share of disbursements. And yet it is on-the-job training and in-house training that have

been singled out as particularly effective in evaluations conducted in developed, transition, and Latin American economies (Betcherman et al, 2004).

If the training fund is eliminating a market failure due to liquidity constraints that constrain firm incentives to train, one would expect the program would have broad participation. Instead, Figure 2 shows that taxes levied on firms typically exceeded the training grants disbursed, so much so that the training levy was cut in half in FY2009. Only 9% of the firms provided training in the period we examine and the World Bank (2011) estimates that only 20% of firms have provided formal training that could qualify for reimbursement in the past. This level of training is below the 30% training incidence for Sub-Saharan Africa reported by Johanson (2009).

Training funds have been underutilized in other developing countries as well, causing the funds to be repurposed to other uses (eg Costa Rica, Gabon , Togo, and Zimbabwe). In some places, the funds were used to create a large government training bureaucracy rather than assisting firms (Colombia, Venezuela). In Mauritius, the number of private training institutions is increasing even as their share of training provision is declining and firms are complaining about their services.

Even if the Mauritius training fund is not fully utilized, it may still increase the propensity to train. To assess that, we need to establish a model of expected training in the absence of the government program. We turn to that next.

III. Theory

Becker's (1993) theory of on-the-job training provides a useful framework for our evaluation, allowing us to predict which firms would participate. A firm's incentive to invest in

training depends on the anticipated returns to training compared to the opportunity costs and direct costs of the training. Let T_i be a dummy variable that indicates whether the i^{th} firm invests in training. Training will occur if the expected net return from training R_i is positive. Probability that firm *i* trains is

$$\Pr(T_i = 1) = \Pr(R_i > 0) \qquad (1)$$

R_i will take the form

$$R_i = N_i(\pi - \tau)[(\sum_{t=1}^{M}\left(\frac{1}{1+r}\right)^t)(T_i W_{it}^T + (1 - T_i)W_0^O)] + N_i(\pi - \tau)(1 - T_i)W_0^O$$

$$-N_i T_i W_0^O(1 + \tau) + N_i T_i(S_{i0}^T + \varepsilon_i^T - C_{i0}^T) \qquad (2)$$

where *M* represents the firm's time horizon over which it anticipates employing N_i workers. The firm earns a markup π on the wages it pays. The firm's cost of labor includes a tax rate, τ. The firm must pay taxes into the training fund, whether or not it trains. If the firm trains, it pays the post-training wage, W_{it}^T for all $t>0$. If the firm does not train, it pays workers a constant base wage, W_0^O for all *M* periods. If the firm trains in period *0*, it gets no output in period *0* but pays out the worker's opportunity wage along with the tax levy, $W_0^O(1 + \tau)$. The remaining terms incorporate firm-specific costs and benefits from training, where the direct cost of training is C_{i0}^T, the training subsidy from the government is S_{i0}^T, and the firm also earns an unobservable positive or negative incremental per worker return to training, ε_i^T, that is known to the firm but not the econometrician. The marginal return to training is

$$\frac{\partial R_i}{\partial T_i} = N_i(\pi - \tau)[(\sum_{t=1}^{M}(\frac{1}{1+r})^t)(W_{it}^T - W_0^O)] - N_i(\pi + 1)W_0^O + N_i(S_{i0}^T + \varepsilon_i^T - C_{i0}^T) \gtrless 0 \quad (3)$$

If $\frac{\partial R_i}{\partial T_i} > 0$, the firm should invest in training. If negative, the firm will not train. Factors that make $\frac{\partial R_i}{\partial T_i}$ more positive will raise the probability of training. To begin, we assume that

$W_t^T > W_0^O$ so that training raise worker productivity.[5] It is also requires that $\pi > \tau$ so that the profit from raising a worker's marginal product exceeds the taxes that would be paid on the resulting wage increases. $\frac{\partial R_i}{\partial T_i}$ becomes more positive and so likelihood of training increases with increases in the mark-up over wages π, increases in the training subsidy S_{i0}^T, increases in the productivity of training as proxied by the wage gap $(W_{it}^T - W_0^O)$, and increases in the unobserved profitability from training ε_i^T. The probability of training also increases with smaller tax levy imposed on the induced increase in wages, τ; with smaller interest rates that reduce the present value of future returns to training, *r*; and with smaller training costs C_{i0}^T.

The theory demonstrates the potential problem with training funds that generate revenues through taxes on wages. Training will raise wages and so the training fund policy taxes the return on training even as it lowers training costs. There is no guarantee that the policy will raise aggregate training in the economy. The training fund is most effective when firm's face liquidity constraints as represented by high interest rates *r*. The reason is that $\frac{\partial^2(\frac{\partial R_i}{\partial T_i})}{\partial \tau \partial r} > 0$: the tax does not affect the present value of training as much when the firm is discounting the future more heavily. However, if the constraints on liquidity are modest, the tax levy becomes more costly and the likelihood that the training fund increases probability of training diminsishes.

If the costs of training C_{i0}^T and the subsidy S_{i0}^T are constant and do not vary with firm size, equation (3) implies that there will be no size-bias in the incidence of training. In other words, C_{i0}^T and/or S_{i0}^T must be nonlinear in *N* to generate the size-bias we observe in the training data.

[5] Training cannot lower productivity from the base level, but it is possible that the training adds no value so that $W_t^T = W_0^O$. In that case, the only reason the firm would engage in training is that the subsidy S_{i0}^T is so large that it fully compensates the firm for the lost production while the firm trains.

Either or both of the following specifications could generate the rising incidence of training as firm size increases

$$C_{i0}^{T} = \frac{c_0}{N_i} + C(N_i);\ C'(N_i) \leq 0 \qquad (4A)$$

$$S_{i0}^{T} = S(N_i); S'(N_i) \geq 0 \qquad (4B)$$

Equation (4A) suggests that firms face a fixed cost of participation due to paperwork involved in applying or validating the training and providing the required accounting to the government. Average cost of training falls with the size of the firm because these fixed costs are spread over a larger number of trainees and also because there may be increasing returns to training such that *C'*<0.[6] Even if the marginal cost of training is constant as N_i increases, there will be falling average cost of training as firm size rises. As for $S'(N_i) \geq 0$, the requirement that the firm have a minimum number of trainees to qualify for a subsidy generates a subsidy that increases in *N*.[7]

The theory suggests that there should be rising incidence of training as firms increase in size, as the subsidy increases in value, as training costs decrease, and as wages rise relative to the untrained wage. We test all these propositions in the next section.

IV. Empirical specification

The theory suggests two specifications. The first treats training as a dichotomous variable. Using (3), we infer that T_i=1 if

$$I = (\pi - \tau)[(\sum_{t=1}^{M}(\frac{1}{1+r})^t)(W_{it}^{T} - W_0^{O})] - (\pi + 1)W_0^{O} + S_{i0}^{T} - C_{i0}^{T} > -\varepsilon_i^{T}$$

[6] Black et al (1999) show that there are economies of scale in training that favor large firms.

[7] We can redefine T_i as training intensity such that $0 \leq T_i \leq 1$. That would make sense, for example, if firms invested between 0 and 100% of the workers time in the first period in training. In that case, firms that train will invest optimally by setting $\frac{\partial R_i}{\partial T_i} = 0$ in (3). For an interior solution, firms must face increasing costs of training or decreasing returns to training.

If we approximate the index function $I(\cdot)$ by its reduced form, we have

T_i=1 if $I(\pi, W_{it}^T, W_0^O, \tau, C_{i0}^T, S_{i0}^T, N_i) > -\varepsilon_i^T$

T_i=0 otherwise (5)

If the unobserved return to training $\varepsilon_i^T \sim N(0,1)$, then (5) defines a probit equation. If instead, we have a continuous measure of training intensity, as for example if T_i is measured as the training cost as a fraction of total compensation, then the reduced form will be

$$T_i = f(\pi, W_{it}^T, W_0^O, \tau, C_{i0}^T, S_{i0}^T, N_i, \varepsilon_i^T) \quad (6)$$

which we can approximate using ordinary least squares.

In our application, the training levy tax rate τ is the same for all firms and we assume the markup over the wage π is also fixed in expectation across firms. The base wage W_0^O should also be the same across firms in the same industry. Mauritius is a small island economy, and so it is logical to assume that worker mobility will equalize sectoral base wages throughout the island. Consequently, sectoral variation in W_0^O can be controlled using sector-specific dummy variables. The remaining observable explanatory variables in (5) and (6) that vary across firms include W_{it}^T, C_{i0}^T, S_{i0}^T, and N_i.

IV. Data

Our data source is an administrative data set that includes training levy, firm size and firm sector information for the universe of all registered firms in Mauritius in 2007. The data set also includes accounting data for about 30 % of the firms in 2007. The data are sufficient to allow us to approximate the information we need to evaluate the determinants of training in Mauritius.

Endogenous Variables

We have two measures of T_i available in the data set:

Training Incidence: A dummy variable equal to 1 if the firm trained in 2007. Only 9% of the firms reported training expenditures in 2007.

Training Intensity: The log of total training expenditures per employee in 2007. This measure presumes that when a large firm only trains a single worker, that represents a less intensive training investment than if a small firm trains its lone employee.

Exogenous Variables

The key regressors we require are measures of firm wages, training costs and the anticipated subsidy. The Mauritius administrative data did not include individual wages or the wage bill for the firm. However, it did include a measure of the aggregate training levy paid by the firm. Regardless of whether they train or not, each firm pays the training levy used to subsidize firm training. The levy is proportional to the firm's base wage bill which is total compensation excluding overtime, bonuses and benefits. That means that the training levy $\tau N_i \overline{W_i}$ where τ is the tax rate, N_i is the number of firm employees, and $\overline{W_i}$ is the average wage in the firm in year *t*. In log form, $\ln\left(\frac{\tau N_i \overline{W_i}}{N_i}\right) = \ln(\tau \overline{W_i}) = \ln(\tau) + \ln(\overline{W_i})$. In regressions, the effect of the tax rate will be captured in the constant term. Because sector dummies controls for variation in W_0^O, the coefficient on $\ln(\tau \overline{W_i})$ is interpretable as the elasticity of training with respect to $(W_i^T - W_0^O)$, a proxy of the anticipated return to training.

The Mauritius administrative data provide information on the total cost of training including firm payments and the government subsidy for all firms that participate in the program. We compute an average cost per hour of training by dividing firm payments plus subsidies divided by the total hours of training across all trainees in the firm. To create an expected cost of

training for each firm, we divided the data into 9 industrial sectors. Each sector was further subdivided into the three firm size groups defined in Table 1. The average training cost per hour for participating firms in each of the 27 cells is used as the expected training cost, C_{i0}^{T}. We use the log form of this measure.

We use a similar strategy to estimate the expected subsidy in each of the 27 cells. For each company receiving a subsidy in 2007, we compute the ratio of training grants received by the company to the firm's total expenditures on training. A small fraction of firms had ratios greater than 1. Since firms should only get back a fraction of their training costs, we expect this value to be less than one, and therefore set any values greater than one to one. Expected subsidy is the mean subsidy per across all training firms of this measure by sector and firm size cell. Because these values vary between zero and one we left these as rates rather than converting to logs.[8]

A large literature suggests that there is more need for training in larger firms with more complex production processes and internal labor markets.[9] In addition, returns to scale in training may give larger firms a cost advantage in training provision (Black et al, 1999). Our firm size measure is total employment N_{i0} in log form.

Capital and skill are presumed to be complements in production, and so training is believed to be most important in firms with more complex production processes. Therefore, we include a measure of firm capital K_{io} to control for heterogeneity in training needs across firms.

[8] As many of the values are close to zero, taking the log led to very large negative values for some and values close to zero for others, and so the log tended to exaggerate outliers. In addition, because for numbers close to zero, $ln(1+x) \rightarrow x$, leaving these values in rates did not depart much from the log transformation applied to the other measures.

[9] Doeringer and Piore (1985) showed how firm size led to the creation of internal labor markets, increased firm training, and lower worker mobility. Oi and Idson's (1999) review of the literature shows that worker mobility is inversely related to firm size.. Black et al (1999) show that the incidence of training rises with firm size because large firms have a cost advantage in offering training. Acemoglu and Pischke (1998, 1999) argue that asymmetric information on worker productivity leads to worker immobility that increases firm incentive to train. The asymmetric information they discuss is likely to be more important in large firms.

We only have capital asset measures for 4013 firms and so we use the log of the mean value per firm in each sector and firm size cell as the common measure for all firms in the cell.

V. Results: Training incidence and intensity

We report two specifications of the training equation in Table 2.[10] The results are quite consistent with one another, whether training is measured as a dichotomous variable or as a per worker investment. The results are also consistent with the theoretical predictions implied by equation (3): factors that raise the expected net return on training increase the likelihood that the firm invests. Noting that sector-specific dummy variables are used to fix the value of the base wage W_0^O, a 10% increase in the post-training wage relative to the base wage raises the probability of training by 4.8%. Recall that in the Becker framework, the firm's return to training is proportional to $(W_{it}^T - W_0^O)$, and so higher worker returns in the form of higher wages signal that the firm is making a higher return as well.

The other factors that should raise the returns to training also increase the incentives to train. Firm size and capital intensity both have strong positive effects on firm training probability and intensity. Ten percent increases in firm size and capital stock both raise the probability of offering training by 1%. All of these findings are consistent with a standard model of firm investment in on-the-job training.

Interestingly, expected training costs do not significantly affect the probability of training. That suggests that expected training costs are not an impediment to training, casting doubt on the justification of the training fund.

[10] The goodness of fit is low, but our dependent variable is whether the firm invested in training in one particular 12 month period rather than the more theoretically appropriate measure which would be whether the firm ever engaged in training. We note that 20% of Mauritius firms train, but only 9% of them trained during our one-year window, an indication of considerable noise in the dependent variable. However, with the huge sample size, we were able to derive reasonable coefficients despite the noisy training indicators.

And yet the probability of training is quite sensitive to the expected subsidy in their sector/firm size cell. The large elasticity implies that relatively small subsidies greatly expand interest in training, holding constant factors that should increase returns to training. On the margin, firms that would not have invested in training without the training fund do invest with the promise of training subsidies. Without the subsidy, training would be concentrated in the largest, capital intensive firms with the most rapidly rising wage profiles.

None of the industry dummy variables are statistically significant individually or jointly. Outside the incentive offered by the subsidy, there is no evidence that the government favors one sector over another. Because training was supposed to target information technologies, these results suggest that the apparent bias toward information technology firms we observed in Table 1 exists because those firms have a greater need to train even without the training fund and not because the training fund is atypically raising training incentives for information technology firms.

The question remains as to whether the training fund increases the incidence of training through the subsidy or lowers the incidence of training because of the tax. The consistent pattern of tax levy receipts exceeding disbursements seen in Figure 2 suggests that the nete effect may be to reduce training. We add additional evidence to that effect next.

VI. Results: Cross-subsidization in the Mauritius training fund

While the evidence from Table 2 suggests that firms would respond elastically to the issuance of training subsidies if the program were made more easily available, we have not documented whether the training fund reallocates from some firms and toward others. Table 3 divides the firms into the 27 firm size by industry cells. For each cell, we compute the total

training levy paid by firms in the cell, the total subsidies received by firms in the cell, and the ratio of the benefits received to the taxes paid. Ratios above one indicate that the cell group received more in benefits than it paid in taxes while ratios less than one indicate the cell paid more in taxes than it received in training subsidies.[11] We also report the fraction of firms in each cell that engaged in training.

The results show a surprising result: the pattern of cross subsidization is from large to small firms. While small firms are not likely to train in the absence of the training fund, small firms receive more in training subsidies than they pay in taxes. The cross subsidization from large to small firms occurs in every sector. The largest ratios are not the targeted information sectors, but rather agriculture, wholesale and retail trade and transportation.

Moving up the size distribution, intermediate sized firms are more likely than small firms to invest in training, but only in information technology is the ratio of subsidy to training levy larger than it was for the smallest firm. Finance, hotels and information technology are the three sectors that received more in subsidy than they paid in taxes.

Curiously, it is the largest firms that should have the greatest incentive to train without the subsidy, but they are atypically taxed to subsidize the firms with the least natural inclination to train. In every sector but Finance, the ratio of benefits to taxes paid is lower for the largest firms than for the intermediate or small firms. Yet it is these largest firms that have the highest propensity to train in every sector.

Combining the inference derived from Tables 2 and 3, it seems clear that the Mauritius training fund alters firm incentives to train but it does so by taxing the firms with the comparative advantage in training in order to subsidize the firms with the least to gain from training. Coupled with the finding in Figure 2 that the training fund takes in more in taxes than it

[11] We also computed cell values in per worker and per firm terms. The ratios were virtually identical.

pays out in subsidies, it seems that the net effect may well be to lower the returns to training for large firms through the tax more than it lowers the marginal cost of training as would be the case if the presumed liquidity constraints on large firms were not severe. It does raise the incidence of training in the smallest firms that may indeed face liquidity constraints on training. Whether this is a general pattern of training funds in developing countries that tax firm returns to training in order to generate funds used for training subsidies is unclear, but the Mauritian policy is not dissimilar to the most commonly used training funds in Africa and Latin America. Our results suggest that the policy may be counter-productive.

VII. Results: Training effects on firm output and growth

We have only limited ability to examine whether training actually raise labor productivity, and so we offer these estimates as suggestive. Training intensive firms should have higher current productivity and should have greater potential for future growth. We embed the firm's training investment in a standard Cobb Douglas production function.

$$lnQ_{it} = \alpha_0 + \alpha_K lnK_{it} + \alpha_N lnN_{it} + \alpha_T lnT_i + X'_{it}\beta + \varepsilon_{it} \qquad (7)$$

Our measure of output is total revenue reported in 2007. For this application, we need to use the actual capital measure and so we can only estimate the production function for about one-third of the firms. For this application, we use the continuous measure of training, $\ln T_i$, as defined by the right-hand columns in Table 2. Note that we need to use predicted values of training to generate an expected level of training given the firm's observable attributes. The reason is that any one year's training level measures the long-run level of training investment with considerable error due to random labor turnover that changes the fraction of employees requiring training from one

year to the next. The predicted training level will reflect the long term relationships between firm attributes, taxes subsidies, and propensities to train.

Training may not just change current output but it may change the pace of firm growth. If true, then the training effect may be better captured by equations of the form

$$ln\frac{Q_{it+1}}{Q_{it}} = \gamma_0 + \gamma_K lnK_{it} + \gamma_N lnN_{it} + \gamma_T lnT_i + X'_{it}\theta + \epsilon_{it} \qquad (8)$$

Equation (8) is estimated using two alternative outcome measures:

Log Wage Bill Growth: The difference in logarithms of the total levy paid between 2007 and 2008 will be proportional to the growth in the wage bill. We use 2007 measures of capital, labor and training as regressors.

Log Employment Growth: The difference in logarithms of the number of employees between 2007 and 2008.

We report these regressions in Table 4. The production function estimates suggest that a 10 percent increase in training intensity increases current output by 4.2 percent. However, training does not appear to affect growth in the wage bill or employment, suggesting that training does not alter the growth prospects of firms. More definitive conclusions would require a longer longitudinal record on training and nontraining firms to see if our cross-sectional production function estimates hold up over longer horizons. However, these results suggest that the benefits of the training are largely confined to the firm providing the training and that the program does not generate positive externalities that spread to other firms not receiving training subsidies that might raise the growth rate of the economy as a whole.

VIII. Conclusions and recommendations

The Mauritius training program is aimed at encouraging firm training by imposing a levy on all firms and then reimbursing them a percentage of the expenses paid for some types of training. The levy is based on the firm's wage bill, meaning that the largest taxes are paid by firms with the most employees and/or that pay the highest wages, the firms that have the highest return to training in the absence of the program. The tax lowers incentive to train, even as the subsidy raises the incentive to train. Our results show that the factors that should increase the incentives to train in the absence of the training fund behave as expected and that training costs do not serve as an impediment to training. While the subsidies do raise the likelihood of training for firms that would not have trained otherwise, the greatest effect is on the smallest firms. As a result, the program disproportionately taxes the largest and most capital intensive firms that would be most likely to train without the program, and disproportionately benefits the smallest firms that would have the least incentives to train.

One problem is that the training subsidies target general skills such as those provided by domestic of foreign training firms and graduate programs and not training provided on-the-job or in-house. Evaluations in both developed and developing countries have found greater benefits from on-the-job training rather than the classroom training favored by the Mauritius training fund.

If the performance of the training fund is to be improved, it should target the type of training that is most useful in its absence – training specific to the firm. If more general skills are to be offered, it may be useful to follow the sectoral training model used in Europe in which the firms within a specific sector pool resources to invest in skills uniquely required by firms in the sector with the government serving in a coordinating role.

However, another option is to eliminate the training fund program altogether. As shown in the theory, the training fund is most effective when there are liquidity constraints on firms. There is no evidence that the largest and most capital intensive firms in Mauritius suffer from liquidity constraints, and as a result, theory predicts that the negative incentive effects of the tax outweigh the positive effects of the subsidy. As a result, the training fund may well lower the overall incidence of training, consistent with the result in Figure 2 that the program takes in more in taxes than in pays out in subsidies. It is virtually certain that there are alternate uses of these public funds that would produce a better return.

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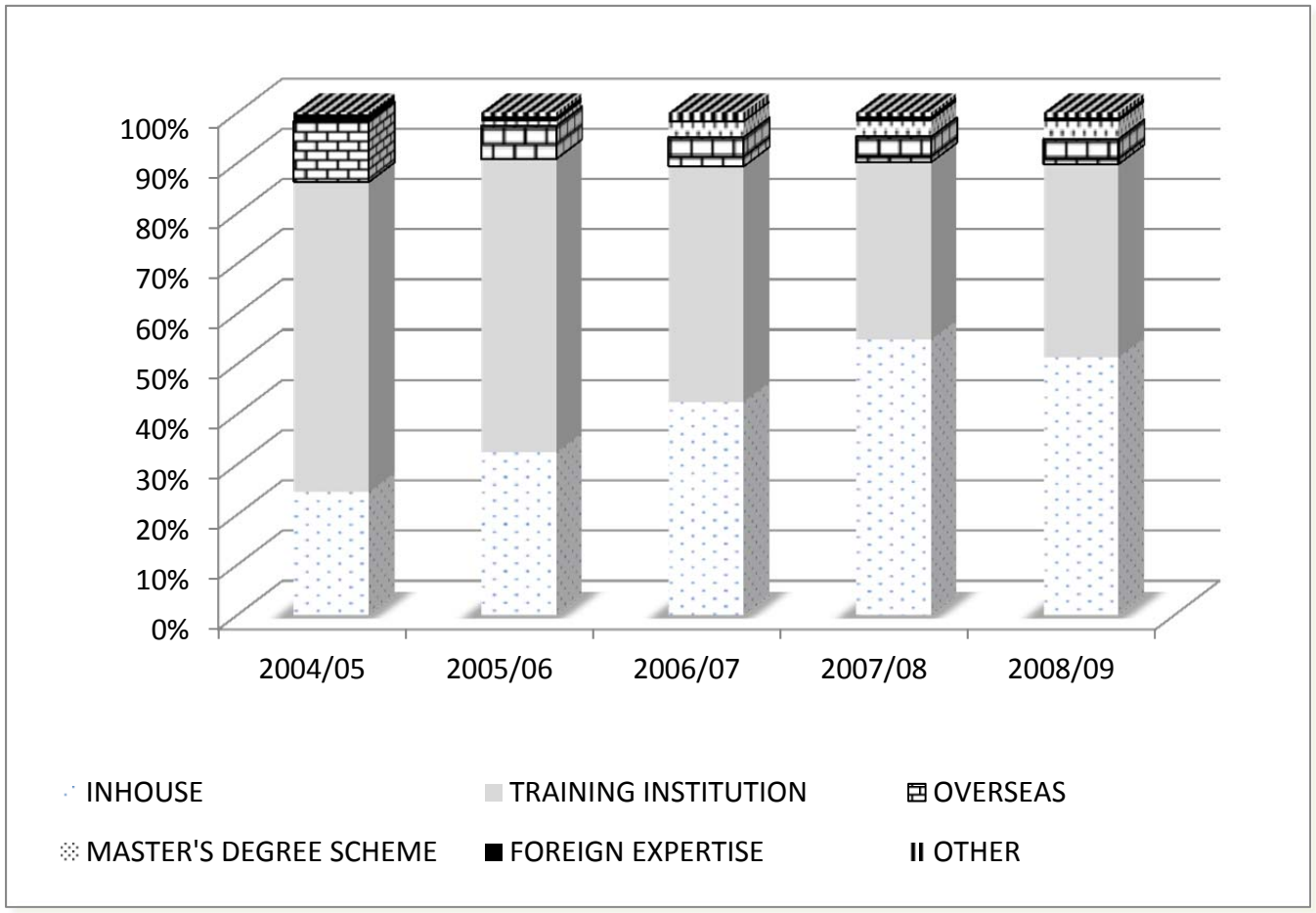
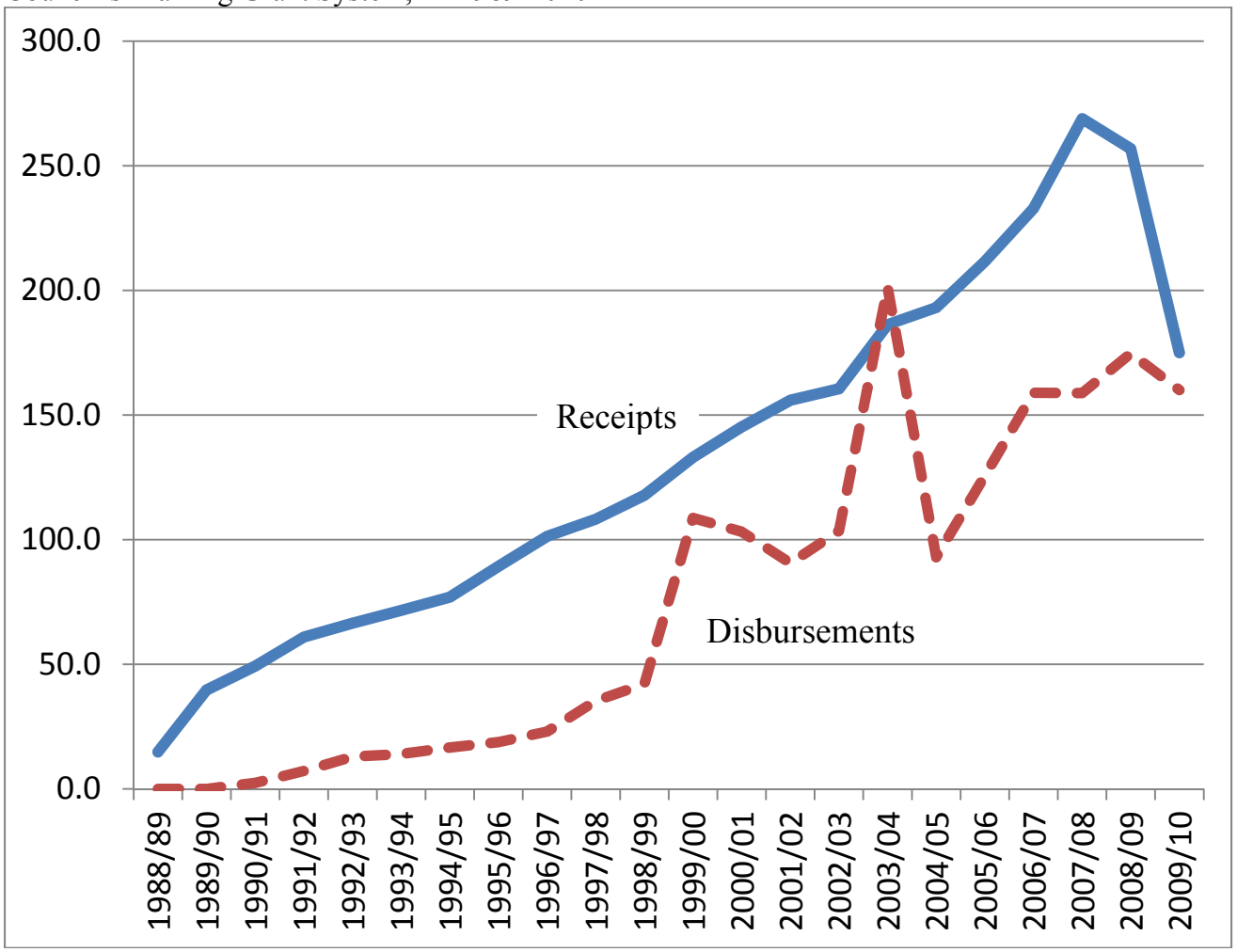
Figure 1: Distribution of training by type and location of trainer, Mauritius Training Fund, FY2005-2009



Source: Authors' compilation of data provided by the Mauritius Human Resource Development Council.

Figure 2: Tax Levy Receipts and Disbursements (in million Mauritian rupees) of the Mauritius Human Resource Development Council's Training Grant System, FY1989-2010



Source: Authors' compilation of data provided by the Mauritius Human Resource Development Council.

Table 1: Averages of firm propensity to train by sector and firm size, Mauritius, 2007/2008.

Sector	Small 1-9 workers	Medium 10-50 workers	Large >50 workers	Overall means
Total	6.4%	14.3%	29.0%	9.1%
Sector				
Agriculture	5.8%	10.4%	33.3%	8.2%
Manufacturing and Textiles	6.2%	10.9%	28.0%	10.3%
Wholesale and retail	6.2%	11.0%	40.7%	8.0%
Community, social and other services	6.7%	17.3%	29.5%	9.2%
Construction	5.4%	9.1%	27.5%	7.2%
Finance	10.2%	25.7%	29.3%	14.9%
Hotels	5.6%	15.4%	25.6%	9.2%
Information technology	7.4%	23.9%	46.7%	13.6%
Transport	6.5%	17.1%	22.9%	8.4%
Sample size	13403			

Source: Authors' computation based on the Mauritius training and firm characteristics data set, 2007.
Note: These are firms that either trained only in 2007 or in 2007 and 2008. Firms that trained only in 2008 were excluded from this analysis.

Table 2: Regressions explaining training intensity and training probability

	Training Incidence			Training Intensity		
	Marginal effect	**Standard error**	**Elasticity**	**Maginal effect**	**Standard error**	**Elasticity**
Log average wage $\ln(W_i^T)$	0.055***	0.02	0.61	0.483**	0.20	0.48
Expected subsidy (S_{i0}^T)	0.258*	0.15	2.84	2.919*	1.52	1.53
Log expected training cost $\ln(C_{i0}^T)$	-0.001	0.005	-0.01	-0.024	0.05	-0.02
Log number of employees $\ln(N_i)$	0.022***	0.003	0.24	0.123***	0.03	0.12
Log Capital	0.008**	0.004	0.09	0.092***	0.04	0.09
Sector						
Agriculture	-0.003	0.02		-0.115	0.18	
Manufacturing and textiles	0.003	0.01		0.008	0.08	
Wholesale and retail	-0.004	0.01		-0.042	0.07	
Community, social and other services	0.001	0.01		-0.045	0.09	
Construction	-0.014	0.01		-0.131	0.10	
Finance	-0.025	0.02		-0.227	0.21	
Hotels	-0.010	0.01		-0.146	0.11	
Information technology	0.006	0.02		0.166	0.19	
Constant				-5.434***	1.51	
R^2	0.02			0.06		
Sample size	13403			13392		

Source: Authors' computation based on the Mauritius training and firm characteristics data set, 2007/2008

Notes: * significant at 10 percent **significant at 5 percent ***significant at 1 percent

Table 3: Total training levies paid and subsidies received in 2007, by firm size and sector cells, in million Mauritian rupees.

	Small 1-9 workers				Medium 10-50 workers				Large >50 workers			
	(1) Levy	**(2) Subsidy**	**(2)/(1) Ratio**	**Ratio that Trained***	**(1) Levy**	**(2) Subsidy**	**(2)/(1) ratio**	**Ratio that trained***	**(1) Levy**	**(2) Subsidy**	**(2)/(1) ratio**	**Ratio that Trained***
Agriculture	0.94	4.71	5.01	0.07	2.31	1.51	0.65	0.12	14.3	1.99	0.14	0.40
Manufacturing and textiles	2.66	4.83	1.82	0.08	8.28	7.88	0.95	0.14	40.3	14.10	0.35	0.41
Wholesale and retail	3.24	10.30	3.18	0.09	4.06	2.97	0.73	0.14	11.4	3.10	0.27	0.51
Community, social and other services	3.4	9.02	2.65	0.08	5.62	3.72	0.66	0.21	11.9	3.60	0.30	0.35
Construction	1.86	2.59	1.39	0.07	4.07	2.49	0.61	0.12	11.6	2.39	0.21	0.37
Finance	3.3	6.93	2.10	0.13	6.07	6.17	1.02	0.32	22.2	70.10	3.16	0.43
Hotels	1.69	4.07	2.41	0.08	3.35	4.47	1.33	0.20	32.1	8.65	0.27	0.41
Information technology	0.98	1.67	1.71	0.12	1.92	10.70	5.57	0.31	3.39	0.62	0.18	0.60
Transport	6.86	24.60	3.59	0.08	10	16.00	1.60	0.20	24.3	5.88	0.24	0.34

Source: Authors' computation based on the Mauritius training and firm characteristics data set, 2007.
*****Ratio that trained : number of firms that trained as a fraction of total number of firms in each sector.

Table 4: Regressions explaining various measures of firm output and growth using predicted intensity of training

Variables	Log output		Log wage bill growth		Log employment growth	
	Coeff	SE	Coeff	SE	Coeff	SE
Log capital	0.076***	0.007	0.020	0.015	0.039***	0.009
Predicted intensity of training	0.417*	0.241	0.061	0.105	0.027	0.064
Log number of employees	0.716***	0.060	0.042**	0.018	-0.076***	0.011
Sector						
Agriculture	-0.554***	0.164	-0.137***	0.052	-0.095***	0.032
Manufacturing and textiles	-0.656***	0.076	0.018	0.025	0.058***	0.015
Wholesale and retail	-0.287***	0.063	0.037*	0.022	0.006	0.014
Community, social and other services	-0.751***	0.081	0.022	0.025	-0.036**	0.015
Construction	-0.364***	0.100	0.106***	0.037	0.073***	0.023
Finance	-0.926***	0.140	0.096**	0.041	0.009	0.025
Hotels	-0.976***	0.076	0.029	0.037	-0.009	0.022
Information technology	-0.623***	0.139	0.162**	0.069	0.132***	0.043
Constant	13.308***	0.120	0.182	0.181	-0.503***	0.111
R^2	0.47		0.01		0.03	
Sample size	4013		10563		10562	

Source: Authors' computation based on the Mauritius training and firm characteristics data set, 2007.
Notes: * significant at 10 percent **significant at 5 percent ***significant at 1 percent

Appendix 1: Summary Statistics

Variable	Mean	
	2007	2008
Firm characteristics		
Percentage trained	11.93	6.64
Number of Employees	20.97	20.64
Grants received (conditional on training) (thousand rupees)	154.72	99.89
Grants received (unconditional) (thousand rupees)	18.46	6.63
Levies paid (thousand rupees)	18.06	18.23
Accounting Data (million rupees)		
Sales in 2007	45.90	33.00
Cost of Capital	19.30	18.80
Fraction of firms in		
Agriculture	0.08	0.07
Manufacturing and textiles	0.14	0.14
Wholesale and retail	0.13	0.29
Community, social and other services	0.14	0.14
Construction	0.08	0.08
Finance	0.05	0.06
Hotels	0.07	0.07
Information technology	0.02	0.02
Transport	0.28	0.11

Source: Authors' computation based on the Mauritius training and firm characteristics data set, 2007.