Solvay Business School

# Centre Emile Bernheim

## Research Institute in Management Sciences

Working paper n°06/020

# On the Efficiency Effects of Subsidies in Microfinance: An Empirical Inquiry

**M. Hudon and D. Traça**

February 2008


*Université Libre de Bruxelles – Solvay Business School – Centre Emile Bernheim*
*ULB CP 145/01 50, avenue F.D. Roosevelt 1050 Brussels – BELGIUM*
*e-mail : ceb@admin.ulb.ac.be Tel. : +32 (0)2/650.48.64 Fax : +32 (0)2/650.41.88*

12th February 2008

# On the Efficiency Effects of Subsidies in Microfinance: An Empirical Inquiry


**ABSTRACT**

The impact of subsidies on the efficiency of microfinance institutions (MFIs) is a key question in the field, given the large volume of subsidies received over the last twenty years. Using an original database of rating agencies, this paper gives empirical evidence on the impact of subsidy intensity on the efficiency of MFIs. After correcting for endogeneity bias, our results suggest that subsidies have contributed to raise efficiency, for the majority of MFIs in our sample. However, the evidence suggests also that there is a level beyond which increased subsidization taxes efficiency, at the margin. In our sample, 50% of MFIs receive levels of subsidization higher than that threshold.



JEL G30, G32, J23

# 1 Introduction

Over the last twenty years, the Microfinance sector has attracted a remarkable US$ 1b. per year, in subsidies from private and public donors (CGAP, 2005). Yet, despite the notoriety of some success stories, less than 5 per cent of MFIs are operationally sustainable, while the remaining 95% still require subsidies to cover their costs and finance their loans (UNCDF, 2005). Moreover, dozens of institutions that claim to makeprofits seem to still rely on subsidies in order to cover their seemingly high transaction costs (Armendariz and Morduch, 2005). Such extensive subsidization has created a debate on the implications for the efficiency of MFIs. This paper addresses this question from an empirical standpoint. It delivers evidence on the impact of subsidies on the cost-performance of MFIs, based on data collected by two microfinance ratings agencies.

The effect of subsidies on efficiency is a topic of intense debate in academic and policy circles. Many authors are concerned that excessive subsidization will inhibit the promise of sustainability in the provision of financial services to the poor.[1] The main concern is that subsidies undercut both scale and efficiency, and distort the market by favouring more inefficient institutions. On the other hand, Armendariz and Morduch (2005) have stressed a potentially efficiency-enhancing role of "smart subsidies", for allowing MFIs to build their infrastructure and develop the know-how, which allow them to function efficiently and ensure appropriate financial services' delivery.[2]

[1] See, for example, CGAP (2004), Morduch (2005) and (UNCDF, 2005)

[2] Other effects of subsidies in the sector are often mentioned. Many commentators stress the role of subsidies in supporting the low interest rates that make loans affordable to the poorer of the poor. For instance, Zeller and Meyer (2002) argue that "reaching large numbers of the poorest may therefore justify the provision of subsidies to MFIs specialized in serving them". On the other hand, CGAP (2006) argues that excessive subsidisation hurts the sector by creating hurdles for the emergence of private actors, such as the

In an effort to integrate both views, Lapenu (2000) questioned the level of subsidization of microfinance institutions that should be accepted, stressing the empirical nature of the problem. Surprisingly, evidence on the impact of subsidies on the performance of MFIs is scarce in the literature, with the exceptions of Cull et al. (2006) and Hudon (2006). This paper contributes to fill the gap between theory and practice

Our work is particularly relevant for donors and policy makers for it provides some guidelines on how far subsidies can take the microfinance industry to develop and achieved improved levels of efficiency over time. The data we use includes information on "donated equity" which covers equity received through cash donations from sources that do not receive stock and that carries no restrictions (CGAP, 2003). We take this as a measure of historical subsidies received by the institution, and compute a measure of the subsidy intensity of each MFI, by taking the ratio of "donated" to total equity.

Using a cross-section regression, we estimate the efficiency-tax from subsidies. The efficiency-tax measures the proportional decline in the efficiency of an MFI with a given level of subsidy intensity, relative to the benchmark of no subsidies. The efficiency tax can be positive or negative depending on whether subsidization reduces or enhances cost-effectiveness.

We address potential nonlinearities by allowing for a marginal efficiency-tax that varies with the subsidy intensity. The marginal efficiency-tax is the proportional decline in efficiency due to a marginal rise in subsidy intensity. Since the notion of "smart subsidies" seems to suggest that the efficiency-enhancing effects of subsidies peter out, beyond a certain threshold, our working hypothesis is that the marginal efficiency tax is increasing in the level

commercial banks.

of subsidization and, thus, is more likely to become positive at higher levels of subsidy intensity. This implies that the efficiency tax is larger, and more likely to be positive at higher levels of subsidization.

An important challenge is the well-known endogeneity of the MFI's subsidy intensity. In particular, an MFI with higher unit costs and weaker sustainability may attract higher subsidies from its donors, who are eager to see the MFI survive. We address this problem through an IV estimator that uses the residuals of a first-stage regression of the subsidy intensity on operational sustainability. These residuals are orthogonal to the operational sustainability, and thus exogenous to the effort of donors to support institutions with lower efficiency.

Looking at our results, they confirm the notion that OLS estimates of the efficiency tax are inflated relative to the IV results. Focusing on the IV results, we obtain that, in general, subsidies have contributed to increase the efficiency of MFIs, with the mean efficiency tax in our sample estimated at $-14\%$ and $-19\%$ depending on the cost measure. We obtain also that the marginal efficiency tax is increasing in the subsidy intensity, and becomes positive for higher levels of subsidization. This means that reductions in the levels of subsidization should increase efficiency, for approximately half of the MFIs in our sample.

Efficiency can be decomposed into the wage-rent and productivity components. We conclude by estimating the efficiency tax in each of these components separately. We show that subsidies tend to increase MFI productivity, at the margin, at low levels of subsidy intensity, but also make them pay higher prices for their labor. We interpret this result as evidence that subsidies allow MFIs to higher better staff (or to develop their own staff),

paying them higher wages, with a net increase in efficiency, as described above. However, beyond a certain threshold, subsidies increase wage-rents and lower productivity, at the margin, in clear evidence of the moral hazard concerns raised in the literature.

The structure of the paper is as follows. In the following section, we present the dataset obtained from the microfinance rating agencies, focusing on the measures of subsidy intensity. Next, we discuss the theoretical linkages between subsidy intensity and the efficiency of MFIs. Section 4 introduces the econometric framework. Section 5 and 6 provide econometric results.

## 2 The Microfinance Ratings Data

Our data was obtained from the financial statements gathered by two leading microfinance rating agencies: PlaNet Rating and Microfinanza. The ratings were produced between 2002 and 2005, and provide balance-sheet and income statement information for 100 institutions, including data on subsidies obtained historically. For most MFIs, the dataset includes observations for three different years. The rating reports include the balance-sheet and income statement data, in addition to the number of borrowers and staff and indicators of operational and financial sustainability.[3]

These MFIs include some of the largest and better managed around the world. Given the well-established concentration of microfinance clients in the largest institutions (Honohan, 2004), our sample is quite representative of the universe of microfinance activity.[4] For instance, MFIs included in the 15th MicroBanking Bulletin, the largest database in mi-

[3] Operational sustainability measures how well an MFI covers its costs through operating revenues. It is thus the ratio of operating expense on financial expenses, loan-loss provision and operating expenses (CGAP, 2003).

[4] Honohan (2004) finds that "the largest 30 microfinance firms account for more than 90 per cent of the clients served worldwide by the 234 top firms (and hence for more than three-quarters of those served by all of the 2572 firms reporting to the Microcredit Summit)."

crofinance with more than 700 MFIs, have an average OSS of 115% (MicroBanking Bulletin, 2007) while our MFIs reach a similar 118%. The average number of borrowers is 10,102 in the MicroBanking Bulletin, while it is 14,081 in our sample.

The rating reports make an impressive effort for capturing the subsidies obtained from each of the MFI throughout for a sufficiently long period of time. The balance-sheet includes an entry for "donated equity", which includes equity received through cash donations from sources that do not receive stock. It represents accumulated donations that carry no restrictions (CGAP, 2003). On the other hand, all donations for operating and non-operating expenses are included in retained earnings, net of the operational deficit of the MFI, and thus are not included in "donated equity". In this sense, "donated equity" underestimates the magnitude of subsidies received by the institutions.

We obtain the subsidy intensity of each MFI ($SUB$) as the ratio of "donated equity" by total equity. For each MFI, we then average the average over the three years for which we have data. Out of the 100 MFI's in the sample, 16 have zero donated equity, i.e. are subsidy free. The distribution of Subsidy Intensity is shown in Fig 1. The mean subsidy intensity is 0.73 and the median is 0.65.

# 3 Subsidy Intensity and the Efficiency of MFIs

The effect of subsidies on the efficiency of MFIs is an important element of the policy debate in microfinance. The theoretical arguments raised in the literature go in both directions. In this section, we discuss the literature and derive testable propositions for the empirical effect of subsidies on the efficiency of MFIs.

On the efficiency taxing effects of subsidies, the literature advances two lines of argument.

First, there are the effects of soft-budget constraints, where donor-financed bailouts of poorly preforming MFIs reduce the incentives for cost-cutting (Dewatripont and Maskin, 1995; Kornai et al., 2003). The need to ensure the public-good effects associated with the commitment to fight poverty in a given region create the conditions for the time-inconsistency of donors attempts to discipline MFIs.

Second, there is the traditional moral hazard argument where managers and workers of MFIs take advantage of the lack of costly monitoring by donors to shirk, gather perks or extract wage-rents. The monitoring problems that are the backbone of these theories are clearly pervasive in the sector. Donors are often geographically far away from the MFI's operations, and lack the information or the knowledge about the inner workings of the sector. Moreover, the lack of reliable information, the inadequate bookkeeping, and insufficient disclosure of the sector makes it difficult to monitor the use of donated funds or measure their effectiveness. For example, in 2004, after a peer-review headed by CGAP and DFID, the European Commission chose to stop funding most credit lines to MFIs, due to the lack of internal expertise and the poor management of its schemes (Domes, 2005).

On the other hand, there are several reasons to expect that subsidies may contribute to increase the efficiency of MFIs. In particular, subsidies allow institutions the breathing space to invest in the development of its infrastructure and human resources necessary to increase efficiency and quality of service in the long-run. Such relaxation of the liquidity constraint is particularly important in a sector with limited to access to banks and capital markets, due to tradition, ownership structures and mission statements[5] .

[5] On the distinction between "mission-oriented" nonprofit organizations and "profit-oriented", see Besley and Ghatak (2005) or Labie (2001)

Along these lines, Armendariz and Morduch (2005) argue for targeting subsidies in financing start-up expenses and institutional capacity building.[6] Morduch (2007) suggests that financing of costs occurred when the institution expands in new areas where it starts almost from scratch might be appropriate. Overall, the notion of "smart" subsidies seems to make the case for a limited level of subsidization, suggesting that the efficiency-enhancing effects of subsidies are likely to peter out, when the levels of subsidy intensity go beyond a certain threshold. Balkenhol (2007) argues that the extent of disincentives depends on the intensity, entry point, dosage, timing and phasing-out.

Another interesting argument is raised by Rowat and Seabright (2006). They provide a model where aid agencies pay below market wages, as a commitment device to reassure donors against the misuse of their funds. From this perspective, we might expect that organizations that are more subsidized have to pay lower wages to attract donors funds. In this case, although productivity is not affected the actual staff cost of the MFI with higher subsidy is lower, which implies an increase in the wage-adjusted productivity, i.e. the unit cost, that measures efficiency.

# 4 Econometric framework

## 4.1 Measuring efficiency

The main costs of the loan granting activity of MFIs include the financial costs of accessing loanable funds, the fixed costs of supporting the MFI and the administrative costs of maintaining a relationship with borrowers for the provision of loans. [7] Given the loan

[6] Armendariz de Aghion and Morduch (2004) also emphasize the *form* of subsidies, arguing that "smart" subsidies should be transparent, rule-bound and time-limited.

[7] To avoid tainting the sample by an MFI's activities outside lending, we focus on MFIs that provide no savings services. Our resulst are robust to the inclusion of these institutions.

methodologies in microfinance, the costs of the relationship with borrowers are paramount, including the gathering of information, the monitoring of borrowers or the collection of late payments.

For simplicity, we will assume that all the administrative expenses comprise of relationship costs with borrowers.[8] In theory, these costs will depend on the actual number of borrowers, the numbers of loans provided to each, and the value of each loan. However, experience from microfinance organizations suggests that once a relationship with a client is established, the marginal costs of providing additional or larger loans amount only to the financial cost of the funds lent, while the marginal administrative cost is small. As argued by Christen (2000), the cost per borrower is an efficiency indicator that neutralizes the effect of loan size. The alternative of using the cost per dollar of loan, institutions serving the low-end market are likely to be, on average, more efficient than broad and high-end programs.

Let the total real administrative costs of MFI $i$ be given by $c_i B_i$, where $B_i$ is the number of borrowers of the MFI and $c_i$ denotes the real administrative cost per borrower, defined as

$$c_i = \frac{w_i / A_i}{\tilde{w}} \tag{1}$$

where $w_i$ is the mean price charged to the MFI $i$ for a composite factor (including staff and other administrative inputs), in local currency[9] , $\tilde{w}$ is the economy wide price of the same composite factor, also in local currency, and $A_i$ is the productivity of the composite factor, in terms of number of borrowers served. This formulation allows the MFI to pay above or below market prices for its factors, namely for its employees. If the MFI pays the on-going

[8] Note that we are ignoring the costs associated with savings activity. In the empirical section, we will eliminate from the sample all MFIs with savings activities.

[9] In our dataset, all variables are denominated in local currency. Scaling by local currency measure of factor prices provides measures of real administrative costs that are comparable across countries.

market wages, then $w_i = \tilde{w}$ and the real administrative cost is given by the inverse of the productivity of the composite factor.

We assume that $c_i$ is a random variable determined by:

$$\ln c_i = \beta_0 + \beta_1 s_i + \beta_2 s_i^2 + \beta_z \ln z_i^y + \beta_y \ln y_i^* + \beta_g g_i + \beta_d d + \varepsilon_i \tag{2}$$

where $s$ is the subsidy intensity, $z_i^y \equiv z/\tilde{y}$ is the average loan size ($z$) (scaled) by the GDP per capita ($\tilde{y}$), $g$ is the size of the MFI, $\tilde{y}_i^*$ is the GDP per capita, PPP in 2000 international \$, $d$ is a set of dummy variables controlling for the region and governance model (for-profit, non-profit and cooperative).

### 4.2 The efficiency tax

The term $\beta_1 s_i + \beta_2 s_i^2$ is the efficiency tax from subsidies, which is the main focus of our analysis. Following Balkenhol (2007), we assume that the extent of disincentives from subsidies depends on their intensity. Note that, given the logarithmic specification for $c_i$, the efficiency tax measures approximately the proportional increase or decrease in the real administrative cost of an MFI, relative to the benchmark of no subsidies. In this sense, we estimate an ad-valorem rate of the efficiency-tax. The efficiency reducing effects of subsidies due to moral hazard or soft-budget constraints raise the efficiency tax. On the other hand, the efficiency enhancing effect of "smart subsidies" lowers the efficiency tax. Ultimately, the subsidy tax captures the net effect of these two forces, and, therefore, can be positive or negative.

We also compute the marginal efficiency tax, - $\beta_1 + 2\beta_2 s_i$ - covering the impact of a marginal increase in subsidy intensity on the efficiency tax. Since the notion of "smart subsidies" seems to suggest that the efficiency-enhancing effects of subsidies peter out when the levels of subsidy intensity become exaggerated, our working hypothesis is that the marginal

efficiency tax is increasing in $s$ (i.e. $\beta_2 > 0$).

An increasing marginal efficiency-tax implies that, at the margin, the efficiency-enhancing effects of subsidies are likely to be stronger at lower levels of subsidy intensity, whereas the efficiency-taxing effects are likely to strengthen as the level of subsidization increases. Note than an increasing marginal efficiency tax has two important implications. First, it allows for an optimal, finite level of subsidization, when and if the marginal efficiency is zero. Second, it means that the absolute (and average) efficiency tax is large, and more likely to be positive at higher levels of subsidization.

### 4.3 Additional controls

Eq. (2) is clearly not exhaustive in outlining the drivers of the real administrative cost per borrower. Our parsimonious specification is driven by the availability of data and by our main focus on estimating the efficiency-tax from subsidies. Nevertheless, we include a few additional controls, which are important because, due to the potential correlation with the extent of subsidization, their omission would bias the estimates of the efficiency tax.

In particular, we first include a control for size, $g$, that captures economies of scale, namely due to the spreading of the fixed administrative costs related to the upkeep of the institution; e.g. IT and accounting infrastructure. Our measure of size is computed using the methodology developed by the MicroBanking Bulletin.[10]

Second, we include a control for benchmark productivity of the labor force. In the absence of staff profiles or worker characteristics, at level of the MFIs, we use GDPpc,PPP ($\tilde{y}_i^*$), implicitly assuming that benchmark productivity in an institution is correlated with

[10] The scale is measured by the size of the institution's loan portfolio. The measure of scale is regionalized to reflect differences in income levels across regions (Microbanking Bulletin, 2002). See Appendix 1.

average productivity in the country. It is important to include this control, due to potential negative correlation between GDPpc,PPP and the subsidy intensity, to the extent that donors target countries or regions with lower standards of living and higher poverty rates. If we were to omit this control for GDPpc,PPP, we would introduce a bias in the estimate of the coefficients on subsidies to zero.

Last but not least, and as it is well-established in the microfinance literature (Balkenhol, 2007), the average loan size ($z$) is an indicator of the poverty incidence of the MFI, since it is associated with the income level of its clients. It reflects the debt absorption capacity of clients and the MFIs poverty focus. The inclusion of a control for $z_i^y$ in (2) captures the notion that MFIs serving borrowers with higher income levels must provide a better quality of service thus incurring in a higher cost per borrower, which implies that $\beta_z > 0$. Given the commitment of donors to the social mission of microfinance of providing loans to the poor, the subsidy intensity ($s$) and the loan size ($z^y$) is likely to be negatively correlated. For this reason, the omission of $\ln z^y$ in is likely to bias downward the estimate of the subsidy tax.

### 4.4 An estimable specification

Now, for the sake of the estimation of (2), it is useful to assume that $\tilde{w}$ is proportional to nominal GDPpc ($\tilde{y}$), $\tilde{w}_i = \tilde{\omega}_i \tilde{y}_i$ ($\omega > 0$). Then, we obtain a proxy for the real administrative cost per borrower given by $c_i^y = (w_i/A_i)/\tilde{y}_i = \tilde{\omega}_i c_i$. Assuming $\ln \tilde{\omega}_i = \ln \tilde{\omega} + \epsilon_i$, $c_i^y$ can taken as the dependent variable in estimating (2) from the ratings data; with the term $\ln \tilde{\omega}$ included in the estimate of the constant, as follows[11] :

$$\ln c_i^y = [\beta_0 - \ln \tilde{\omega}] + \beta_1 s_i + \beta_2 s_i^2 + (\beta_z - 1) \ln z_i^y + \beta_g g_i + [\varepsilon_i + \epsilon_i] \tag{3}$$

[11] In addition to producing a currency-free measure of efficiency, scaling by GDP per capita helps account for country-specific elements that affect the efficiency of MFIs, including wage inflation.

Note that, since the output (and revenues) of an MFI is measured by the amount of loans provided, the appropriate measure of an MFIs the unit administrative cost should be expressed in terms of the dollar volume of loans. This can be easily obtained as: $\ln(c_i B_i / L_i) = \ln c_i^y - \ln z_i^y$, which we can obtain from (3) as

$$\ln(c_i B_i / L_i) = [\beta_0 - \ln \tilde{\omega}] + \beta_1 s_i + \beta_2 s_i^2 + (\beta_z - 1) \ln z_i^y + \beta_g g_i + [\varepsilon_i + \epsilon_i] \tag{4}$$

The expression in (4) highlights one the most important difficulties for sustainability in microfinance: that the small loan size of the average customer, due to their low income levels, raises the unit transaction costs, and undermines financial performance. More important, the expression shows also that the efficiency tax of subsidies estimated in (2), $\beta_1 s_i + \beta_2 s_i^2$, is an appropriate estimate of the efficiency tax on the costs per dollar of loan, and thus on the sustainability of the MFI.

# 5 Econometric results

## 5.1 Data

Our sources include the ratings reports described above, for all data concerning the MFIs, and the World Development Indicators (WDI) for country data on GDPpc, in LCU and PPP. To obtain the dependent variable, we begin from data on administrative costs, in local currency, obtained from the institutions' income statements. These can be decomposed into Staff Costs and Other Costs = Admin Costs - Staff Costs. Dividing each by the number of borrowers, and scaling by GDPpc,LCU, we can obtain two components of the real unit costs per borrower, $c_i^y$, which we address separately as dependent variables in the next two sections.

Data on loans is obtained from the balance sheets, in local currency, and averaged for the beginning and end of the year. Then we divide it by the number of borrowers and scale it by GDPpc,LCU, to obtain the loan size per borrower by GDPpc, $z_i^y$. For all variables, data is averaged across the years in the sample to produce a cross-section dataset.

Out of the 100 institutions, 22 are also active in the savings sector, receiving deposits from their clients. We ignore these MFIs in our regressions, because the data does not allow us to separate the costs of each activity. In so doing, we avoid potential contamination of our results from savings activity. Our results are robust to including these MFIs, although the effect of savings activity on the MFIs administrative costs is unclear.

On the other hand, in our sample, 3 MFIs present very high levels of subsidization (see Fig 1). Using the method of Hadi (1992, 1994), we can identify these as outliers with a significance of 0.0001. In addition, 2 MFIs lack of data needed to obtain the dependent variables. In our regressions, we eliminate these 27 observations from the sample, leaving a final sample of 73 MFI.

Moreover, data on GDPpc,PPP is not available for Serbia and Montenegro in WDI, which leaves only 71 MFIs, when the variable is included in the regressions. Table 1 provides the main descriptive statistics of our restricted sample of 71 MFIs.

## 5.2 Results - Staff costs

### 5.2.1 OLS

Table 2 presents the OLS regression results for the specification in (3), including only the staff costs component of administrative costs in computing the real administrative cost per borrower. In the next section, we provide estimates for the efficiency tax, using the non-staff

costs component. By estimating separately these two components, we are allowing for the possibility that the drivers of the relationship between subsidies and administrative costs may affect them differently.

All regressions show an impressive $R^2$, denoting the importance of our variables and controls as determinants of the variations in the real administrative cost per borrower across MFIs, even when they are in different countries or regions. Most controls show signs in accordance with our predictions, and all are statistically significant.[12] First, an increase in the loan size raises the cost per borrower, - capturing the notion that the MFIs customers are likely to be among the better off, requesting a higher level of service. Second, larger MFIs have lower costs per borrower, as they benefit from economies of scale. The effect of GDPpc,PPP has a sign contrary to the expected, perhaps depicting a higher quality of service serving better off customers, in countries where the standard of living is higher.

The results suggest that MFIs with higher subsidy intensity are less efficient, as measured by the cost per borrower. Fig. 2 plots an estimate of the efficiency-tax implied by regression 1.[13] It shows that it is slightly negative for a very low levels of subsidization, reaching a minimum of $-2.9\%$. In our sample, the efficiency tax estimated from regression 1 is negative for 40% of the MFIs that receive subsidies. Overall, the mean efficiency subsidy implied by regression 1 amounts to around 9%. However, the poor significance of the coefficient on the linear term raises questions on the presence of a negative efficiency tax at any level of subsidization.

[12] In all cases, controls for the region and governance of the organizations were non-significant, and we omit them from the regressions throughout the paper.

[13] We use a range of subsidy intensity - $SUB$ and $SUB(IV)$ - that covers 95% of the observations in our sample

In regressions 2 and 3, we obtain more statistically significant measures of the efficiency tax, particularly when only the quadratic term in included. We interpret this as evidence that the efficiency tax is likely to be positive, in the specification of Table 2. Taking regression 2 as a benchmark, implies a mean efficiency tax of 30%. On the other hand, our results imply also that the marginal efficiency tax is increasing, as predicted in previous discussions.

#### 5.2.2 Instrumental variables

A fundamental concern is the endogeneity of an MFIs subsidy intensity. The argument is straightforward: if donors have ulterior motivations to support effects of an MFIs work on the ground they are likely to provide additional subsidies if the MFIs costs are high and its sustainability is threatened.

To correct this endogeneity bias, we follow a two-stage procedure. In the first-stage, we compute the component of subsidy intensity that is orthogonal to the sustainability of the MFI. In the second-stage, we use these in estimating (3).

The first-stage regression yields the following estimate

$$SUB = \underset{(2.70)}{2.711} \ \underset{(-2.10)}{-0.442} \ \ln OSS \qquad Adj\ R^2 = 0.045,\ n = 73$$

where the signs are as expected, and both coefficients are significant at 5%. The low level of the $R^2$ shows that many other factors influence the subsidy intensity of MFIs. In particular, it can be argued (and confirmed by the data) that two of our controls in (3), namely the Loan Size and GDPpc,PPP, are also important determinants of subsidy intensity, since they are a measure of the poverty incidence of the MFIs activities, and thus related to the ability to lobby donors for funds. However, the role of these controls as determinants of the subsidy intensity does not bias our estimates of the efficiency-tax from subsidies, provided we include

them as controls in the regression. Technically, the role of GDPpc,PPP and Loan Size as determinants of subsidy intensity create potential multicollinearity, hence overblown standard errors, and not endogeneity bias.

We then construct a new variable for the subsidy intensity: $SUB(IV) = e_i - \min(e_i)$, where $e_i$ is the residual of the above regression for MFI $i$ and $SUB(IV) > 0$. In so doing, the new variable becomes orthogonal to $\ln OSS$, and is thus unaffected by the desire of donors to support institutions that one unsustainable due to high administrative costs. Table 1 provides the main statistics for the distribution of $SUB(IV)$.

Table 3 shows the regression results for (3), using $SUB(IV)$ as the explanatory variable. The efficiency tax from subsidies is now clearly non-linear, with the quadratic and the linear term simultaneously significant. Some of the additional controls are not significant, however, removing them has very limited influence in the estimates of the parameters of the efficiency tax.

We can estimate the efficiency tax for the MFIs in the sample, by computing $\beta_1 s_i + \beta_2 s_i^2$ with the instrumented measure of Subsidy Intensity and our IV estimates for regression 1. We plot the corresponding values of efficiency tax in Fig. 2. In contrast with our previous OLS estimates, we now obtain that the efficiency tax is negative for 93% of the sample. The mean efficiency tax is $-14\%$ (compared to 9% in the OLS estimates). These results seem to suggest that, once reverse causality is controlled for, the evidence supports the notion that subsidies help MFIs increase their efficiency.

Our results also imply that, like in the OLS case, the marginal efficiency tax is increasing in the subsidy intensity. However, unlike in the OLS estimates, the evidence that the

efficiency tax is non-monotonic is highly significant. When subsidy intensity is high, namely higher than 0.65 for the benchmark regression, further increases in subsidization reduce efficiency. In our sample, 44% of the MFIs have levels of subsidization where the marginal efficiency tax from subsidies is negative. In other words, our results show that 56% of the MFIs would see their efficiency increased with a decline in the levels of susbsidization. Hence, even if our results suggest that subsidies on average tend to help the efficiency of MFIs, we still find that above a certain threshold their marginal effect becomes negative. We interpret this as a detrimental moral hazard effect.

### 5.3 Results - Other administrative costs

In this section, we estimate (3) using a dependent variable obtained from Other Costs = Total Cost - Staff Cost, i.e. Non-Staff administrative costs. Non-staff costs include all intermediate goods and supplies, along with the amortization of fixed assets. Table 4 provides the regressions results, using OLS and IV methodologies, similarly to the previous section.

Overall, the results are rather similar to the ones obtained for staff costs. OLS estimates show signs of a pervasive efficiency tax from subsidies which we plot in Fig. 2. The efficiency tax estimated from regression 1 is positive for 42% of the sample of MFIs that receive subsidies, with a mean efficiency tax just above 2%. Moreover, although regression 1 suggests a negative efficiency tax at very low levels of subsidization, the lack of statistical significance of the linear term on subsidies raises questions on the robustness of this result. Estimates of the efficiency tax based on the specification with only the quadratic term seem to fit the data better. Taking regression 2, the mean efficiency tax rises to 17%.

Turning now to the IV estimates, regressions 1 and 2 show that the significance problems

are addressed with the removal of the GDPpc,PPP variable. The results in regression 1 imply a negative efficiency tax for the vast majority (97.2%) of the sample, with the mean efficiency tax of −19%. Once again, we plot the efficiency tax in Fig. 2

In both OLS and IV estimates, the evidence is strongly supportive of an increasing marginal efficiency tax. However, while in the OLS estimates the evidence seems to support an increasing efficiency tax, in the IV estimates, there is again strong support for a non-monotonic tax. In regression 6, rising subsidy intensity increases the efficiency of the MFI until it reaches a level of around 0.78, after which further rises in subsidy intensity tends to lower the efficiency of the MFI. In our sample, 50% of the MFI have a higher subsidy intensity than this threshold, implying that reduction in their levels of subsidization would increase their efficiency.

### 5.4 Discussion

Our empirical analysis in this paper is quite consistent in the picture they draw of the efficiency tax from subsidies on the real administrative cost per borrower. Several points are worth noting from Fig. 2. First, the estimates of the efficiency tax for Staff and Non-staff costs are very similar and consistent. In the OLS estimates, for example, the results shows a rising efficiency tax for both measures. Second, the endogeneity of subsidy intensity has a clear and consistent effect of inflating the estimates of the efficiency tax. In fact, once we instrument, we find evidence that, for the vast majority of MFIs in the sample, the subsidies they obtain allow them to have a lower administrative cost per borrower than MFIs that are not subsidized. There are two reasons for this. On one hand, there is the actual problem of endogeneity, which implies that the OLS estimates overestimate the efficiency tax. On the

other, there is the effect of soft-budget constraints on efficiency, which is eliminated by our instrumenting procedure. In this sense, it can be argued that the IV estimates underestimate the efficiency tax, or, in this case, overestimate the efficiency enhancing effect of subsidies.

Third, in all specifications, we obtain that the marginal efficiency tax from subsidies is increasing in the level of Subsidy Intensity. Fourth, in the IV estimates, there is an optimal level of subsidy intensity, in the range of 0.7 to 0.8, where the largest impact in lowering the real administrative cost per borrower is achieved. Above this threshold, an increase in subsidy intensity generates an increase in the real administrative cost per borrower. In our sample, around 50% of the MFIs have levels of Subsidy Intensity that are higher than the threshold.

Our interpretation of these results is that they support both strands of the policy debate. On one hand, the role of subsidies in helping MFIs increase their efficiency, by providing the liquidity to improve the human and physical infrastructure, is well borne in the data. Although our data on subsidies does not allow us to identify empirically the "smart subsidies", our results are in accordance with the principles argued by Armendariz de Aghion and Morduch (2004). On the other hand, the scope for an efficiency-taxing effect, based on notions of moral hazard, also is supported by the data. Such effects seem to be dominant, at the margin at higher levels of subsidy intensity. Our results also provide a first response to the question raised by Lapenu (2000) and Balkenhol (2007) about the acceptable level of subsidies.

## 6 Productivity and wage-rents

Now, turning to the notion that subsidy intensity affects staff costs, we pin-down two effects. First, there may be an effect on productivity, related to the impact of subsidies on the incentives for effort and innovation by managers and staff, as well as on the availability of funds to finance key investments on human resources and physical assets. Second, there is potential for a rent-seeking effect, whereby staff can take advantage of the subsidies provided by donors with only limited ability to monitor management decisions to extract higher wages and other perks and benefits.

We can obtain such decomposition from (2), as follows

$$\ln c_i = \ln w_i/\tilde{w} - \ln A_i$$

where the term $\ln w_i/\tilde{w}$ corresponds to the wage-rent and the second term, $\ln A_i$, is a measure of productivity. The presence of wage rents implies that the MFI pay for its labor a wage that is higher than the country's on-going wage rate. One point to take into account is that we have no data on the profiles and characteristics of the workforce of MFI, which makes it impossible to control for their benchmark productivity. For example, it is possible that high wages in an MFI are simply the labor market outcome of a better educated, inherently more productive labor force. This would imply higher wages and stronger productivity, with the net effect captured in the effects on $c_i$ addressed above.

We perform separate estimates of the efficiency tax on the wage-rent and productivity, following the methodology developed in the previous sections. Note that the sum of these two should yield the efficiency tax on the staff costs measure of the real administrative cost estimated above. The measure of productivity, in terms of number of borrowers per

staff member is presented in the ratings reports. Using the GDPpc,LCU as a proxy for the country's wage level, as discussed above, we obtain a proxy for the wage-rent as $\ln w_i/y = \ln c_i^y - \ln A_i$, where $c_i^y$ the staff cost per borrower scaled by GDPpc,LCU introduced above. The descriptive statistics are shown in Table 1.

Table 5 shows the estimates of the OLS and IV regressions for Productivity. Note that the dependent variable is $\ln A_i$, which implies that the sign of the coefficients must be reversed, when computing the efficiency tax. The results show that OLS and IV estimates are similar, with an $R^2$ extremely low, compared to those obtained in the previous sections. In all cases, the controls have the expected signs, although they are not significant in the majority of cases.

In both cases, the coefficients in the quadratic and linear specifications of subsidy intensity are significant. Fig. 3 plots estimates of the efficiency tax, taking into account the sign reversal. It shows that the tax is positive for only the MFI with the largest subsidy intensity in our sample of 73, in the OLS and IV estimates. This implies that for virtually the whole sample, MFIs that receive subsidies are more productive, in terms of borrowers per staff, than those that do not.

Nevertheless, although subsidies tend to help increase productivity, the strong non-linearity of the efficiency tax implies that, at the margin, subsidies may be contributing to lower productivity beyond a certain threshold. The level of subsidy intensity to produces the minimum for the efficiency tax is 0.9 in the OLS estimated, and 1.1 in the IV estimates. In our sample, this implies that, respectively, 26% and 23.3% of the MFIs are in the region where the marginal efficiency tax is positive. For these, a decline in their level of

subsidization would increase their efficiency.

Turning now to the efficiency tax on wage-rents, Table 6 provides the regressions results for both OLS and IV estimation, taking as the dependent variable the cost per staff scaled by GDPpc, LCU. The $R^2$ is now much larger than for the case of *Productivity*. Noting that one component of the wage rents might be the omitted effect of the qualifications of the labor force, the controls of Loan Size and GDPpc,PPP suggest that an increase in these factors implies an increase in the quality of the service provided, causing an increase in the cost of staff.

The estimates of the efficiency tax obtained using OLS and IV portray a similar picture. In regressions 1 and 5, the linear and quadratic terms are not significant, and the best individual significance for the components of the efficiency tax is obtained when only the quadratic term is involved (regressions 3 and 7). In any case, estimates of the efficiency tax based on the coefficients obtained in regressions 1 and 5 provide estimates of the efficiency tax that are positive for the whole span of the subsidy intensity in the sample. Of course, the same is true in the estimates obtained from regressions 3 and 7. Like before, IV results provide estimates for the efficiency tax that are lower than the OLS ones. Taking regressions 1 and 5 as benchmarks, the mean efficiency tax is 28%, in the OLS estimates and 20% in the IV estimates.

Our decomposition of the efficiency tax on the real administrative cost per borrower into a wage-rent and a productivity component has provided a clearer picture (see Fig. 3). Above all, the dichotomy between OLS and IV estimates on the previous sections has subsided. Although the OLS estimates remain higher than the IV estimates in both cases, it

seems clear that subsidies create an efficiency tax, on the wage rent component, and enhance efficiency, in terms of the productivity component.

On the other hand, the notion of an increasing marginal efficiency tax is confirmed in all cases. For the case of productivity, this implies an increasing efficiency tax, beyond a threshold. Hence, although subsidies enhance the productivity of the labor force, on average, for MFIs with large levels of subsidization, a decline in subsidy intensity would have a beneficial effect on productivity. Around 30% of the MFIs in the sample are in those conditions.

Our results can be interpreted in two ways. First, it is possible that MFIs that receive subsidies pay higher salaries to attract more productive people, or invest more on training (if these are included in staff costs). Subsidies would then be used as tools to improve staff productivity. Such explanation is backed by the evidence that shows that, at low levels of subsidization, subsidies contribute to reduce the real administrative cost per borrower, or at least have only a negligible effect on taxing efficiency.

However, we should note that the marginal effect on productivity becomes negative, as the level of subsidization pushes to its upper bound, while the effect on the wages paid to staff, relative to the national standard, strengthens. This leads us to a second - moral hazard/wage-rent - interpretation of our results, which seems to dominate at higher levels of subsidy intensity. Under this interpretation, the results are evidence that subsidies clear out the pressure on the staff of MFIs allowing them to paid higher wages and provide other perks to staff, without a corresponding effect on their performance, which actually starts declining beyond a certain threshold, as employees are under less pressure from management and from

the market to be productive.

## 7 Concluding Remarks

Delivering credit, savings or insurance through MFIs should reduce transaction costs and informational hurdles and improve the access of the poor to financial services. To this end, donors should aim at building a more inclusive financial sector large without creating aid dependence or weakening incentives to reach sustainability (Hardy et al., 2002, p. 13). Donors' challenge is thus to design efficient or "smart subsidies" which are not likely to introduce long-term subsidy dependence (UNCDF, 2005).

After having corrected for endogeneity bias, our results suggest that subsidies have had a positive impact on efficiency but over-subsidisation of a MFI can be counter-productive. For the vast majority of MFIs in the sample, the subsidies they obtain allow them to have a lower administrative cost per borrower than MFIs that are not subsidized. The marginal effect on efficiency however becomes negative above a threshold. This means that reductions in the levels of subsidization should increase efficiency, for approximately half of the MFIs in our sample.

From a policy standpoint, these results support both strands of the policy debate, confirming Balkenhol's (2007) notion that the effect of subsidies depends on their intensity. On one hand, the role of subsidies in helping MFIs increase their efficiency, by providing the liquidity to improve the human and physical infrastructure is well borne in the data. This effect is stronger and dominant at lower levels of subsidy intensity which in turn lends support to the "smart subsidies" idea. On the other hand, the scope for an efficiency-taxing effect, based on notions of moral hazard, is also supported by our empirical analysis, and seems to

be dominant at the margin and at higher levels of subsidy intensity.

One point to note is that our measure of subsidy intensity covers only subsidies in the form of equity due to availability of data. Although we have shown that these subsidies matter, it might be argued that subsidies that cover operational expenses are even more likely to generate an efficiency tax. Lack of data prevents us from addressing this question, which remains a challenge for future work. Further research is also needed on the impact of efficiency on interest rates policy but also on the transaction and turnover cost of MFIs.

# 8 References


Armendariz de Aghion, B. and J. Morduch (2004), "Microfinance, Where do We stand" in in Charles Goodhart, ed. Financial Development and Economic Growth: Explaining the Links, (London: Palgrave).

Armendariz, B. and J. Morduch (2005), The Economics of Microfinance, MIT Press, Boston.

Balkenhol, B. (2007), Microfinance and Public Policy. Outreach, Performance and Efficiency, ILO, Palgrave Edition, New York.

Besley, T. and M. Ghatak (2005), Competition and Incentives with Motivated Agents, American Economic Review, 95, 3, pp. 616–636.

Christen, R. (2000), Bulletin Highlights, MicroBanking Bulletin, 4, February 2000, pp. 41-47.

Consultative Group to Assist the Poor (CGAP) (2003), Definitions of Selected Financial Terms Ratios and Adjustments for Microfinance, CGAP, Washington D.C.

Consultative Group to Assist the Poor (CGAP) (2004), Building Inclusive Financial

Systems: Donor Guidelines on Good Practice in Microfinance, CGAP, Washington D.C.

Consultative Group to Assist the Poor (CGAP) (2005), Mapping of Funding Flows, CGAP, Washington D.C.

Cull, R., Demirgüç-Kunt, A. and J. Morduch (2006), Financial Performance and Outreach: A Global Analysis of Leading Microbanks, World Bank Policy Research Working Paper, 3827.

Dewatripont, M and E. Maskin (1995), Credit and Efficiency in Centralized and Decentralized Economies, Review of Economic Studies, 62, 4, pp. 541-555.

Domes, D. (2005), The European Commission's Approach to Microfinance, European Dialogue Conference – Luxembourg Round Table on Microfinance, 17 October 2005.

Hardy, D., Holden, P. and V. Prokopendo (2002), Microfinance Institutions and Public. Policy, IMF working paper, 02/159.

Honohan, P. (2004). Financial Sector Policy and the Poor: Selected Findings and Issues. World Bank Working Paper No. 43. Washington, DC, World Bank.

Hudon, M. (2006), Financial performances, management and ratings of the microfinance institutions: Do subsidies matter?, Working Paper, Université Libre de Bruxelles.

Hulme, D. and P. Mosley (1996), Finance against poverty, London, Routledge

Kornai, J., Maskin, E. and G. Roland (2003), Understanding the Soft Budget Constraint, Journal of Economic Literature, XLI, pp. 1095-1136.

Labie, M. (2001), Corporate Governance in Microfinance Organizations: a Long and Winding Road, Management Decision, 39, 4, pp. 296-301

Lapenu, C. (2000), The Role of the State in Promoting Microfinance Institutions, IFPRI,

Washington D.C.

MicroBanking Bulletin (2002), An Introduction to the Peer Groups and Tables, MicroBanking Bulletin, November 2002.

Morduch (2005), Smart Subsidy for Sustainable Microfinance, Finance for the Poor, 6, 4, pp. 1-7.

Morduch (2007), Smart Subsidies in Balkenhol, B. (2007), Microfinance and Public Policy. Outreach, Performance and Efficiency, ILO, Palgrave Edition, New York.

Rowat, C. and P. Seabright (2006), Intermediation by Aid Agencies, Journal of Development Economics, 79, pp. 469-491.

Stephens, B., 2005. Sustainability in sight: An analysis of MFIs that become sustainable, MicroBanking Bulletin, 10, pp. 23-29.

UNCDF (2005), Blue Book, UNCF, Geneva.

Valenzuela, L. (1998), Overview of MFIs Fraud, ACCION, Cambridge.

Zeller, M. and R. Meyer (2002), The Triangle of Microfinance: Financial Sustainability, Outreach, and Impact, Johns Hopkins University Press, Baltimore.

**Appendix 1:** Size categories; The MicroBanking Bulletin Methodology (2002)

| Region | Scale of Operations[1]<br>Total loan portfolio (US$) |
|---|---|
| Africa<br>Africa/ MENA[2]<br>Asia (Central) | Large: > 5 million<br>Medium: 800,000 to 5 million<br>Small: < 800,000 |
| Asia (Pacific)<br>Asia (South) | Large: > 8 million<br>Medium: 1 to 8 million<br>Small: < 1 million |
| Eastern Europe<br>Latin America | Large > 10 million<br>Medium: 1.5 to 10 million<br>Small: < 1.5 million |

1 Criteria for classification of scale of operations varies by region. See corresponding group of regions.

2 MENA = Middle East/ North Africa.

Table 1 : Descriptive Statistics

| Variable | Name | Min | Mean | p25 | p50 | p75 | Max | N |
|---|---|---|---|---|---|---|---|---|
| $c_y$ - Staff Costs | Ln of Staff Costs per Borrower | -11.293 | -4.646 | -6.468 | -4.245 | -2.965 | 4.626 | 73 |
| $c_o$ - Other Costs | Ln Oth Adm per Borrower | -11.793 | -5.043 | -6.985 | -4.710 | -3.665 | 4.315 | 73 |
| ln A | Ln Productivity | 3.045 | 4.571 | 4.190 | 4.625 | 4.999 | 5.585 | 73 |
| ln $w/\hat{w}$ | Ln Staff costs per borrower | -6.342 | -0.075 | -2.060 | 0.712 | 1.370 | 9.008 | 73 |
| SUB | Subsidy Intensity | 0.000 | 0.607 | 0.190 | 0.631 | 0.935 | 2.163 | 73 |
| SUB(IV) | Subsidy Intensity Instrumented | 0.000 | 0.750 | 0.330 | 0.835 | 1.104 | 2.230 | 73 |
| ln LOSZ | Ln Loan Size per Real GDP per capita | -9.783 | -2.557 | -4.433 | -2.343 | -0.352 | 6.406 | 73 |
| ln GDPpc | LN Real GDP per capita | 6.932 | 8.384 | 8.040 | 8.460 | 8.860 | 9.095 | 71 |

Table 2 - Staff Costs; OLS

| | 1 | 2 | 3 |
|---|---|---|---|
| | ln of Staff Costs per borrower | | |
| SUB^2 | 0.367* | 0.253** | |
| | [2.32] | [4.75] | |
| SUB | -0.209 | | 0.367** |
| | [0.62] | | [2.75] |
| ln LOSZ | 0.930** | 0.932** | 0.934** |
| | [38.64] | [36.47] | [34.84] |
| ln GDPpc | 0.262+ | 0.285* | 0.315* |
| | [1.77] | [2.27] | [2.42] |
| Size | -0.191* | -0.213* | -0.241* |
| | [2.10] | [2.29] | [2.61] |
| Constant | -4.379** | -4.605** | -4.903** |
| | [3.37] | [4.39] | [4.42] |
| Observations | 71 | 71 | 71 |
| R-squared | 0.97 | 0.97 | 0.96 |

Robust t statistics in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

Table 3 - Staff Costs; IV

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| | ln of Staff Costs per borrower | | | |
| SUB(IV)^2 | 0.648** | 0.726** | 0.663** | 0.727** |
| | [3.27] | [4.49] | [3.97] | [3.60] |
| SUB(IV) | -0.853* | -1.070** | -0.912* | -1.052* |
| | [2.01] | [2.86] | [2.28] | [2.47] |
| ln LOSZ | 0.923** | 0.907** | 0.917** | 0.912** |
| | [42.16] | [39.18] | [40.38] | [42.13] |
| ln GDPpc | 0.199 | | | 0.196 |
| | [1.21] | | | [1.16] |
| Size | -0.155 | | -0.152 | |
| | [1.64] | | [1.34] | |
| Constant | -3.662* | -2.085** | -2.010** | -3.700* |
| | [2.48] | [9.38] | [9.66] | [2.41] |
| Observatio | 71 | 73 | 73 | 71 |
| R-squared | 0.97 | 0.96 | 0.96 | 0.97 |

Robust t statistics in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

Table 4 - Dep Var: ln Other Admin Costs per Borrower

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | | | OLS | | | | IV | | |
| SUB^2 | 0.289 | 0.348+ | 0.153* | 0.145* | | | | | |
| | [1.32] | [1.73] | [2.43] | [2.40] | | | | | |
| SUB | -0.247 | -0.362 | | | 0.206+ | | | | |
| | [0.62] | [0.99] | | | [1.67] | | | | |
| SUB(IV)^2 | | | | | | 0.491+ | 0.463* | 0.084 | |
| | | | | | | [1.92] | [2.18] | [1.31] | |
| SUB(IV) | | | | | | -0.771 | -0.726+ | | 0.057 |
| | | | | | | [1.58] | [1.75] | | [0.38] |
| ln LOSZ | 0.931** | 0.929** | 0.934** | 0.930** | 0.934** | 0.924** | 0.927** | 0.927** | 0.925** |
| | [34.73] | [37.97] | [33.13] | [35.42] | [32.43] | [37.27] | [39.86] | [35.47] | [35.95] |
| ln GDPpc | 0.088 | | 0.115 | | 0.13 | 0.032 | | | |
| | [0.54] | | [0.80] | | [0.89] | [0.18] | | | |
| Size | -0.339** | -0.319** | -0.365** | -0.356** | -0.379** | -0.300** | -0.295** | -0.352** | -0.342** |
| | [3.42] | [3.11] | [3.97] | [3.87] | [4.01] | [2.95] | [2.83] | [3.70] | [3.37] |
| Constant | -3.140* | -2.404** | -3.407** | -2.471** | -3.552** | -2.493 | -2.253** | -2.461** | -2.452** |
| | [2.24] | [14.27] | [2.82] | [16.87] | [2.90] | [1.62] | [11.52] | [16.38] | [14.33] |
| Observatio | 71 | 73 | 71 | 73 | 71 | 71 | 73 | 73 | 73 |
| R-squared | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |

Robust t statistics in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

Table 5 - Dep Var: ln Productivity

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| | | | OLS | | | | IV | |
| SUB^2 | -0.408* | -0.433* | -0.478* | -0.26 | | | | |
| | [2.13] | [2.44] | [2.58] | [1.44] | | | | |
| SUB | 0.717+ | 0.798* | 0.869* | 0.395 | | | | |
| | [1.73] | [2.11] | [2.24] | [1.05] | | | | |
| SUB(IV)^2 | | | | | -0.412* | -0.218 | -0.477** | -0.438* |
| | | | | | [2.16] | [1.31] | [2.69] | [2.52] |
| SUB(IV) | | | | | 0.878+ | 0.408 | 1.039* | 0.961* |
| | | | | | [1.92] | [1.03] | [2.48] | [2.32] |
| ln LOSZ | -0.032 | | -0.022 | -0.050+ | -0.03 | -0.049+ | -0.021 | |
| | [1.10] | | [0.90] | [1.73] | [1.02] | [1.70] | [0.85] | |
| ln GDPpc | 0.19 | 0.261 | 0.19 | | 0.207 | | 0.209 | 0.274 |
| | [1.04] | [1.46] | [1.05] | | [1.14] | | [1.17] | [1.51] |
| Size | 0.137 | 0.092 | | 0.193 | 0.126 | 0.196 | | 0.083 |
| | [1.12] | [0.85] | | [1.55] | [1.01] | [1.55] | | [0.75] |
| Constant | 2.599 | 2.081 | 2.678+ | 4.207** | 2.323 | 4.153** | 2.354 | 1.821 |
| | [1.63] | [1.31] | [1.69] | [25.26] | [1.42] | [22.02] | [1.46] | [1.12] |
| Observations | 71 | 71 | 71 | 73 | 71 | 73 | 71 | 71 |
| R-squared | 0.11 | 0.09 | 0.09 | 0.09 | 0.11 | 0.08 | 0.1 | 0.1 |

Robust t statistics in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

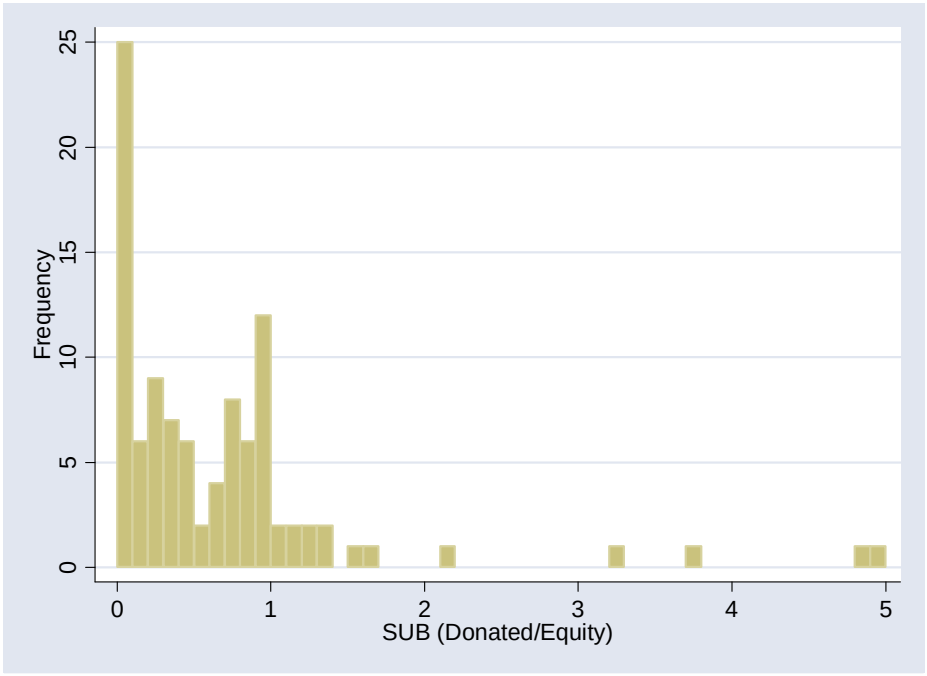
Table 6 - Dep Var: ln Wage Premium

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| | | | OLS | | | | IV | |
| SUB^2 | -0.041 | -0.013 | 0.238* | | | | | |
| | [0.14] | [0.05] | [2.29] | | | | | |
| SUB | 0.508 | 0.449 | | 0.445+ | | | | |
| | [0.81] | [0.73] | | [1.96] | | | | |
| SUB(IV)^2 | | | | | 0.235 | 0.25 | 0.248* | |
| | | | | | [0.75] | [0.81] | [2.38] | |
| SUB(IV) | | | | | 0.025 | -0.013 | | 0.441+ |
| | | | | | [0.03] | [0.02] | | [1.81] |
| ln LOSZ | 0.898** | 0.894** | 0.892** | 0.898** | 0.893** | 0.891** | 0.892** | 0.895** |
| | [20.45] | [22.71] | [21.07] | [20.72] | [20.82] | [23.16] | [20.81] | [20.47] |
| ln GDPpc | 0.452+ | 0.452+ | 0.397+ | 0.446+ | 0.406 | 0.405 | 0.403+ | 0.441+ |
| | [1.71] | [1.71] | [1.71] | [1.87] | [1.48] | [1.48] | [1.76] | [1.84] |
| Size | -0.054 | | -0.001 | -0.048 | -0.029 | | -0.027 | -0.057 |
| | [0.33] | | [0.00] | [0.30] | [0.17] | | [0.17] | [0.35] |
| Constant | -1.78 | -1.811 | -1.23 | -1.722 | -1.339 | -1.346 | -1.312 | -1.738 |
| | [0.75] | [0.76] | [0.61] | [0.82] | [0.53] | [0.53] | [0.66] | [0.82] |
| Observations | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 |
| R-squared | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |

Robust t statistics in brackets

+ significant at 10%; * significant at 5%; ** significant at 1%

Figure 1: Subsidy Intensity (Donated Equity / Current Equity)




Descriptive Statistics

| Percentiles | | | |
|---|---|---|---|
| 1% | 0 | | |
| 5% | 0 | | |
| 10% | 0 | Obs | 100 |
| 25% | 0.100893 | Sum of Wgt. | 100 |
| 50% | 0.468041 | Mean | 0.665857 |
| | | Std. Dev. | 0.864188 |
| 75% | 0.91872 | | |
| 90% | 1.228085 | Variance | 0.74682 |
| 95% | 1.885983 | Skewness | 3.040884 |
| 99% | 4.881849 | Kurtosis | 14.1926 |

**Figure 2 - Efficiency Tax from Subsidies**

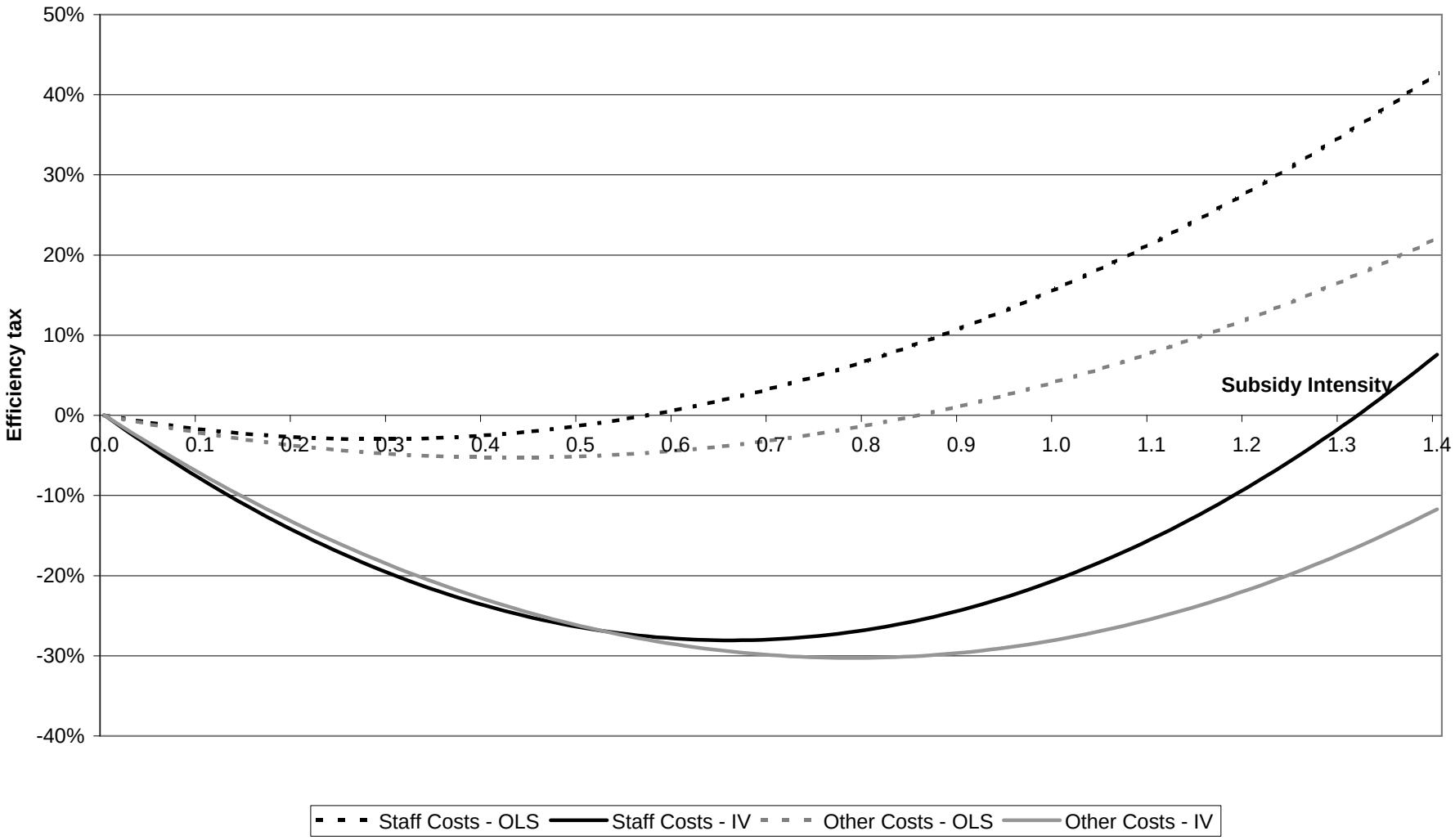


**Figure 3: Efficiency Tax: Productivity and Wage Rents**