Home Production and VAT Regressivity. Evidence from El Salvador

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Abstract

Food taxes are seen as regressive given that the lower the income, the higher the proportion of income spent on food. However, in developing countries, lower income households can obtain food from untaxed sources, such as informal markets and home production. Using data from El Salvador, this paper shows that the regressivity of taxing food is decreased when home production is considered.

Furthermore, it is shown that home production is sensitive to tax changes. After the end of a tax exemption to goods that could be home produced, home production increased by 19% in the short run.

1 Introduction

The value added tax (VAT) is the main source of tax revenue in many developing countries. In order to offset its regressivity in current consumption, many of them impose exemption or differentiated rates at the cost of smaller tax bases, administrative costs and inefficiencies. According to Ebrill et al (2001) 47% of all countries with VAT have more than one tax rate.

In the United States, moving towards a consumption tax generates favourable opinions from a theoretical perspective, however, other opinions do not endorse its implementation because of its impractical nature, due to the necessary high tax rate, and the induced evasion that it could imply. It is been argued that high consumption taxes can increase the informal sector, as well as induce other evasion and elusion strategies. This papers deals with a particular type of elusion: home production. When a good can be home produced, the existence of a tax induces an increase in home production and reduces the tax base. Furthermore, when there are complementarities in home production, it could not only increase home production of newly taxed goods, but also on other goods.

Home production can be present in a variety of goods: child care, restaurant services, laundry, gardening, cleaning, repair activities etc. These can be of importance in developing as well as developed countries. Engström et al (2005) develop a general equilibrium model where services can be home produced and goods are produced exclusively in the market, finding that a tax cut on services

can decrease unemployment, whereas a tax cut in goods has no effect. Piggot and Whalley (2001) analyze the effect on home production and informal economy of the change towards a board VAT in Canada in 1990. Calibrating their model they find the tax change induced an increase in both home production and the informal sector and was welfare-worsening but pro-poor.

This paper focuses in developing countries and analyzes the case of El Salvador. Using Salvadorean data it is shown that home production reduces the food VAT regressivity. Furthermore, using a VAT tax increase in goods that could be home produced, I find an increase in home production overall, not only in the goods that were subject to the tax increase, suggesting the existence of complementarities in home production.

These results shed light on the tax incidence of indirect taxes. The lower the income, the higher the share of the budget that goes to food consumption. But also, the lower the income, the higher the share of consumption that is home produced. It also shows the importance for governments on considering each country developing stage to define the optimal tax rate and structure.

The paper is organized as follows: Section 2 describes the tax system in El Salvador and the tax change. In section 3 a model of home production and optimal taxes is developed. The data is introduced in section 4. The effect of home production on the VAT incidence is presented in section 5. Section 6 shows the tax change effects, and finally conclusions are presented in section 7.

2 Tax System in El Salvador

El Salvador has a per capita GDP of $4,700 (dollars-PPP)[1]. Poverty rate was 37% in 2004. The main economic sectors in 2005 as percentage of the GDP are services: 60%, agriculture: 9.8% and industry: 30.3% (2005 estimates).

Tax revenues were 11.5% of GDP in 2004, which is low relative to countries with the same development level. Revenue relies heavily on indirect taxes, VAT represents around 50% of tax revenue, income tax 30%, tariffs 10% and specific taxes (alcohols, cigarettes, gas and sodas) 4%. Taxes are at the country level, and the VAT rate is 13%. It is argued that the low revenue is not due to a design problem, but of implementation: exemptions to the income tax and size of the informal sector. The Ministry of Finance calculates the evasion between 20 and 30 percent of the revenue. Only the income tax is not regressive, and given its small share of the revenues, the income distribution after tax is more regressive than before taxes[2].

In April 2000[3] the VAT exemption of milk, fruit, vegetables, beans, corn, rice and medicines was ended. The measure was asked by members of the agricultural sector which argued that the exemptions put them in a competitive disadvantage with importers, given that they had to pay VAT for their inputs. The law was approved on April 13 and published on May 3 of the same year.

[1] CIA factbook.

[2] Figures from household data of income and consumption in a given period.

[3] "Decreto 877"(Law 877),

The expected price increase was 4% for milk, 7.8% for beans, 7.2% for corn, 5.5% for rice and 7.8% for fruits and vegetables. The expected impact on consumer prices was of 1.23% [4].

3 Model

3.1 Consumer Problem

This section closely follows Sandmo (1990) and Kleven et al (2000), but incorporates complementarities in home production The household maximizes $U(x, y, z, l)$ where x and z can be home produced or bought in the market. Prices are $p_x(1 + \tau_x)$ for good x, $p_y(1 + \tau_y)$ for good y, and $p_z(1 + \tau_z)$ for good z. Good x and good z can be produced at home using labor according to the production function $g_x(h_x, h_z)$ and $f_z(h_x, h_z)$ respectively, where h_x are the hours spent in home production of good x and h_z the hours spent in home production of z. Let x_1 and z_1 be the amount of good x and z bought in the market. Therefore $x = x_1 + g_x(h_x, h_z)$, and $z = z_1 + f_z(h_x, h_z)$.

The time constraint is $T = h_x + h_z + h_m + l$, where h_m are the hours worked in the market, l is leisure time and T is the maximum available time. Finally the budget constraint is: $wh_m = p_y(1+\tau_y)y + p_x(1+\tau_x)x_1 + p_z(1+\tau_z)z_1$, were w is the wage rate.

The household has to choose the consumption level of x, y and z, the allocated time to the production of x and z, to the labor market, as well as to leisure.

The first order conditions of the problem are:

$$MU_x - \lambda p_x(1+\tau_x) = 0 \quad (1)$$

$$MU_y - \lambda p_y(1+\tau_y) = 0 \quad (2)$$

$$MU_z - \lambda p_z(1+\tau_z) = 0 \quad (3)$$

$$MU_l - \lambda w = 0 \quad (4)$$

$$\lambda[-w + p_x(1+\tau_x)\frac{\partial g_x}{\partial h_x} + p_z(1+\tau_z)\frac{\partial f_z}{\partial h_x}] = 0 \quad (5)$$

$$\lambda[-w + p_x(1+\tau_x)\frac{\partial g_x}{\partial h_z} + p_z(1+\tau_z)\frac{\partial f_z}{\partial h_z}] = 0 \quad (6)$$

[4] http://archive.laprensa.com.sv//20000415//economia/economia.asp

Equations (1) to (4) give the usual first order conditions for a consumption decision[5]:

$$\frac{MU_x}{MU_y} = \frac{p_x(1+\tau_x)}{p_y(1+\tau_y)} \tag{7}$$

$$\frac{MU_x}{MU_z} = \frac{p_x(1+\tau_x)}{p_z(1+\tau_z)} \tag{8}$$

$$\frac{MU_x}{MU_l} = \frac{p_x(1+\tau_x)}{w} \tag{9}$$

$$\frac{MU_y}{MU_l} = \frac{p_y(1+\tau_y)}{w} \tag{10}$$

$$\frac{MU_z}{MU_l} = \frac{p_z(1+\tau_z)}{w} \tag{11}$$

Equations (5) and (6) by themselves determine the hours allocated to home production. The separation theorem implies that the home production decision is independent of the consumption decision. Conditions (5) and (6) imply that h_x and h_z neither depends on the utility function nor in the desired consumption level of good x or z.

From (5) the comparative statics are:

$$\frac{dh_x}{d\tau} = -\frac{\frac{\partial g_x}{\partial h_x}}{(1+\tau_x)\frac{\partial^2 g_x}{\partial h_x \partial h_x} + \frac{p_z}{p_x}(1+\tau_z)\frac{\partial^2 f_z}{\partial h_x \partial h_x}} \tag{12}$$

$$\frac{dh_x}{dw} = \frac{1}{p_x(1+\tau_x)\frac{\partial^2 g_x}{\partial h_x \partial h_x} + p_z(1+\tau_z)\frac{\partial^2 f_z}{\partial h_x \partial h_x}} \tag{13}$$

As long as $g_x(h_x, h_z)$ and $h_z(h_x, h_z)$ are concave ($g_x^{"}(h_x, h_z) < 0, f_z^{"}(h_x, h_z) < 0$) , and the cross derivatives are negative, $\frac{dh_x}{d\tau} > 0$ and $\frac{dh_x}{dw} < 0$. The separation of the consumption and production decision implies that the response of h_x to price changes depends on g_x and f_z, excluding both income and substitution effect from the consumption side of the problem.

However, the total effect of an increase of p_x in the consumption of x is determined by conditions (7), (8) and (9). These are the usual FOC, and the total effect will depend both on the income and the substitution effect. As long as x is normal, the effect will be negative.

[5] The problem can be equivalently written as a profit maximization $\pi(p_x, w)$, using both the time constraint $T = l + h_m + h_z + h_x$, and a budget constraint $p_x(1+\tau_x)x + p_y(1+\tau_y)y + p_z(1+\tau_z)z = p_x f_x(h_x, h_z) + p_z g_z(h_x, h_z) + w h_m$. This explicitly allows for sells of good x and z at prices p_x and p_z respectively. Combining them we get $p_x(1+\tau_x)x + p_y(1+\tau_y)y + p_z(1+\tau_z)z + wl = p_x f_x(h_x, h_z) + p_z g_z(h_x, h_z) - w(h_x + h_z) + wT$, where $p_x f_x(h_x, h_z) + p_z g_z(h_x, h_z) - w(h_x + h_z) = \pi(p_x, w)$ is the profit from the farming activiy. From this set up is also clear that I am excluding the posibility of hiring labor. This is because the estimation of the agriculture production function is not the purpose of the paper. Finally, these are the first order conditions for an interior solution.

Before working the optimal tax model, it is useful to derive the Roy Identity:

$$V = U(x, y, l) + \mu[w * h_m - p_y(1 + \tau_y)y - p_x(1 + \tau_x)x_1 - p_z(1 + \tau_z)z_1] \quad (14)$$

So the Roy Identity works as always:

$$\frac{\partial V}{\partial R} = \mu \quad (15)$$

$$\frac{\partial V}{\partial p_x(1 + \tau_x)} = -\mu x_1 \quad (16)$$

$$x_1 = -\frac{\partial V/\partial p_x}{\partial V/\partial R} \quad (17)$$

3.2 Optimal Tax Problem

This section follows Salanie, but introduces home production.

Suppose the government has to choose tax rates on good x, y and z: τ_x , τ_y and τ_z respectively, to raise a fixed amount of government revenue T while maximizing social welfare. Then the problem is:

$$\max W(V_1(q), V_2(q), ..., V_I(q)) \quad (18)$$

$$s.t. \qquad T = \sum_{i=1}^{N} (\tau_x x_{i1} + \tau_z z_{i1} + \tau_y y_i) \quad (19)$$

where $V_i(q)$ is the indirect utility of individual i, W is the social welfare function and N is the number of consumers. The indirect utility depends on a set of goods q, which will be consumed different by income class not only in their total consumption but also in the share that is bought in the market.

The Lagrangian is:

$$L = W(V_1(q), V_2(q), ..., V_I(q)) + \lambda[\sum_{i=1}^{N} (\tau_x x_{1i} + \tau_z z_{1i} + \tau_y y_i) - T] \quad (20)$$

The FOC are:

$$\tau_x \quad : \quad \sum_{i=1}^{N} \frac{\partial W}{\partial V_i}\frac{\partial V_i}{\partial \tau_x} + \lambda[\sum_{i=1}^{N} x_{1i} + \tau_x \frac{\partial x_{1i}}{\partial \tau_x} + \tau_z \frac{\partial z_{1i}}{\partial \tau_z} + \tau_y \frac{\partial y_i}{\partial \tau_x}] = 0 \quad (21)$$

$$\tau_y \quad : \quad \sum_{i=1}^{N} \frac{\partial W}{\partial V_i}\frac{\partial V_i}{\partial \tau_y} + \lambda[\sum_{i=1}^{N} \tau_x \frac{\partial x_{1i}}{\partial \tau_y} + \tau_z \frac{\partial z_{1i}}{\partial \tau_y} + \tau_y \frac{\partial y_i}{\partial \tau_y} + y_i] = 0 \quad (22)$$

$$\tau_z \quad : \quad \sum_{i=1}^{N} \frac{\partial W}{\partial V_i}\frac{\partial V_i}{\partial \tau_z} + \lambda[\sum_{i=1}^{N} \tau_x \frac{\partial x_{1i}}{\partial \tau_z} + \tau_z \frac{\partial z_{1i}}{\partial \tau_z} + \tau_y \frac{\partial y_i}{\partial \tau_z} + z_{1i}] = 0 \quad (23)$$

From Roy Identity:

$$x_{1i} = -\frac{\partial V_i/\partial \tau_x}{\partial V_i/\partial R_i} \quad (24)$$

Let $\alpha_i = \frac{\partial V_i}{\partial I_i}$, so $-x_{1i}\alpha_i = \frac{\partial V_i}{\partial \tau_x}$, so $-x_{1i}\alpha_i = \frac{\partial V_i}{\partial \tau_x}$

$$\frac{\partial W}{\partial V_i}\frac{\partial V_i}{\partial \tau_x} = -\frac{\partial W}{\partial V_i} x_{1i}\alpha_i \quad (25)$$

Let $\beta_i = \frac{\partial W}{\partial V_i}\alpha_i$. Note that β_i weights the marginal utility of income of consumer i by his weight in the social welfare function. It is the social marginal utility of income of consumer i. Then:

$$\frac{\partial W}{\partial V_i}\frac{\partial V_i}{\partial \tau_x} = -\beta_i x_{1i} \quad (26)$$

Therefore, the FOC can be re-written as:

$$\tau_x \quad : \quad \sum_{i=1}^{N} \beta_i x_{1i} = \lambda[\sum_{i=1}^{N} x_{1i} + \tau_x \frac{\partial x_{1i}}{\partial \tau_x} + \tau_z \frac{\partial z_{1i}}{\partial \tau_x} + \tau_y \frac{\partial y_i}{\partial \tau_x}] \quad (27)$$

$$\tau_y \quad : \quad \sum_{i=1}^{N} \beta_i y_i = \lambda[\sum_{i=1}^{N} \tau_x \frac{\partial x_{1i}}{\partial \tau_y} + \tau_z \frac{\partial z_{1i}}{\partial \tau_y} + \tau_y \frac{\partial y_i}{\partial \tau_y} + y_i] \quad (28)$$

$$\tau_z \quad : \quad \sum_{i=1}^{N} \beta_i z_{1i} = \lambda[\sum_{i=1}^{N} \tau_z \frac{\partial z_{1i}}{\partial \tau_z} + \tau_z \frac{\partial z_{1i}}{\partial \tau_z} + \tau_y \frac{\partial y_i}{\partial \tau_z} + z_{1i}] \quad (29)$$

Working with the first FOC:

$$\frac{\sum_{i=1}^{N} \beta_i x_{1i}}{\lambda} - \sum_{i=1}^{N} x_{1i} = \tau_x \frac{\partial x_{1i}}{\partial \tau_x} + \tau_z \frac{\partial z_{1i}}{\partial \tau_z} + \tau_y \frac{\partial y_i}{\partial \tau_x} \quad (30)$$

The Slutsky equation for this good is :

$$\frac{\partial x_{1i}}{\partial \tau_x} = \frac{\partial x_i}{\partial \tau_x} - \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} \tag{31}$$

$$= \frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} - x_{1i}\frac{\partial x_i}{\partial R_i} - \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} \tag{32}$$

$$= \frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} - x_{1i}[\frac{\partial x_{1i}}{\partial R_i} + \frac{\partial g_{xi}(h_x, h_z)}{\partial R_i}] - \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} \tag{33}$$

$$= -x_{1i}\frac{\partial x_{1i}}{\partial R_i} + [\frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} - \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x}] \tag{34}$$

I am using x_{1i} in the expression for the income effect because the adjusted income (that makes original bundle affordable), depends on x_{1i} and not on x_i. Likewise, $\frac{\partial g_i(h_x)}{\partial R_i} = 0$ from the consumer problem: the number of hours allocated to home production only depens on relative prices.

So, the FOC can be written as:

$$\frac{\sum_{i=1}^N \beta_i x_{1i}}{\lambda} - \sum_{i=1}^N x_{1i} \tag{35}$$

$$= \sum_{i=1}^N \tau_x(-x_{1i}\frac{\partial x_{1i}}{\partial R_i} + [\frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} - \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x}]) \tag{36}$$

$$+\tau_z(-x_{1i}\frac{\partial z_{1i}}{\partial R_i} + [\frac{\partial z_i}{\partial \tau_x}|_{\bar{U}} - \frac{\partial f_{zi}(h_x, h_z)}{\partial \tau_x}]) + \tau_y(\frac{\partial y_i}{\partial \tau_x}|_{\bar{U}} - x_{1i}\frac{\partial y_i}{\partial R_i}) \tag{37}$$

Equivalently,

$$\sum_{i=1}^N \tau_x \frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} + \tau_y \frac{\partial y_i}{\partial \tau_x}|_{\bar{U}} + \tau_z \frac{\partial z_i}{\partial \tau_x}|_{\bar{U}} \tag{38}$$

$$= \frac{\sum_{i=1}^N \beta_i x_{1i}}{\lambda} - \sum_{i=1}^N x_{1i} + \sum_{i=1}^N x_{1i} * [\tau_x \frac{\partial x_{1i}}{\partial R_i} + \tau_z \frac{\partial z_{1i}}{\partial R_i} + \tau_y \frac{\partial y_i}{\partial R_i}] \tag{39}$$

$$+\tau_x \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} + \tau_z \frac{\partial f_{zi}(h_x, h_z)}{\partial \tau_x} \tag{40}$$

Let

$$b_i = \frac{\beta_i}{\lambda} + [\tau_x \frac{\partial x_{1i}}{\partial R_i} + \tau_z \frac{\partial z_{1i}}{\partial R_i} + \tau_y \frac{\partial y_i}{\partial R_i}] \tag{41}$$

Note that b_i is the net social marginal utility of income of tax i. The first term is the social marginal utility of income of consumer i divided by the cost of budget resources for the government. The second term is the increase in tax revenue collected on consumer i when his income increases by one unit.

Then,

$$\sum_{i=1}^{N} \tau_x \frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} + \tau_y \frac{\partial y_i}{\partial \tau_x}|_{\bar{U}} + \tau_z \frac{\partial z_i}{\partial \tau_x}|_{\bar{U}} \tag{42}$$

$$= \sum_{i=1}^{N} x_{1i} b_i - \sum_{i=1}^{N} x_{1i} + \sum_{i=1}^{N} \tau_x \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} + \tau_z \frac{\partial f_{zi}(h_x, h_z)}{\partial \tau_x} \tag{43}$$

Let $\mathbf{x}_1 = \sum_{i=1}^{I} x_{1i}$, then:

$$\sum_{i=1}^{N} \tau_x \frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} + \tau_y \frac{\partial y_i}{\partial \tau_x}|_{\bar{U}} + \tau_z \frac{\partial z_i}{\partial \tau_x}|_{\bar{U}} \tag{44}$$

$$= \sum_{i=1}^{N} x_{1i} b_i - \mathbf{x}_1 + \sum_{i=1}^{N} \tau_x \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} + \tau_z \frac{\partial f_{zi}(h_x, h_z)}{\partial \tau_x} \tag{45}$$

So,

$$\sum_{i=1}^{N} \tau_x \frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} + \tau_y \frac{\partial y_i}{\partial \tau_x}|_{\bar{U}} + \tau_z \frac{\partial z_i}{\partial \tau_x}|_{\bar{U}} \tag{46}$$

$$= -\mathbf{x}_1 (1 - \sum_{i=1}^{N} \frac{x_{1i}}{\mathbf{x}_1} b_i) + \sum_{i=1}^{N} \tau_x \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} + \tau_z \frac{\partial f_{zi}(h_x, h_z)}{\partial \tau_x} \tag{47}$$

Let $\bar{b}$ equal to the average b_i.
Let

$$\theta_x = cov(\frac{b_i}{\bar{b}}, \frac{N x_{1i}}{\mathbf{x}_1}) \tag{48}$$

Variable θ_x represents the covariance of the net social marginal utility of income of tax on individual i. with the share of quantity bought by individual i. Note that the consumption level of x does not affect θ_x, but only the part of good x that is bought. If for example goods x and y were consumed in the same percentage across the income distribution, the concavity of the social welfare function would not matter, but if there is a difference in the share of home production by income class, the concavity, expressed in θ_x becomes relevant again.

Then,

$$1 - \sum_{i=1}^{N} \frac{x_{1i}}{\mathbf{x}_1} b_i = 1 - \bar{b} - \bar{b}\theta_x \tag{49}$$

Replacing in the previous equation,

$$-\frac{\sum_{i=1}^{N} \tau_x \frac{\partial x_i}{\partial \tau_x}|_{\bar{U}} + \tau_y \frac{\partial y_i}{\partial \tau_x}|_{\bar{U}} + \tau_z \frac{\partial z_i}{\partial \tau_x}|_{\bar{U}}}{\mathbf{x}_1} = 1 - \bar{b} - \bar{b}\theta_x - \frac{1}{\mathbf{x}_1} \sum_{i=1}^{N} \tau_x \frac{\partial g_{xi}(h_x, h_z)}{\partial \tau_x} + \tau_z \frac{\partial f_{zi}(h_x, h_z)}{\partial \tau_x} \tag{50}$$

The LHS is the relative reduction in the compensated demand of x_1 induced by the tax.

The RHS depends negatively on θ_x: government should discourage less the consumption of goods that have a positive θ_x, i.e., goods that are heavily consumed by agents with high net social margin utility of income. In other words, the government should discourage less the consumption of goods that lower income consumers buy with more frequency

The higher the reaction of home production to the tax, of both the taxed good (high $\frac{\partial g_{xi}(h_x,h_z)}{\partial \tau_x}$), and good z (high $\frac{\partial f_{zi}(h_x,h_z)}{\partial \tau_x}$) the lower should be the tax rate.

4 Data

The Salvadorean household survey "Encuesta de Hogares de Propósitos Múltiples" (EHMP) 1999-2004, is used in the analysis. The survey is made by El Salvador's statistical office ("Dirección de Estadistícas y Censos- DIGESTYC"). Each wave has approximately 15,000 household and it is evenly distributed across the year, in such a way that it is possible to obtain representative samples using data of three consecutive months. For all these years the survey has modules on demographic, housing, education, labor, remittances, expenditure and agriculture[6]. In the expenditure section households are asked about the consumption of a variety of food and non-food items, as well as how each item was obtained. There are three sources: market, home production and gifts and transfers. Each household is asked about the value gotten from each source for each item.

Using each year EHPM it is possible to construct the budget share of housing, food, health and educational expenditures. Figure (1) shows the budget share of these aggregates for 1999-2004 (3 months moving average). Food represents around 54% of the budget, followed by housing with 23% and other expenditures[7].

Table (2) shows the average value of food consumption by source. The difference between total consumption and total itemized consumption is that the second includes only household that open their consumption by income and source. On average, in 1999, 87% of consumption was bought, 9% was home produced, and 3% came from gifts and transfers.

5 Home Production and Food VAT Regressivity

In order to address the food VAT incidence, it is necessary to understand the percentage of home production that is bought in the market. Figure (2) shows the food share for each expenditure decile in 1999-2004. As expected, the food

[6] The agriculture module is not available.

[7] See the appendix for details on the construction of variables.

share decreases with expenditure[8]. In 1999, the first decile spends 62% of its budget on food, whereas the top decile spends 40%. On average, the first decile spends on VAT as a proportion of its budget, 54% more. This implies that a food VAT is regressive: considering the food share information, the first decile would pay 54% more VAT than the top decile as proportion of their own budget.

However, to address the VAT incidence, the relevant variable is market-bought food share, not food share[9]. The model presented above predicts that households with lower labor income will have a higher proportion of home production. Figure (3) shows the percentage of consumption bought, home produced and received as gifts and transfers by per capita expenditure decile. It can be seen that home production decreases with total expenditure. In 1999, the share bought goes from 72% in the first decile to 92% in the last decile, home production represents 15% in the first decile and 6% in the last one, and gifts and transfers go from 12% to 1.5%

The remaining question is whether the distribution of home production is big enough to offset the distribution of food consumption. Figure (4) shows that is not the case. Each line in the graph represents the share of total expenditure paid in VAT under different scenarios for each expenditure decile. The proportion of expenditure paid in taxes is bigger when there is no exemption and home production is not considered. Note there are two lines that reflect "total consumption", the difference between them is that the second only considers itemized consumption[10]. Therefore, the second one is the relevant comparison to the other scenarios. The other three scenarios are different combinations of tax exemption and home production. The lower tax paid occurs when there is home production and the tax exemption. Almost all deciles pay more taxes when there is no tax exemption but home production is recognized.

The relationship between VAT paid as a percentage of total expenditure of the first over-the-top decile decreases from 2.3 times with total expenditure to 1.86 with home production and no tax exemption. At the same time, it is important to recognize that the elimination of the tax exemption does not increase the tax burden from the bottom to the top line in the graph, but to the dashed crossed line. This reduces the size of the tax increase by about half to the first decile.

6 The effect of the tax change

As mentioned before, in April 2000 a tax exemption to fruits, vegetables, rice, beans, and milk ended. In this section, we are interested in the effect of the end of the exemption in home production.

[8] It has been documented an increase in the cost per calorie as income increases (Deaton 1997). Therefore, the relationship between food share and total expenditure would be steeper with a constant bundle.

[9] It would be interesting to distinguish buys from formal market and buys from informal markets. Unfortunately that clasification is not available.

[10] Not all households itemize their consumption (by source and item). Consumption source can only be computed for itemizing households.

6.1 Complementarities in home production

If there are complementarities in home production, then the end of the tax exemption would not only affect formerly tax exempted items, but also other goods that can be home produced (for example corn tortillas, sugar, meat, eggs and cheese).

Table (3) shows the percentage of households with any home production that produce tax exempted items. Depending on the year, they are between 45% and 60% of the households. Table (4) shows that of those households with home production of tax exempted goods, between 73% and 87% produce other items. The high prevalence of joint production suggests the existence of complementarities in home production.

6.2 Specification

The increase in home production is only expected when a wedge between the market and home production price is created. Therefore not any price increase should increase home production. For example, if an increase in fertilizers drives the price increase of agricultural goods, then, assuming home and market production have the same technology, it will affect the price of both market and home production and will not generate a wedge between them, and therefore no effect in home production is expected. A tax increase explicitly creates a wedge between these prices, and the tax increase analyzed induces the wedge only for certain goods.

The tax effect will be identified with a difference in difference approach. The approach is to look at a close window around the tax change to identify behavioral changes. The advantage of a small window is that it is unlikely that other things could affect home production and thus any effects in home production can be attributed to the tax change. The disadvantage is how much home production can actually be produced in a short period of time. For beans, the sowing period is in May or August and the harvest is in July or October respectively. The harvest season for rice is usually in September. Fruits are produced all the year, but the harvest is stronger in December, and vegetables are also harvested all the year, with a stronger season from November to May[11]. Therefore May is a sowing season, and we could observe effects in the pattern of home production immediately.

The first difference will be a comparison of the year of the tax change with a different year. The year dummy will capture any difference in the level of home production between the two years. To control for seasonal effects, a quarter dummy is included. The variable of interest is the interaction of this two variables, which will capture any differential effect in the treatment year after the tax change. Therefore the estimated equation is:

[11] According to conversations with representatives of the Ministry of Agriculture of El Salvador.

$$\log(p_{ijt}q_{ijt}) = \alpha_j + \beta_1 dy + \beta_2 dq + \beta_3 dy * dq + \epsilon_{ijt}$$

The dependent variable is the log of the value of home production. Municipality level fixed effects are used (α_j) to capture different geographical characteristics in home production. Since the tax change was in April 2000, dq is a dummy with value equal one for May, June and July and equal zero for January, February and March. dy equal one for 2000, and equal zero for 1999.

The chosen comparison year is 1999, because it is the closest year when it is possible to obtain data of the first quarter. An earthquake in 2001 made impossible the survey implementation on the first months of 2001.

6.3 Results

Table (5) shows the main results. The dependent variables are the logarithm of the value of consumption of home production, market consumption and gifts and transfers. The year dummy takes the value of 1 for 2000 and 0 for 1999, and the quarter dummy takes the value of 1 for May, June and July, and 0 for January, February and March. The interaction is positive and significant for home production, and is not significant for market consumption and gifts and transfers.

Home production is 19.5% higher after the tax change. Since the tax exemption affected only to 27% of consumption (the percentage of tax exempted goods over total itemized consumption), the implicit elasticity is 5.5. There is no significant effect on neither market consumptions nor gifts and help in the same period

Table (6) shows several robustness checks. Panel A shows the same regression but for four different time periods, the first two are different control periods: 2002 and 2003. For both of them, there is a positive and significant effect in home production. No effect is found for market consumption, and a positive effect is found in gifts and transfers. There is no expected sign for gifts and transfers because they are not a household decision. A negative sign for market consumption is possible but not certain, since there are income effects that affect the total demand of the good.

The other two periods in Panel A: 2002-2003 and 2003-2004 are set as fake experiments. If there are no underlying unobservables that could affect home production in the second quarter with respect to the first one, then the interaction should not be significant. In fact, for home production and gifts and transfers none of them are significant. For market consumption, the interaction is negative and significant in 2002-2003.

Since many households don't have home production, market consumption and/or gifts and transfers, the regression in logs has many missing values. Panel B shows the interaction coefficient when missing values are replaced by the 5-percentile value. The coefficient for home production remains significant, and the results for market consumption and gifts and transfers found before still hold. However, the size of the coefficient decrease from 0.195 to 0.088.

Panel C shows the results when the dependent variable is changed to the share of home production (or market consumption/gifts and transfers) over total itemized consumption. The share of home production increases by 0.14 , and the share of market consumption decreases by 0.16.[12].

In order to control that the effects in home production are not caused by different samples, Panel D shows the interaction coefficient when both home production and market consumption regressions share the same sample. The results for home production is similar to the one obtained in table (5).

To see the effect of potential outliers, panel E shows the interaction effect when the dependent variable is winsorized at 10% (5% in each end of the distribution). This affect the size of the coefficient. For home production, the coefficient decreases from 0.195 to 0.171.

Finally, the value of the dependent variable is divided by 1.13 for months after the tax change, with the objective to check that the observed tax increase is due to changes in quantities and not changes in the value. Panel F shows that magnitudes of the coefficients and their significance change. The loss of significance of the coefficient for home production has to be consider carefully because it assumes that households report the home production value at market prices including taxes.

6.4 Other results

To check for differences in enforcement, a variable that measures the distance to the capital of the country was interacted by the year*quarter variable. The variable is not significant for any specification when home production is the dependent variable.

The effect of the tax change is stronger in rural areas than in urban areas in the baseline period, as can be seen in table (8). However, when other comparison years are used instead of 1999, the effect is stronger in urban areas. (See table (8)). Therefore it is not possible to define clearly where the effect is bigger[13].

Household labor income and a dummy with value 1 if the chief of the household worked in the agricultural sector, were also included in the regressions, and no pattern was observable[14].

There is no distinguishable difference in home production between formerly tax exempted goods and other goods after the tax change. Table (7) shows the simplest specification, where the dependent variable is the log of the value of home production in formerly tax exempt goods and goods that faced no

[12] The implied increase in the share home production from the baseline estimation (5) is 0.018.

[13] This can be in part to the definition of rural and urban areas in the EHPM. Each municipality center is considered as urban. Other localities are considered urban as long as they have water, electricity, phone, educational centers and urban transport.

[14] Since household labor income depends on hours worked and the sector is also a choice variable, the value of this variables should be measured before the tax change. However, in absence of a panel it is only possible to use these variables at an aggregated level, in this case, the municipality level. Therefore the regressions include the average value of this variables in 1999 for each municipality.

tax change. Using the first two quarters of 1999 and 2000, the year*quarter dummy is positive and significant for both goods types. Using the share of home production or a dummy with value 1 if there is any home production for each good type does not change the result, and is not found when the last months of the year are used as treatment period[15].

Table (10) shows the effect in total demand of formerly taxed and not taxed goods in the quarter after the tax change. The interaction coefficient has a positive sign for both good types, and although the coefficients are not significant at the 5%, they are close to be. This would indicate that the substitution after the tax increase in the short run was in the home production-market consumption margin, and not in the total consumption of the goods.

Finally, the same set of regressions (not shown) was implemented comparing the first quarter (January-March) to the months from August to December. No distinguishable pattern on home production was founded. However, given the large extension of the window it is arguable that some other changes could have affected home production and market consumption, other than the tax change.

7 Conclusions

In most countries, exemptions and differentiated rates are introduced to diminish the regressivity of taxing food. Although there is no doubt that such an effect can be achieved with those instruments, there are efficiency and administrative costs that have to be considered. On the other hand, home production is not evenly distributed across income groups but concentrated in those which lower income. In the case of El Salvador, this decreases the regressivity of food VAT, but does not offset it. In 1999, the ratio of food VAT paid by the first to the last deciles decreases from 2.3 times to 1.86 when home production is considered.

Home production is sensitive to tax changes in the short run. The end of the tax exemption not only increases home production of formerly tax exempted goods, but also on goods that did not face any tax change. This suggests the existence of complementarities in home production decreases the tax base as a response to tax changes, more than the case of absence of complementarities.

Therefore, although there are efficiency costs with different VAT rates and exemptions, the expected effects on the tax base have to be carefully considered. Even though the existence of tax exemption generates certain inefficiencies, its elimination, as any tax increase, generates other inefficiencies. In the case of El Salvador home production increased 18% after the tax change.

[15] A pooled specification with all years and two observation per household, one for home production of formerly tax exempted goods and another one for goods without any tax change was also implemented. The variable of interest in this case was the interaction of year*quarter*good type dummy. This variable was found not significant. (Not shown).

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9 Data Appendix

9.1 Food Consumption

For years 2002, 2003 and 2004, the expenditure module asks for the consumption value of each good in the last seven days, and the source of each item. When the consumption is not itemized, the interviewers only report the total value and not the source. For each item households can indicate more than one source. I group the sources in market consumption, home consumption and gifts and transfers. When a household does not itemize, it doesn't report the source of consumption. I identify the household that itemized, and consider as zero the value of consumption of goods that is not reported. I multiply these weekly values by 52 to get the annual consumption.

For years 1999 and 2000, each household is asked about the value of home production, gifts and transfers, and market consumption for each good. The question is framed about last week for 1999 and the last month for 2000, but there is a frequency question where households can declare a frequency between a day and a year. Using this information, I compute the annual consumption of each item by source. Households can also declare the value of total consumption by each source. Again, when a household itemizes but does not declare the value of one item, it is assumed to be zero.

For each household that itemize I compute the value of rice, beans, fruits, vegetables and milk consumed, and the source of each of them. I can't distinguish corn from other grains as I would like to, so I don't use it. I also compute the total value of market consumption, home production, and gifts. For households that do not itemize, I can only compute the total food consumption.

9.2 Housing

Housing expenditueres include rent and services. If the value of the rent is missing, I impute a value based on an hedonic price regression of the logarithm of rent on household characteristics. Services include water, electricity, gas, phone, TV, etc.

9.3 Education

Expenditure on educational fees, uniforms, textbooks, shoes, transport, and snacks are reported for each household member with more that 3 years old. For each item, households are asked about the value bought, home produced or donated. The expenses on snacks are added to the food expenditure, and the others are grouped for each household under educational expenditures.

9.4 Health

Expenditure on doctor, laboratory analysis and other exams, hospital, and medicines are reported by source (home production, market or donation).

9.5 Others

Households are ask about their consumption on a broad range of services, such as laundry articles, gas, public transport, clothing, furniture, gifts, insurance, etc. The expenditure on durable goods is not directly added to total expenditure, but only a 10%, representing an (arbitrary) flow of services from them. Other expenditures, such as household reparation, transportation and insurance is grouped in "others". Extraordinary expenditures, such as funerals and wedding are not included in the analysis.

Table 1: Observations

	Number of		
Year	Households	Individuals	% Itemized households
1999	16,164	73,313	84.0
2000	16,046	71,665	86.8
2001	11,953	53,002	81.0
2002	16,479	72,119	100.0
2003	16,808	71,683	79.1
2004	16,490	70,558	72.8

Table 2: Proportion of households that produce tax exempted items

	1999	2000	2001	2002	2003	2004
Consumption by source						
Total Consumption	20,802	19,508	19,815	19,155	18,222	19,362
Itemized (*)	15,380	14,865	15,396	13,514	12,506	12,374
Bought	13,527	12,968	13,018	10,563	9,753	9,685
Home Produced	1,414	1,358	1,426	1,480	1,259	1,173
Gifts and Transfers	439	540	952	1,472	1,494	1,515
Help from family	208	231	158	320	383	366
Consumption by Tax Treatmet						
Total Itemized Consumption(**)	14,250	13,665	14,347	11,045	12,375	12,205
Tax Exempted Goods	3,914	3,149	3,249	2,335	2,529	2,577
Bought	3,478	2,792	2,893	2,065	2,241	2,293
Home Produced	359	302	289	204	221	218
Gifts and Transfers	78	55	67	67	67	66
Non Tax Exempted Goods (***)	10,335	10,517	11,098	8,710	9,847	9,628
Bought	8,813	8,832	9,086	6,569	7,410	7,260
Home Produced	1,171	1,182	1,234	1,005	1,025	939
Gifts and Transfers	351	502	778	1,136	1,412	1,429

(*) Itemized consumption by source.
(**) Itemized by source and item
(***)Including VAT

Table 3: Proportion of households that produce tax exempted items

Year	%
1999	0.48
2000	0.51
2001	0.50
2002	0.60
2003	0.59
2004	0.55

Note: % of hosueholds that have any home production
that produce rice, beans, fruits, vegetables or milk.

Table 4: Proportion of Tax Exempted Producing Households that Produce other Items

Year	%
1999	0.86
2000	0.87
2001	0.85
2002	0.73
2003	0.76
2004	0.77

Note: % of households that produce formerly tax exempted items
(rice, beans, fruits, vegetables, milk) that produce any other
or home production.

Table 5: Demand by Source
1999-2000

Dependent Variable: Ln of Value of Consumption of	Home Production	Market Consumption	Gifts and Transfers
Year Dummy	-0.113	-0.023	-0.05
	[2.98]**	[1.40]	[0.59]
Quarter Dummy	-0.066	0.021	-0.042
	[1.46]	[1.19]	[0.47]
Year * Quarter Dummy	0.195	0.009	0.13
	[3.50]**	[0.39]	[1.06]
Observations	5017	15591	1730
R-squared	0.04	0.15	0.08

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Table 6: Robustness Checks

Year * Quarter Dummy Coefficient			
A. Dependent Variable: Ln of Value of Consumption of			
	Home Production	Market Consumption	Gifts and Transfers
Other Control Years			
2000-2002	0.236	-0.019	0.287
	[3.98]**	[0.82]	[2.60]**
2000-2003	0.303	0.033	0.234
	[4.68]**	[1.34]	[1.99]*
Fake Experiments			
2002-2003	-0.065	-0.055	0
	[0.93]	[2.08]*	[0.00]
2003-2004	-0.118	0.035	-0.029
	[1.88]	[1.40]	[0.33]
B. Dependent Variable: Ln Value of Consumption of replacing 0 by 5% value			
1999-2000	0.088	0.014	0.005
	[3.14]**	[0.61]	[0.20]
C. Dependent Variable: Share of			
1999-2000	0.014	-0.016	0.002
	[2.27]*	[2.11]*	[0.36]
D. Dependent Variable: Ln of Value of Consumption of Same sample as Market Consumption			
1999-2000	0.195	0.038	..
	[3.58]**	[0.89]	..
E. Dependent Variable: Ln of Value of Consumption of Winsorized at 10%			
1999-2000	0.171	-0.002	0.137
	[3.61]**	[0.09]	[1.29]
F. Dependent Variable: Excluding Tax Change Increase (*)			
1999-2000	0.073	-0.113	0.007
	[1.31]	[4.93]**	[0.06]

Robust t statistics in brackets
* significant at 5%; ** significant at 1%
(*) In this specification the reported value is divided by 1.13 for months after the tax change.

Table 7: Home Production by Tax Treatment
1999-2000

Dependent Variable: Ln of Value of Consumption of Home Production of		
	Goods with no Tax Change	Formerly Tax Exempted Goods
Year Dummy	-0.074	-0.286
	[2.07]*	[5.70]**
Quarter Dummy	-0.059	-0.076
	[1.36]	[1.33]
Year * Quarter Dummy	0.188	0.155
	[3.48]**	[2.26]*
Observations	4582	2524
R-squared	0.04	0.08

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Table 8: Home Production by Area
1999-2000

Dependent Variable: Ln of Value of Consumption of Home Production		
	Rural	Urban
Year Dummy	-0.129	-0.094
	[2.85]**	[1.43]
Quarter Dummy	-0.114	0.009
	[1.93]	[0.12]
Year * Quarter Dummy	0.225	0.149
	[3.42]**	[1.50]
Observations	3085	1932
R-squared	0.05	0.06

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Table 9: Home Production by Area

	Year * Quarter Dummy Coefficient	
A. Dependent Variable: Ln of Value of Consumption of		
	Rural	Urban
Other Control Years		
2000-2002	0.23	0.259
	[3.35]**	[2.41]*
2000-2003	0.216	0.464
	[2.75]**	[3.64]**
Fake Experiments		
2002-2003	-0.056	-0.124
	[0.66]	[0.94]
2003-2004	-0.073	-0.278
	[1.03]	[2.11]*
B. Dependent Variable: Ln Value of Consumption of replacing 0 by 5% value		
1999-2000	0.122	0.067
	[2.44]*	[2.01]*
C. Dependent Variable: Share of		
1999-2000	0.02	0.009
	[1.74]	[1.42]
D. Dependent Variable: Ln of Value of Consumption of Same sample as Market Consumption		
1999-2000	0.216	0.164
	[3.29]**	[1.71]

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Table 10: Total Consumption
1999-2000

Dependent Variable: Ln of Value of Consumption		
	Goods with no Tax Change	Formerly Tax Exempted Goods
Year Dummy	-0.012	-0.211
	[0.79]	[11.79]**
Quarter Dummy	-0.042	-0.056
	[2.58]**	[2.90]**
Year * Quarter Dummy	0.04	0.048
	[1.92]	[1.93]
Observations	13808	13274
R-squared	0.08	0.06

Robust t statistics in brackets
* significant at 5%; ** significant at 1%

Figure 1: Budget Share

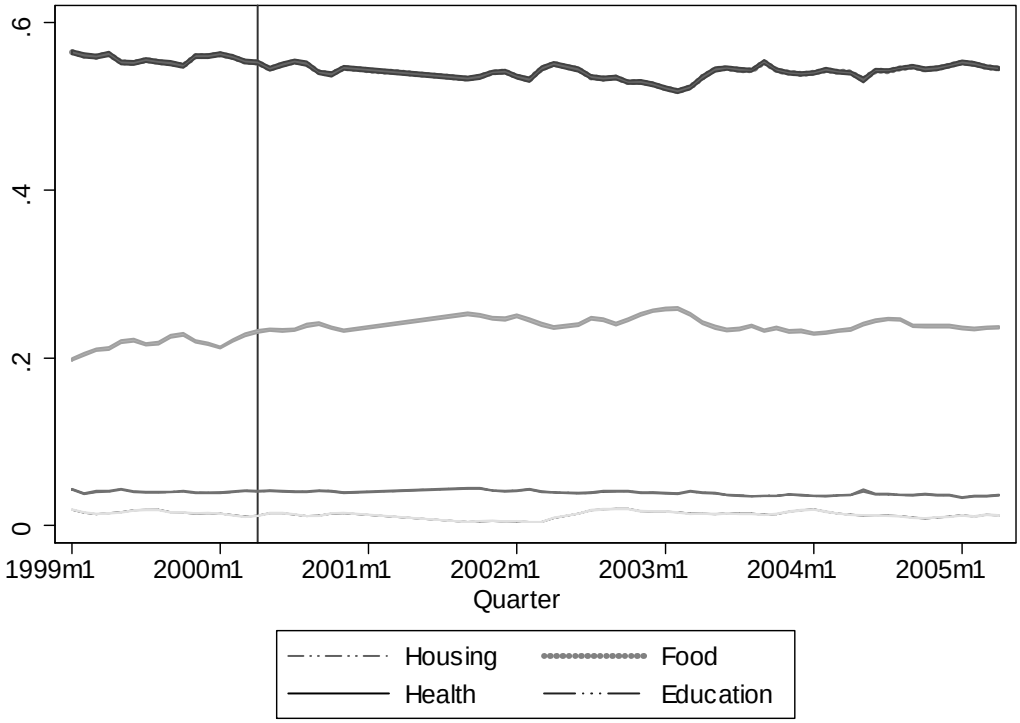

Figure 2: Food Share by Expenditure Decile

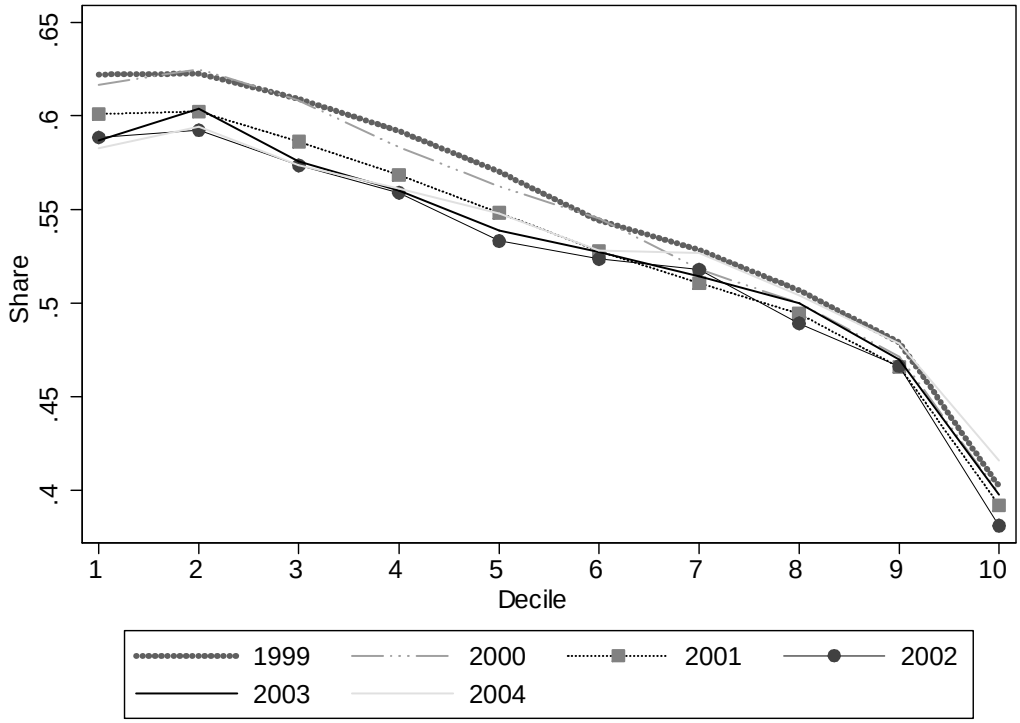

Figure 3: Food Source

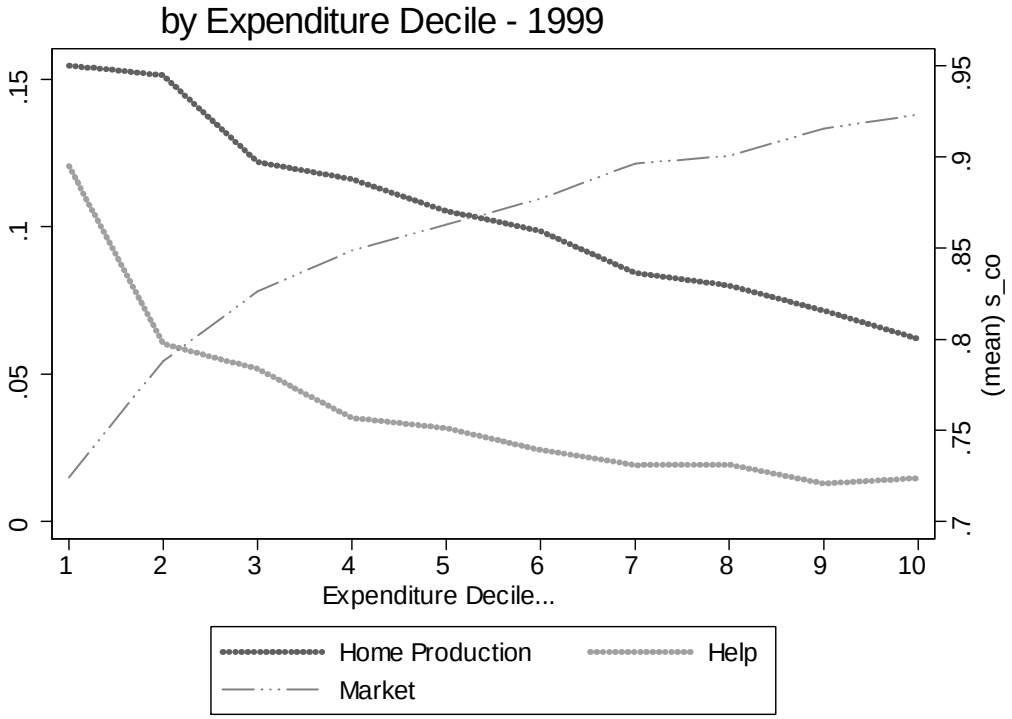

Figure 4: VAT Incidence