

Table 6: Estimation results log-linear model with Heckman's λ

	Estimation with ZCC		Estimation with ATR	
	Coefficient	Standard Error	Coefficient	Standard Error
<i>constant</i>	6.505***	.465	6.627***	.478
<i>gender</i>	-.281**	.112	-.318**	.103
<i>age</i>	.012*	.007	.012**	.006
<i>size</i>	.092***	.026	.092***	.022
<i>s_child</i>	-.084	.244		
<i>s_pens</i>	.216	.347	.281	.322
<i>road</i>	-.027*	.015	-.025*	.014
<i>shop</i>	.004	.003	.004	.003
<i>school</i>	.031**	.016	.029**	.015
<i>tertiary</i>	.671***	.100	.698***	.103
<i>school_o</i>			.004	.018
<i>learn</i>	.218	.153	.226	.155
<i>acad</i>	.391**	.167	.414**	.171
<i>clinic</i>	.054	.107		
<i>groups</i>	.056	.069		
<i>chief</i>			-.079	.059
<i>church</i>			.058	.286
<i>zcc</i>	.481	.501		
<i>atr</i>	.185	.123	.056	.550
λ_1	-.092	.185	.045	.172
λ_0	1.531	1.957	.939	1.379

Notes: Dependent variable: $\ln(\text{income})$; N=180; Adjusted R²= .46. *p < .1, **p < .05, ***p < .01. Standard errors corrected according to Heckman (1979).

Supplementary Appendix A

- 1. Overview of recent micro-level research on the effect of religion on economic variables**
- 2. Data collection and sampling**
- 3. Description of the Heckman (1979) two-step procedure to check for possible selectivity biases arising from unobserved variables and self-selection into religiosity**

1. Overview of recent micro-level research on the effect of religion on economic variables

Study	Synopsis of results with respect to effects on religion on economic variables
Guiso et al. (2003)	Using data from 66 countries, the authors find that religious upbringing, religiosity and religious practice promote economically conducive attitudes.
Cuesta (2004)	Religious affiliation does not have an effect on basic needs satisfaction in Nicaragua.
Steen (2004)	Focusing on men in the USA, 'the paper finds evidence that both men raised as Catholics and men raised as Jews have higher earnings.'
Sakwa (2006)	Among Catholic university students in Nairobi, Kenya, religious attitudes towards poverty correlate with specific poverty alleviation objectives.
Arano and Blair (2008)	There is a 'bicausal relationship between religion and income' in Mississippi, USA.
Chiswick and Huang (2008)	Among Jewish men in the USA, 'religious involvement is associated with more favorable labor market outcomes,' but 'beyond some point religious practice has a negative effect.'
Bettendorf and Dijkgraaf (2010)	Using data from 25 countries, 'church membership is found to have a positive effect on income for high-income countries,' while 'this effect is negative for low-income countries.'
Bettendorf and Dijkgraaf (2011)	Religious attendance does not have an effect on household income in the Netherlands.
Permani (2011)	There is a positive effect of religious social capital on earnings in Indonesia.
Cornelissen and Jirjahn (2012)	In Germany, 'being raised by two religious parents, but having no current religious affiliation is associated with higher earnings.'
Audretsch et al. (2013)	'Religions like Islam and Jainism are more favorable for self-employment,' while 'Hindus are less likely to be self-employed.'

2. Data collection and sampling

The data collection process followed a two-phase design, a qualitative preparatory study followed by a quantitative household survey. We chose the two-phase approach in order to be able to contextualise the key analytical concepts and to pre-test the survey instrument. In the first phase, semi-structured interviews and focus group workshops were conducted in various villages. We gathered information on religious communities and developed contextually relevant categorizations with representatives of the local population. Moreover, we collected data on income sources such as informal income-generating activities and agricultural production patterns such as livestock-breeding, small-scale horticultural activities and the cultivation of field crops (cf. survey questionnaire in supplementary appendix B). The data was used to develop the survey instrument and later to perform consistency checks on the quantitative data.

In the second phase, 221 households were sampled from the universe (all households in Fetakgomo Municipality) in a two-stage cluster sampling process. We used a geographical approach. As the area is entirely rural, in nearly all instances one household inhabits one dwelling. The primary sampling units (clusters) were formed on the basis of the subplace delimitations by StatsSA. Thirty of 61 clusters were randomly selected with equal probability of selection. The size of the clusters varied between 25 and 2066 households.

The secondary sampling units are the households.¹ The sampling frame was recent Google Maps (2011) satellite imagery, in which all dwellings were clearly visible. Cluster delimitations were plotted on the aerial map, facilitating an allocation of households/dwellings to clusters. In each cluster, the households to be interviewed were selected through

¹ In order to ensure compatibility with data from official statistics, we used StatsSA's (2010) definitions of a household as 'a group of persons who live together and provide themselves jointly with food and/or other essentials for living, or a single person who lives alone' and of a household member as 'a person that resides with the household for at least four nights a week.' The household head was operationalised as the household member who bears the responsibility in the household.

fixed rate sampling (1 in 55), ensuring that each household in the universe had the same probability of selection given the differing size of the clusters. The satellite image proved to be an accurate frame. In the rare case of inaccuracies encountered, the frame was adjusted accordingly by adding those household or removing them, respectively. If the household head was absent, at least four re-visits were done at different hours and at least two different days. Of the 221 sampled households, 14 either refused to participate or were repeatedly unavailable. Interviews were conducted in 207 cases, yielding a response rate of 93.7%. Of these, due to missing values and the removal of outliers, 180 are used in the empirical part. All interviews were conducted with the household head in Northern Sotho, using the questionnaire presented in supplementary appendix B.

3. Description of the Heckman (1979) two-step procedure to check for possible selectivity biases arising from unobserved variables and self-selection into religiosity

In the first step, we run two probit-models, on the household head's probability of being member of the ZCC and on the probability of practicing ATR (as those are the religion categories with significant coefficients in the estimation of (2), see section 5 of the main article). The selection of the household into religion category r (zcc or atr , respectively) is modelled as follows.

$$r_i^* = z_i\gamma + u_i \quad (\text{A.1})$$

where r_i^* is a latent variable and religion category $r_i = 1$ if $r_i^* > 0$ and $r_i = 0$ otherwise. z_i is the respective vector of the variables explaining the decision to actively practice zcc or atr . Symbol γ is a vector of the respective coefficients in the probit model and u_i is the error term, assumed to be normally distributed. This probit model needs to contain "at least one nontrivial determinant" of r_i , that is, a variable uncorrelated with household income except through its correlation with the religion category (Cameron & Trivedi, 2005:870). In section 5 of the main article, we identify such variables from the probit model (A.1) in combination with the results of equation (2) and provide a justification why we consider this exclusion restriction to hold.

We compute the inverse Mill's ratio (Heckman's λ) from the generalised residual of the probit estimates. The inverse Mill's ratio is given as

$$\lambda_1 = \frac{\varphi(z_i\gamma)}{\Phi(z_i\gamma)} \quad \text{and} \quad \lambda_0 = \frac{\varphi(z_i\gamma)}{1 - \Phi(z_i\gamma)} \quad (\text{A.2})$$

for the $r=1$ and the $r=0$ cases, respectively. $\varphi(z_i\gamma)$ is the probability density function of the standard normal distribution and $\Phi(z_i\gamma)$ the cumulative distribution function.

In the second step, Heckman's λ is included as an additional regressor in the income equation. It is interacted with the dummy of the religion category r :

$$\ln(\text{income}_i) = \mathbf{x}_i\boldsymbol{\beta} + \beta_r r_i + \beta_a \lambda_{1i} r_i + \beta_b \lambda_{0i} (1 - r_i), \quad (\text{A.3})$$

where \mathbf{x}_i summarises the regressors, $\boldsymbol{\beta}$ is the corresponding vector of coefficients, r_i denotes the religiosity dummy variable with β_r its coefficient. The terms $\beta_a \lambda_{1i} r_i$ and $\beta_b \lambda_{0i} (1 - r_i)$ switch on and off depending on whether a household is in the $r_i = 1$ category or not. The coefficient β_r is the ‘true’ effect of the dummy variable. The coefficients of Heckman's λ , β_a and β_b are the estimated covariances between the unobserved variables in the error term of the probit estimate and the unobserved variables in the error term of the income equation (1). If there is no significant correlation between the error terms, we can rule out selection bias from unobserved variables (Cameron & Trivedi, 2005). To statistically test for selection bias we perform a t-test on the coefficients of λ_1 and λ_0 (cf. Vella & Verbeek, 1999).

References

- Arano, KG, & Blair, BF, 2008. Modeling Religious Behavior and Economic Outcome. Is the Relationship Bicausal? Evidence From a Survey of Mississippi Households. *Journal of Socio-Economics* 37, 2043–53.
- Audretsch, DB, Bönte, W, & Tamvada, JP, 2013. Religion, social class, and entrepreneurial choice. *Journal of Business Venturing* 28, 774–89.
- Bettendorf, L, & Dijkgraaf, E, 2010. Religion and Income: Heterogeneity Between Countries. *Journal of Economic Behavior and Organization* 74, 12–29.
- Bettendorf, L, & Dijkgraaf, E, 2011. The Bicausal Relation between Religion and Income. *Applied Economics* 43, 1351–63.
- Cameron, CA, & Trivedi PK, 2005. *Microeconometrics. Methods and applications.* Cambridge University Press, Cambridge.
- Chiswick, BR, & Huang, J, 2008. The Earnings of American Jewish Men. Human Capital, Denomination, and Religiosity. *Journal for the Scientific Study of Religion* 47, 694–709.
- Cornelissen, T, & Jirjahn, U, 2012. Religion and earnings. Is it good to be an atheist with religious parental background? *Economics Letters* 117, 905–8.
- Cuesta, J, 2004. From Economicist to Culturalist Development Theories. How Strong is the Relation between Cultural Aspects and Economic Development? *The European Journal of Development Research* 16, 868–91.
- Google Maps, 2011. maps.google.com. Accessed 6 June 2011.
- Guiso, L, Sapienza, P, & Zingales, L, 2003. People's Opium? Religion and Economic Attitudes. *Journal of Monetary Economics* 50, 225–82.
- Heckman, JJ, 1979. Sample selection bias as a specification error. *Econometrica* 47, 153–61.
- Lipford, JW, & Tollison, RD, 2003. Religious participation and income. *Journal of Economic Behavior & Organization* 51, 249–60.

Permani, R, 2011. The presence of religious organisations, religious attendance and earnings.

Evidence from Indonesia. *The Journal of Socio-Economics*, 40 (3), 247–258.

Sakwa, MM, 2006. Bible and Poverty in Kenia. An Empirical Exploration. Dissertation:

Radboud Universiteit.

StatsSA (Statistics South Africa), 2010. Concepts and definitions for Statistics South Africa

v3. Pretoria: Statistics South Africa.

Steen, TP, 2004. The relationship between religion and earnings. Recent evidence from the

NLS Youth Cohort. *International Journal of Social Economics* 31, 572–81.

Vella, F, & Verbeek, M, 1999. Estimating and interpreting models with endogenous treatment

effects. *Journal of Business & Economic Statistics* 17, 473–78.

Questionnaire Number	
Distance to tar road	[km]
Reliability / Remarks	

1. Socio-demographic Characteristics

1.a Mohlokomedi wa lapa / Motho yo a rwalago maikarabelo

Gender	<input type="checkbox"/> Monna	<input type="checkbox"/> Mosadi
Age	Le belegwe neng?	

School	<input type="checkbox"/> sa se tsena
Le feditše sekolo ka mphato ofe?	

Tertiary Education	[Code 1-6]
Le ile la tsena college goba yunibesithi?	
Le na le tikrii ya college goba yunibesithi?	
Le ile la tsena sekolo sa mošomo?	

Tertiary education codes	
1	= unfinished learnership
2	= learnership
3	= unfinished college
4	= college
5	= unfinished university
6	= university

Schooling codes	
0	= No schooling
1	= G1/Sub A
2	= G2/Sub B
3	= G3/S1
4	= G4/S2
5	= G5/S3
6	= G6/S4
7	= G7/S5
8	= G8/S6/F1
9	= G9/S7/F2
10	= G10/S8/F3
11	= G11/S9/F4
12	= G12/S10/F5

1.b Members of the household

Mo lapeng le go dula batho ba bakae? (Batho ba ba robalago mo lapeng matšatši a a fihlago a mane mo bekeng)				
	Motho wa mathomo ke lena. Motho wa bobedi, o...			
	O belegwe neng?	O feditše sekolo ka mphato ofe?	Tertiary Education	
2		<input type="checkbox"/> sa se tsena	[Code 1-6]	
3		<input type="checkbox"/> sa se tsena	[Code 1-6]	
4		<input type="checkbox"/> sa se tsena	[Code 1-6]	
5		<input type="checkbox"/> sa se tsena	[Code 1-6]	
6		<input type="checkbox"/> sa se tsena	[Code 1-6]	
7		<input type="checkbox"/> sa se tsena	[Code 1-6]	
8		<input type="checkbox"/> sa se tsena	[Code 1-6]	
9		<input type="checkbox"/> sa se tsena	[Code 1-6]	
10		<input type="checkbox"/> sa se tsena	[Code 1-6]	
11		<input type="checkbox"/> sa se tsena	[Code 1-6]	
12		<input type="checkbox"/> sa se tsena	[Code 1-6]	

1.c Social Status

Maemo a lapa le ke afe setšhabeng? / Mošomo wa lena setšhabeng ke eng?		
Tona		[0/1]
Moetapele wa koma		[0/1]
Le leloko sehlopa sa poloko?		[0/1]
Le leloko la serapa sa community garden project?		[0/1]
Le na le karata ya boleloko bja mokahlo wa dipolitiki?		[0/1]
Le moleloko wa dihlopa tše dingwe?		[0/1;efe]
Le tswalana bjang le ba mošate?		[Code 0-4]

Chief's family codes	
0	=no
1	=distant family or council member and no relation
2	=2 nd degree relation (e.g. cousin) or distant relation and council member
3	=1 st degree relation (e.g. brother) or relation and senior councillor
4	=chief him/herself

2. Distances

2.a Central locations

Le ya kae go reka dijo (mabenkele a magolo)?		[km]
Go na le kliniki mo motseng?		[km]

3. Religion / Tumelo

Dipotšišo tše di lebane le mohlakomedi wa lapa le / Questions apply to household head

3.a Church attendance

Naa le tsena kereke efe?	Le thomile neng go tsena kereke ve?	Le tsenela ditirelo tše kae mo kerekeng?	Le tsenela mediro ye mengwe ya phutego gaka (go swana le khwaere goba mekgatlo ya banna goba ya basadi goba dihlopa tša baswa etc.)? / Le tšea karolo efe mo kerekeng?
		<input type="checkbox"/> / <input type="checkbox"/> / <input type="checkbox"/> g	<input type="checkbox"/> beke / <input type="checkbox"/> kgwedi / <input type="checkbox"/> ngwaga
Le tsena kereke ye ngwe gape?		per year	times per year
		<input type="checkbox"/> / <input type="checkbox"/> / <input type="checkbox"/> g	<input type="checkbox"/> beke / <input type="checkbox"/> kgwedi / <input type="checkbox"/> ngwaga
		per year	times per year

3.b Traditional Religion

Le a phasa? [0/1]

3.c Praying

Naa le rapela ka nnoši? Gaka? ka beke

4. Agriculture / Temo

4.a Field crops

Le a lema mašamong naa?

Area Le na le mašemo a makae? Morgen / ha

Water Ka ntle ga pula, o na le meetse a go humanago go tšweletša temo ya gago pele? [0/1]

Crops

Ke dibjalwa dife tšeo o di bjalago tšamong ya gago?		
Dibjalwa dife?	Ka tiwaelo le buna ... (mafela a ma) kaakang ka ngwaga o tee?	Le rekiša ... ka bokae?
Mafela / Mahea		
Mabele		
Leotša / lebelebele		
Magapu		
Dinawa		
Dipongisi		
Marotse		
		Income from field crops
Le lema ka eng?	<input type="checkbox"/> onki	<input type="checkbox"/> erekere
Le ba lefa bokae / Terekere ke bokae?	Ka tšhelete	
Le tšhela manyoro?	[0/1]	[ke eng?] Ke bokae? <input type="text"/>
		Input costs – field crops

4.b Vegetables (harvest year round)

Le bjala dibjalo ka tšhingwaneng / serapeng?

Area m²

Le bjala dibjalo dife?			
Dibjalo	Area (m ²)	Ka tlwaelo le buna ... kaakang ka beke?	Le rekiša ... ? / Le rekiša ... ka bokae? (refer to quantity given)
Beetroot			
Carrot			
Dintso			
Ditamati			
Eie			
Khabetšhe			
Morogo			
Pepper			
Potato			
Spinatšhe			

Income from gardening

Le tšhela manyoro? [ke eng?] Ke bokae? Input costs – garden vegetables

4.e Livestock and poultry

Naa le na le diruiwa?

Diruiwa	Le na le ... tše kae?	Ka tlwaelo le rekiša ... tše kae ka kgwedi?	Ka tlwaelo le rekiša ka bokae ... e tee?	Le hlaba ... tše kae ka ngwaga?
Dikgomo				
Dipudi				
Dinku				
Dikolobe				
Dikgogo				
Ditonki				

Income from l+p

Livestock and poultry products

Le a gama? Le tlatša dibuckete tše kae ka letšatši? Buckete ke dilitere tše kae?

Maswi a kgomo	litres
Maswi a pudi	litres
Maswi a nku	litres
Le humana mae a makae ka letšatši?	

Income from l+p products

Naa le hira batho go hlokomela diruiwa tša gago?

Aowa Ee → Le ba le fa bokae? ka be

Labour costs l+p

4.f Fruits

Naa le na le mehlare ya dkenywa? E mekae?

4.g Firewood

Le rwallela dikgong tša mollo? (for home use only)

Aowa Ee → Le rwallela gaka? ka beke

Total income from agriculture

5. Household Income / Letseno

5.a Formal sector income

Le a šoma naa? Batho ba bangwe ba ba dulago mo lapeng ba a šoma? (formal employment)			Batho ba ba dulago ka mo lapeng le ba humana letseno la digwebong tša bona na? (formal business)		
	Le / o šomang?	Tefo ke bokae?		Kgwebo ya lena / gagwe ke eng?	Ka tlwaelo le / o dira bokae ka beke goba ka kgwedi?
Mohlokometri			Mohlokometri		
yo mongwe			yo mongwe		
yo mongwe			yo mongwe		
Total			Total		

Le humana phenšene ya mošomo? Ke bokae? _____ **ka kgwedi**

5.b Informal sector income

Mokgwa o mongwe wa go iphediša ke ofe? / Le na le mošomo wa lebakanyana?		
Mokgwa wa go iphediša (rekiša / kgwebo potlana / aga / go hiriša etc.)	Ka tlwaelo le dira bokae ka beke goba ka kgwedi?	Mohlokometri goba yo mongwe?
		<input type="checkbox"/> mohlokometri <input type="checkbox"/> motho yo mongwe
		<input type="checkbox"/> mohlokometri <input type="checkbox"/> motho yo mongwe
		<input type="checkbox"/> mohlokometri <input type="checkbox"/> motho yo mongwe
		<input type="checkbox"/> mohlokometri <input type="checkbox"/> motho yo mongwe
		<input type="checkbox"/> mohlokometri <input type="checkbox"/> motho yo mongwe
Total		

5.c Government grants / other government support

Batho ba ba dulang ka mo lapeng le ba humana mphiwafela na?			
Mphiwafela wa old age		(how many)	* R 1140 =
Mphiwafela wa bana		(how many)	* R 260 =
Total			

Batho ba lapa le ba humana mphiwafela o mongwe wa mmušo? (other government support)	
Ke mphiwafela wa eng?	Ke bokae ka kgwedi?

Lelapa le humana mohlagase wa mahala? (free basic electricity) _____ [0/1]

5.d Remittances

Le humana thušo ya batho ba ba sa dulego ka mo lapeng le?			
	Ke eng le lena?	O le thuša ka eng?	Tšelele goba tšelele ya bokae?
1			
2			
3			
4			
Lena le thuša batho ka tšelele goba dilo tše dingwe? (negative remittances)			
Total			

Total income excluding agriculture	
Total overall income	