**Sibhatu KT (2019) Doi: 10.3389/fsufs.2019.00075**

**Supplementary Material**

**Table A1.** Verification of instrumental variables by household type

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Adopt oil palm | | Dietary diversity score | | Log fruits and vegetables | | Log calorie | | Log food expenditure | |
| All HHs | Local | All HHs | Local | All HHs | Local | All HHs | Local | All HHs | Local |
| Altitude | -0.010\*\*\* | -0.010\*\*\* | -0.001 | -0.001 | -0.001 | -0.001 | -4.6e-04 | -4.7e-04 | -0.001 | -0.001 |
| (0.001) | (0.002) | (0.000) | (0.000) | (0.001) | (0.001) | (3.8e-04) | (4.6e-04) | (0.000) | (0.001) |
| HH size | 0.027 | 0.043 | 0.013\*\* | 0.010 | 0.028\*\* | 0.026 | -0.057\*\*\* | -0.055\*\*\* | -0.066\*\*\* | -0.063\*\*\* |
| (0.023) | (0.027) | (0.007) | (0.008) | (0.013) | (0.015) | (0.007) | (0.008) | (0.007) | (0.008) |
| Age of HH head | -0.003 | -0.009\*\* | -0.001 | -0.001 | 0.001 | 0.000 | 0.001 | -0.000 | 0.001 | 0.000 |
| (0.003) | (0.004) | (0.001) | (0.001) | (0.002) | (0.002) | (0.001) | (0.001) | (0.001) | (0.001) |
| Education of HH head | 0.010 | 0.025 | 0.008\*\*\* | 0.008\*\* | 0.025\*\*\* | 0.028\*\*\* | 0.010\*\*\* | 0.011\*\*\* | 0.018\*\*\* | 0.020\*\*\* |
| (0.011) | (0.013) | (0.003) | (0.004) | (0.006) | (0.007) | (0.003) | (0.004) | (0.003) | (0.004) |
| HH owns business | 0.133 | 0.288\*\*\* | 0.036 | 0.042 | 0.104\*\* | 0.112\*\* | 0.077\*\*\* | 0.067\*\* | 0.139\*\*\* | 0.142\*\*\* |
| (0.086) | (0.103) | (0.025) | (0.030) | (0.045) | (0.053) | (0.024) | (0.028) | (0.028) | (0.033) |
| Ethnicity: (1=Melayu) | -0.193\*\* | -0.096 | -0.034 | -0.030 | -0.040 | 0.016 | -0.013 | 0.019 | -0.071\*\*\* | -0.018 |
| (0.083) | (0.100) | (0.024) | (0.028) | (0.040) | (0.049) | (0.022) | (0.025) | (0.026) | (0.029) |
| Cultivated land area | 0.042\*\*\* | 0.053\*\*\* | 0.002 | 0.001 | 0.014\*\*\* | 0.013\*\*\* | 0.011\*\*\* | 0.010\*\*\* | 0.015\*\*\* | 0.014\*\*\* |
| (0.012) | (0.015) | (0.001) | (0.002) | (0.003) | (0.003) | (0.002) | (0.002) | (0.003) | (0.003) |
| Credit from formal source | 0.435\*\*\* | 0.135 | 0.002 | -0.010 | 0.116\*\*\* | 0.130\*\* | 0.041\* | 0.030 | 0.041 | 0.024 |
| (0.081) | (0.107) | (0.024) | (0.031) | (0.042) | (0.055) | (0.023) | (0.030) | (0.026) | (0.034) |
| Titled land (%) | 0.392\*\*\* | 0.047 | 0.037 | 0.038 | 0.116\*\* | 0.159\*\*\* | 0.092\*\*\* | 0.105\*\*\* | 0.107\*\*\* | 0.135\*\*\* |
| (0.088) | (0.113) | (0.026) | (0.033) | (0.045) | (0.058) | (0.025) | (0.031) | (0.028) | (0.034) |
| Dummy 2015 | -0.030 | 0.066 | 0.003 | 0.009 | -0.721\*\*\* | -0.744\*\*\* | -0.102\*\*\* | -0.090\*\*\* | 0.046\*\* | 0.057\*\* |
| (0.073) | (0.090) | (0.021) | (0.026) | (0.036) | (0.043) | (0.020) | (0.023) | (0.023) | (0.027) |
| Constant | -0.320 | -0.341 | 1.847\*\*\* | 1.869\*\*\* | 5.776\*\*\* | 5.800\*\*\* | 7.973\*\*\* | 7.988\*\*\* | 8.692\*\*\* | 8.675\*\*\* |
| (0.248) | (0.298) | (0.070) | (0.082) | (0.116) | (0.132) | (0.067) | (0.077) | (0.078) | (0.089) |
| Observations | 1378 | 959 | 1378 | 959 | 1377 | 958 | 1378 | 959 | 1378 | 959 |
| *Pseoudo R2*  */Adj. R*2 | 0.105 | 0.103 | 0.005 | 0.006 | 0.264 | 0.287 | 0.153 | 0.157 | 0.200 | 0.216 |

*Notes:* Coefficients are shown with robust standard errors in parentheses. \*\* and \*\*\* denote significance at 5% and 1% levels, respectively. Columns (1) is estimated by probit regression. Column (2) is estimated by Poison. Columns (3)-(5) are from an ordinary least square (OLS) estimation.

**Table A2.** Binary switching regression for oil palm adoption and impact on household diets and food expenditure (only local households)

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Log HDDS (9 food groups) | | | Log fruits and Vegetables (g/AE) | | | Log calorie (kcal/AE) | | | Log food expenditure per AE | | |
| Selection  (1) | Outcome | | Selection  (4) | Outcome | | Selection  (7) | Outcome | | Selection  (10) | Outcome | |
| Adopters  (2) | Non-adopters  (3) | Adopters  (5) | Non-adopters  (6) | Adopters  (8) | Non-adopters  (9) | Adopters  (11) | Non-adopters  (12) |
| HH size | 0.038 | -0.002 | 0.010\* | 0.044 | 0.001 | 0.027 | 0.042 | -0.092\*\*\* | -0.044\*\*\* | 0.043 | -0.111\*\*\* | -0.049\*\*\* |
| (0.027) | (0.009) | (0.005) | (0.027) | (0.027) | (0.019) | (0.027) | (0.016) | (0.009) | (0.027) | (0.015) | (0.010) |
| Age of HH head | -0.007 | 0.000 | -0.000 | -0.009\*\* | -0.002 | 0.002 | -0.009\*\* | 0.001 | 0.001 | -0.010\*\* | -0.001 | 0.002 |
| (0.004) | (0.001) | (0.001) | (0.004) | (0.004) | (0.002) | (0.004) | (0.002) | (0.001) | (0.004) | (0.002) | (0.002) |
| Education of HH head | 0.018 | 0.002 | 0.009\*\*\* | 0.026\*\* | 0.016 | 0.026\*\*\* | 0.027\*\* | 0.001 | 0.013\*\*\* | 0.025\* | 0.010 | 0.020\*\*\* |
| (0.013) | (0.004) | (0.003) | (0.013) | (0.013) | (0.007) | (0.013) | (0.007) | (0.004) | (0.013) | (0.008) | (0.005) |
| HH owns business | 0.244\*\* | -0.028 | 0.031 | 0.293\*\*\* | 0.163\* | -0.006 | 0.281\*\*\* | 0.044 | 0.035 | 0.293\*\*\* | 0.091 | 0.103\*\* |
| (0.095) | (0.029) | (0.020) | (0.103) | (0.097) | (0.071) | (0.102) | (0.062) | (0.038) | (0.103) | (0.061) | (0.047) |
| Ethnicity: (1=Melayu) | -0.072 | -0.002 | -0.036\*\* | -0.085 | -0.065 | 0.076 | -0.082 | 0.045 | 0.018 | -0.096 | 0.009 | -0.020 |
| (0.092) | (0.030) | (0.017) | (0.101) | (0.091) | (0.059) | (0.101) | (0.050) | (0.030) | (0.100) | (0.054) | (0.035) |
| Cultivated land area | 0.044\*\*\* | -0.004\*\*\* | 0.000 | 0.053\*\*\* | 0.002 | 0.018\*\* | 0.055\*\*\* | 0.002 | 0.013\*\* | 0.058\*\*\* | 0.006\*\* | 0.014\*\* |
| (0.011) | (0.002) | (0.001) | (0.016) | (0.003) | (0.007) | (0.016) | (0.003) | (0.005) | (0.016) | (0.003) | (0.007) |
| Titled land (%) | 0.072 | -0.030 | 0.061\*\*\* | 0.049 | 0.103 | 0.173\*\* | 0.030 | 0.052 | 0.116\*\*\* | 0.037 | 0.002 | 0.170\*\*\* |
| (0.105) | (0.032) | (0.020) | (0.112) | (0.107) | (0.070) | (0.113) | (0.059) | (0.036) | (0.111) | (0.061) | (0.042) |
| Credit from formal source | 0.142 | -0.048 | -0.013 | 0.126 | -0.059 | 0.183\*\*\* | 0.150 | -0.081 | 0.076\*\* | 0.142 | -0.101 | 0.074\* |
| (0.102) | (0.033) | (0.021) | (0.108) | (0.096) | (0.068) | (0.106) | (0.058) | (0.034) | (0.107) | (0.062) | (0.040) |
| Altitude | -0.004\*\* |  |  | -0.010\*\*\* |  |  | -0.009\*\*\* |  |  | -0.009\*\*\* |  |  |
| (0.002) |  |  | (0.002) |  |  | (0.002) |  |  | (0.002) |  |  |
| Dummy 2015 | 0.060 | -0.009 | 0.008 | 0.066 | -0.682\*\*\* | -0.773\*\*\* | 0.057 | -0.113\*\* | -0.087\*\*\* | 0.055 | 0.060 | 0.046 |
| (0.085) | (0.026) | (0.016) | (0.091) | (0.077) | (0.051) | (0.090) | (0.047) | (0.027) | (0.089) | (0.051) | (0.033) |
| Constant | -0.613\*\* | 2.262\*\*\* | 1.754\*\*\* | -0.389 | 6.586\*\*\* | 5.520\*\*\* | -0.378 | 8.666\*\*\* | 7.850\*\*\* | -0.386 | 9.534\*\*\* | 8.417\*\*\* |
|  | (0.297) | (0.087) | (0.054) | (0.299) | (0.302) | (0.171) | (0.301) | (0.217) | (0.093) | (0.296) | (0.180) | (0.110) |
| *Σa* |  | 0.289\*\*\* |  |  | 0.699\*\*\* |  |  | 0.451\*\*\* |  |  | 0.475\*\*\* |  |
|  |  | (0.035) |  |  | (0.060) |  |  | (0.060) |  |  | (0.043) |  |
| *Σn* |  |  | 0.207\*\*\* |  |  | 0.657\*\*\* |  |  | 0.344\*\*\* |  |  | 0.422\*\*\* |
|  |  |  | (0.008) |  |  | (0.032) |  |  | (0.023) |  |  | (0.029) |
| *ρa* |  | -0.972\*\*\* |  |  | -0.502\*\*\* |  |  | -0.710\*\*\* |  |  | -0.684\*\*\* |  |
|  |  | (0.023) |  |  | (0.173) |  |  | (0.159) |  |  | (0.119) |  |
| *ρ*n |  |  | -0.200\*\*\* |  |  | -0.329\* |  |  | -0.286 |  |  | -0.458\* |
|  |  |  | (0.0619) |  |  | (0.200) |  |  | (0.458) |  |  | (0.258) |
| Wald test on exclusion restriction variable Altitude: | | | | | | | | | | | | |
|  | χ2 = 0.000\*\*\* | | | *χ*2 = 0.017\*\* | | | χ2 = 0.049\*\* | | | χ2 = 0.000\*\*\* | | |
| Observations | 959 | | | 958 | | | 959 | | | 959 | | |

*Notes:* Coefficients are shown with standard errors in parentheses. HDDS, household dietary diversity score. HH, household. Subscript *a* and *n*denote adopters and non-adopters households, respectively.\*, \*\*, \*\*\* denote significance at 10%, 5% and 1% levels, respectively.

**Table A3.** Treatment effects of oil palm adoption (only local households)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variables | Household type | Adopters | Non-adopters | Treatment effects | |
| Log of HDDS (9 food groups) | Adopters | 1.914 | 1.830 | 0.083\*\*\* | ATT |
| (0.002) | (0.002) | (0.002) |
| Non-adopters | 2.376 | 1.866 | 0.510\*\*\* | ATU |
| (0.001) | (0.002) | (0.002) |
| Log fruits and vegetables (gm/AE/day) | Adopters | 6.013 | 5.730 | 0.283\*\*\* | ATT |
| (0.017) | (0.020) | (0.009) |
| Non-adopters | 6.454 | 5.784 | 0.66\*\*\* | ATU |
| (0.013) | (0.014) | (0.006) |
| Log calorie (kcal/AE/day) | Adopters | 7.964 | 7.989 | -0.025\*\*\* | ATT |
| (0.008) | (0.008) | (0.006) |
| Non-adopters | 8.437 | 7.845 | 0.592\*\*\* | ATU |
| (0.006) | (0.005) | (0.004) |
| Log food expenditure (000 IDR/AE/year) | Adopters | 8.795 | 8.661 | 0.134\*\*\* | ATT |
| (0.011) | (0.010) | (0.007) |
| Non-adopters | 9.286 | 8.625 | 0.651\*\*\* | ATU |
| (0.007) | (0.006) | (0.005) |

*Notes:* Standard errors in parenthesis. \*\*\* denote significance at 1%, based on t-tests. IDR is Indonesian rupiah. ATT: average treatment effect on the treated; ATU: average treatment effect on the untreated.

**Table A4.** Comparing income and expenditure between households who adopted oil palm after 2012 and households who have not yet adopted the crop

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Adopted | Not yet adopted | Difference | t-value | [95% conf. Interval] |
| Annual expenditure per year (000 IDR/AE) | 18346.42 | 12524.16 | -5822.26 | -1.161 | [-15797.36 4152.843] |
| (4995.58) | (446.743) | (5015.52) |  |  |
| Annual income per year (000 IDR/AE) | 23856.25 | 16363.05 | 7493.20 | -1.120 | [-20786.18 5799.786] |
| (6529.86) | (1461.65) | (6691.45) |  |  |
| Observations | 83 | 357 |  |  |  |

*Note:* Mean values with standard errors in parenthesis are reported. The *t*-test is conducted on mean differences. AE, adult equivalent.