# Appendix A: additional results

**Figure A1. Time effects in m3**



*Notes*: Time effects () are estimated in relation to year 2004, which is set as the reference year.

Table A1. Structure of the dataset

|  |  |  |  |
| --- | --- | --- | --- |
| **Country name** | **No. of regions** | **No. of representative farms\*** | **No. of observations (N∙T)** |
| Belgium | 2 | 4 | 43 |
| Bulgaria | 6 | 33 | 250 |
| Czech Republic | 1 | 5 | 70 |
| Denmark | 1 | 5 | 70 |
| Germany | 12 | 37 | 441 |
| Greece | 4 | 17 | 214 |
| Spain | 10 | 43 | 454 |
| Estonia | 1 | 6 | 60 |
| France | 17 | 38 | 431 |
| Hungary | 1 | 6 | 84 |
| Italy | 18 | 89 | 1 031 |
| Lithuania | 1 | 6 | 77 |
| Latvia | 1 | 6 | 68 |
| Malta | 1 | 3 | 30 |
| Netherlands | 1 | 4 | 46 |
| Austria | 1 | 4 | 56 |
| Poland | 4 | 22 | 284 |
| Portugal | 1 | 5 | 70 |
| Romania | 7 | 41 | 350 |
| Finland | 2 | 5 | 62 |
| Sweden | 1 | 4 | 53 |
| Slovakia | 1 | 5 | 61 |
| Slovenia | 1 | 5 | 29 |
| United Kingdom | 4 | 11 | 112 |
| Total | 99 | 404 | 4 446 |

\* Theoretically, this is calculated as the product of the number of regions and the number of economic classes (6); however, due to (1) missing data, (2) FADN data anonymization policy or that (3) some classes of economic size may be absent in some regions the formula should be considered as an upper bound.

Table A2. Summary description of all variables - the average value for a representative farm

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Country’s codes** | **Country name** | **Output (y)** | **Building and Machinery (x1)** | **Labor(x2)** | **Materials(x3)**  | **Area of land(x4)** |
| BEL | Belgium | 158.6 | 161.4 | 4.0 | 49.1 | 70.2 |
| BGR | Bulgaria | 48.0 | 37.1 | 9.1 | 16.0 | 114.5 |
| CZE | Czech Republic | 101.8 | 183.3 | 6.7 | 40.8 | 133.3 |
| DAN | Denmark | 184.1 | 397.1 | 2.5 | 50.7 | 95.4 |
| DEU | Germany | 149.2 | 164.5 | 5.0 | 54.2 | 131.0 |
| ELL | Greece | 23.3 | 31.2 | 3.1 | 6.3 | 15.4 |
| ESP | Spain | 40.0 | 24.4 | 2.6 | 11.4 | 63.4 |
| EST | Estonia | 50.1 | 87.1 | 3.7 | 17.6 | 153.8 |
| FRA | France | 108.4 | 98.7 | 2.8 | 44.8 | 102.4 |
| HUN | Hungary | 52.1 | 64.2 | 4.8 | 20.6 | 98.8 |
| ITA | Italy | 37.8 | 58.6 | 3.2 | 9.6 | 27.1 |
| LTU | Lithuania | 40.7 | 68.4 | 5.1 | 16.6 | 118.0 |
| LVA | Latvia | 43.8 | 47.7 | 5.5 | 16.9 | 136.3 |
| MLT | Malta | 14.7 | 55.0 | 3.5 | 4.6 | 3.9 |
| NED | Netherlands | 265.1 | 311.9 | 4.4 | 63.1 | 63.7 |
| OST | Austria | 54.9 | 170.5 | 2.7 | 15.0 | 49.2 |
| POL | Poland | 37.5 | 91.1 | 5.6 | 15.7 | 55.1 |
| POR | Portugal | 28.5 | 28.6 | 3.6 | 9.0 | 34.3 |
| ROU | Romania | 31.7 | 39.3 | 6.0 | 10.8 | 71.3 |
| SUO | Finland | 30.0 | 88.8 | 1.4 | 11.8 | 67.4 |
| SVE | Sweden | 78.5 | 160.0 | 2.1 | 33.0 | 98.6 |
| SVK | Slovakia | 150.8 | 133.5 | 10.3 | 66.8 | 216.6 |
| SVN | Slovenia | 17.3 | 71.9 | 2.7 | 7.7 | 14.7 |
| UKI | United Kingdom | 157.1 | 173.8 | 4.8 | 71.4 | 186.0 |
| - | Mean | 54.0 | 67.8 | 3.9 | 17.6 | 60.8 |

*Notes:* Descriptive statistics for output and input variables were calculated on the logarithmic scale and then transformed back to the original scale. All variables are measured in thousands of Euros, except labor and agricultural area, which are given in physical units, i.e., hours and hectares, respectively.

**Table A3. Point estimates (posterior means, standard deviations) of the regression coefficients in m0-m6**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Parameter** | **m0** | **m1** | **m2** | **m3** | **m4** | **m5** | **m6** |
| 1 | (intercept) | 10.9873(0.0104) | 11.1155(0.0152) | 11.1136(0.0152) | 10.9841(0.0161) | 11.0822(0.0154) | 11.0799(0.0153) | 11.0759(0.0152) |
| 2 | (trend) | -0.0122(0.001) | -0.0594(0.0043) | -0.0592(0.0043) |  | -0.0395(0.0046) | -0.0393(0.0046) | -0.0381(0.0046) |
| 3 | (x1) B&M | 0.0952(0.0074) | 0.0651(0.015) | 0.0946(0.0073) | 0.0893(0.0071) | 0.0607(0.0148) | 0.0714(0.0122) | 0.0915(0.0071) |
| 4 | (x2) Labor | 0.1525(0.0099) | 0.2425(0.0179) | 0.1537(0.0098) | 0.1538(0.0095) | 0.2403(0.0176) | 0.2415(0.0175) | 0.2347(0.0172) |
| 5 | (x3) Materials | 0.8367(0.0095) | 0.8523(0.0194) | 0.8374(0.0093) | 0.85(0.0092) | 0.8638(0.0191) | 0.8412(0.0089) | 0.8418(0.0089) |
| 6 | (x4) Land | -0.0725(0.0083) | -0.1401(0.0163) | -0.0735(0.0081) | -0.0834(0.008) | -0.1478(0.0161) | -0.1329(0.0125) | -0.1443(0.0111) |
| 7 | (x12) | 0.0926(0.0065) | 0.0951(0.0068) | 0.0901(0.0065) | 0.0876(0.0063) | 0.0943(0.0067) | 0.0928(0.0065) | 0.0897(0.0063) |
| 8 | (x22) | -0.0732(0.0115) | -0.0723(0.0114) | -0.065(0.0114) | -0.063(0.0111) | -0.0715(0.0112) | -0.0676(0.0099) | -0.0678(0.0099) |
| 9 | (x32) | 0.0607(0.0117) | 0.0678(0.0117) | 0.0636(0.0116) | 0.0571(0.0113) | 0.0654(0.0115) | 0.0544(0.0095) | 0.054(0.0095) |
| 10 | (x42) | 0.0376(0.0084) | 0.0367(0.0082) | 0.0398(0.0082) | 0.0338(0.0081) | 0.0336(0.0081) | 0.0342(0.0078) | 0.0355(0.0078) |
| 11 | (x1x2) | -0.0563(0.0133) | -0.0627(0.0132) | -0.0569(0.0131) | -0.0554(0.0128) | -0.0601(0.013) | -0.0586(0.0125) | -0.0591(0.0125) |
| 12 | (x1x3) | -0.1223(0.0139) | -0.1215(0.0143) | -0.1152(0.0138) | -0.107(0.0135) | -0.1186(0.0141) | -0.106(0.0118) | -0.1018(0.0116) |
| 13 | (x1x4) | 0.0194(0.0116) | 0.0171(0.0114) | 0.0132(0.0114) | 0.0066(0.0112) | 0.013(0.0113) |  |  |
| 14 | (x2x3) | 0.1321(0.0171) | 0.1241(0.0169) | 0.1197(0.0169) | 0.1117(0.0165) | 0.1187(0.0167) | 0.123(0.0139) | 0.1233(0.0139) |
| 15 | (x2x4) | -0.0071(0.0151) | 0.0074(0.0148) | -0.002(0.0149) | 0.0034(0.0146) | 0.0101(0.0147) |  |  |
| 16 | (x3x4) | -0.1059(0.017) | -0.113(0.0167) | -0.1084(0.0167) | -0.0952(0.0164) | -0.1061(0.0165) | -0.0929(0.0134) | -0.0949(0.0133) |
| 17 | (t2) |  | 0.0031(0.0003) | 0.0031(0.0003) |  | 0.0018(0.0003) | 0.0018(0.0003) | 0.0017(0.0003) |
| 18 | (t\*x1) |  | 0.0037(0.0017) |  |  | 0.0042(0.0017) | 0.0026(0.0013) |  |
| 19 | (t\*x2) |  | -0.0119(0.002) |  |  | -0.0116(0.002) | -0.0117(0.0019) | -0.011(0.0019) |
| 20 | (t\*x3) |  | -0.0022(0.0022) |  |  | -0.0031(0.0022) |  |  |
| 21 | (t\*x4) |  | 0.009(0.0019) |  |  | 0.0094(0.0019) | 0.0075(0.0013) | 0.009(0.0011) |
| 22 | (t=5,9,10) |  |  |  |  | -0.1095(0.0101) | -0.1092(0.0101) | -0.1092(0.0101) |
| 23 |  |  |  |  | 0.0995(0.0217) |  |  |  |
| 24 |  |  |  |  | 0.0195(0.0216) |  |  |  |
| 25 |  |  |  |  | -0.0486(0.0213) |  |  |  |
| 26 |  |  |  |  | -0.2088(0.0214) |  |  |  |
| 27 |  |  |  |  | -0.0843(0.0211) |  |  |  |
| 28 |  |  |  |  | -0.0188(0.0207) |  |  |  |
| 29 |  |  |  |  | -0.1355(0.0207) |  |  |  |
| 30 |  |  |  |  | -0.1956(0.0207) |  |  |  |
| 31 |  |  |  |  | -0.2112(0.0206) |  |  |  |
| 32 |  |  |  |  | -0.1447(0.0209) |  |  |  |
| 33 |  |  |  |  | -0.159(0.021) |  |  |  |
| 34 |  |  |  |  | -0.1111(0.0208) |  |  |  |
| 35 |  |  |  |  | -0.0643(0.0208) |  |  |  |

**Table A4. Point estimates (posterior means and standard deviations) of the regression coefficients in the SF models based on m6**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Param. | N-HN | N-EX | GT-GB2 | T-HGT | GT-HGED | GT-HGT | T-HGED | GT-GG | T-HN | T-HT | LAP-HGED | GT-HN | GT-HT | LAP-HGT | GT-EXP | LAP-HN | LAP-HT |
| (interc.) | 11.1295(0.021) | 11.1186(0.0178) | 11.0883(0.0173) | 11.2595(0.058) | 11.2692(0.0618) | 11.2553(0.0527) | 11.2636(0.0412) | 11.2002(0.0282) | 11.1622(0.0271) | 11.157(0.0272) | 11.3199(0.018) | 11.1548(0.0287) | 11.1504(0.0265) | 11.3191(0.0196) | 11.1312(0.0198) | 11.2635(0.0162) | 11.2621(0.0169) |
| (trend) | -0.0383(0.0047) | -0.0383(0.0046) | -0.0406(0.0043) | -0.0405(0.0048) | -0.0409(0.0053) | -0.04(0.0052) | -0.0412(0.0051) | -0.0407(0.0048) | -0.0411(0.0047) | -0.0412(0.0047) | -0.0393(0.0044) | -0.0404(0.0047) | -0.0409(0.0045) | -0.0389(0.0045) | -0.0403(0.0049) | -0.0427(0.0048) | -0.0428(0.0045) |
| (x1) B&M | 0.0918(0.0073) | 0.0918(0.007) | 0.0865(0.0068) | 0.0867(0.008) | 0.0826(0.0066) | 0.0841(0.0074) | 0.0858(0.0071) | 0.0869(0.0069) | 0.0881(0.0071) | 0.0879(0.007) | 0.0876(0.007) | 0.0864(0.0072) | 0.0869(0.0071) | 0.0865(0.0082) | 0.0868(0.007) | 0.0937(0.0069) | 0.0936(0.0071) |
| (x2) Labor | 0.2346(0.0171) | 0.2349(0.0171) | 0.2091(0.0172) | 0.2077(0.0165) | 0.2153(0.0168) | 0.2062(0.0161) | 0.2051(0.0187) | 0.2062(0.0181) | 0.2061(0.0174) | 0.2062(0.0171) | 0.2094(0.0171) | 0.2075(0.0169) | 0.2076(0.0166) | 0.2103(0.0165) | 0.2077(0.017) | 0.2003(0.0166) | 0.2018(0.017) |
| (x3) Mat. | 0.8413(0.0094) | 0.8417(0.0089) | 0.8609(0.0085) | 0.86(0.0101) | 0.8639(0.0089) | 0.8629(0.0083) | 0.8615(0.0093) | 0.8603(0.0095) | 0.8586(0.0094) | 0.8594(0.0088) | 0.8621(0.0091) | 0.8607(0.0091) | 0.8599(0.0088) | 0.8633(0.0094) | 0.8606(0.0091) | 0.8536(0.0086) | 0.8532(0.0089) |
| (x4) Land | -0.1442(0.0113) | -0.1448(0.0112) | -0.1488(0.0113) | -0.1487(0.0125) | -0.1534(0.0121) | -0.148(0.0113) | -0.1484(0.0137) | -0.1487(0.0114) | -0.145(0.0109) | -0.1458(0.0116) | -0.1522(0.012) | -0.1486(0.0114) | -0.1476(0.0119) | -0.1532(0.0124) | -0.1482(0.0112) | -0.1401(0.0109) | -0.1403(0.0112) |
| (x12) | 0.0897(0.0064) | 0.0897(0.0068) | 0.0809(0.0068) | 0.0802(0.0065) | 0.0787(0.0062) | 0.0797(0.0062) | 0.0815(0.0065) | 0.0811(0.0064) | 0.0816(0.0064) | 0.0815(0.0064) | 0.0803(0.0062) | 0.081(0.0064) | 0.0804(0.0064) | 0.0804(0.0062) | 0.0805(0.0064) | 0.0828(0.0064) | 0.0825(0.0065) |
| (x22) | -0.0673(0.0102) | -0.0681(0.0103) | -0.0827(0.0099) | -0.0833(0.0092) | -0.0824(0.0103) | -0.0818(0.0099) | -0.0835(0.0121) | -0.0842(0.0116) | -0.0838(0.0099) | -0.0833(0.0099) | -0.082(0.0101) | -0.083(0.0101) | -0.0828(0.0098) | -0.0824(0.0099) | -0.083(0.0101) | -0.0893(0.0101) | -0.0898(0.0102) |
| (x32) | 0.0546(0.0096) | 0.0544(0.0097) | 0.0515(0.0107) | 0.0512(0.0103) | 0.0505(0.0137) | 0.0511(0.0109) | 0.0488(0.0093) | 0.053(0.0106) | 0.0521(0.0101) | 0.051(0.0103) | 0.0545(0.0098) | 0.0508(0.0103) | 0.0513(0.0104) | 0.0537(0.0108) | 0.0509(0.0099) | 0.0556(0.0104) | 0.0552(0.0104) |
| (x42) | 0.0357(0.0078) | 0.0362(0.008) | 0.0547(0.0098) | 0.0544(0.0108) | 0.0554(0.0166) | 0.0543(0.011) | 0.0531(0.0095) | 0.0564(0.0133) | 0.0537(0.0094) | 0.0527(0.0094) | 0.0592(0.0094) | 0.0541(0.0096) | 0.055(0.0099) | 0.0579(0.0097) | 0.0546(0.0097) | 0.0612(0.0099) | 0.0614(0.0097) |
| (x1x2) | -0.0591(0.0125) | -0.0589(0.012) | -0.0536(0.013) | -0.0509(0.0131) | -0.0507(0.0142) | -0.055(0.0129) | -0.0533(0.014) | -0.0505(0.013) | -0.0512(0.0132) | -0.0516(0.0134) | -0.0536(0.013) | -0.0537(0.0131) | -0.0528(0.0126) | -0.055(0.0131) | -0.0534(0.0126) | -0.0424(0.0134) | -0.0421(0.0137) |
| (x1x3) | -0.102(0.0118) | -0.102(0.0124) | -0.0838(0.0124) | -0.0832(0.0129) | -0.0823(0.0118) | -0.0808(0.0118) | -0.0849(0.0117) | -0.0841(0.012) | -0.0861(0.0119) | -0.0858(0.0118) | -0.0814(0.0117) | -0.0839(0.0124) | -0.0829(0.0119) | -0.0818(0.0123) | -0.0828(0.0119) | -0.0889(0.0119) | -0.0882(0.0119) |
| (x2x3) | 0.1228(0.0139) | 0.1234(0.0138) | 0.1366(0.0143) | 0.1354(0.0139) | 0.1354(0.0151) | 0.136(0.0133) | 0.1371(0.0177) | 0.1361(0.0146) | 0.1357(0.0146) | 0.1352(0.0143) | 0.137(0.0146) | 0.1372(0.0145) | 0.1356(0.0138) | 0.1387(0.0145) | 0.137(0.0139) | 0.1369(0.0144) | 0.1371(0.0146) |
| (x3x4) | -0.0955(0.0134) | -0.096(0.0137) | -0.124(0.0163) | -0.1237(0.0179) | -0.1232(0.0237) | -0.1237(0.018) | -0.1187(0.0161) | -0.1276(0.021) | -0.1226(0.0157) | -0.1206(0.0157) | -0.1338(0.0156) | -0.1228(0.0159) | -0.1241(0.0162) | -0.1314(0.0166) | -0.1241(0.0163) | -0.1357(0.0163) | -0.1357(0.0159) |
| (t2) | 0.0017(0.0003) | 0.0017(0.0003) | 0.0019(0.0003) | 0.0019(0.0003) | 0.0019(0.0003) | 0.0018(0.0003) | 0.0019(0.0003) | 0.0019(0.0003) | 0.0019(0.0003) | 0.0019(0.0003) | 0.0018(0.0003) | 0.0019(0.0003) | 0.0019(0.0003) | 0.0018(0.0003) | 0.0019(0.0003) | 0.002(0.0003) | 0.002(0.0003) |
| (t\*x2) | -0.0109(0.002) | -0.0109(0.0022) | -0.0091(0.0019) | -0.009(0.0019) | -0.01(0.002) | -0.0088(0.0018) | -0.0093(0.0023) | -0.0089(0.0018) | -0.0087(0.0019) | -0.0085(0.0019) | -0.0089(0.0019) | -0.0089(0.002) | -0.0089(0.0019) | -0.0092(0.002) | -0.0089(0.0019) | -0.0072(0.0018) | -0.0073(0.0019) |
| (t\*x4) | 0.0089(0.0011) | 0.009(0.0012) | 0.0082(0.0011) | 0.0083(0.0012) | 0.0086(0.0014) | 0.0081(0.0011) | 0.0084(0.0016) | 0.0083(0.0011) | 0.0078(0.0011) | 0.0078(0.0012) | 0.0082(0.0011) | 0.0081(0.0012) | 0.0081(0.0013) | 0.0084(0.0012) | 0.0081(0.0011) | 0.0068(0.0011) | 0.0068(0.0011) |
| (t=5,9,10) | -0.1093(0.0101) | -0.1092(0.0101) | -0.1054(0.0093) | -0.1061(0.0099) | -0.1039(0.0108) | -0.106(0.0102) | -0.1039(0.009) | -0.1046(0.0102) | -0.1054(0.0099) | -0.1055(0.0099) | -0.1049(0.0098) | -0.1048(0.0099) | -0.1052(0.01) | -0.105(0.0099) | -0.1051(0.0097) | -0.1039(0.0096) | -0.1036(0.0094) |

Notes: Full names for variables x1-x4 are provided in Table A2; parameters are the output elasticities with respect to the inputs at the geometric mean of the data.

**Table A5. Characteristics of the marginal prior distribution for efficiency and error components (v, u)**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Prior assumptions on EF (efficiency) | Prior assumptions on u (inefficiency) | Prior assumptions on v |
| MODEL | E(EF) | Me(EF) | D(EF) | Q1 | Q3 | IQR | E(u) | Me(u) | Q1 | Q3 | IQR | E(v) | IQR | q0.975-q0.025 |
| N-HN | 0.745 | 0.826 | 0.245 | 0.604 | 0.943 | 0.339 | 0.402 | 0.192 | 0.060 | 0.511 | 0.451 | 0 | 0.378 | 2.996 |
| N-EX | 0.719 | 0.820 | 0.272 | 0.563 | 0.945 | 0.382 | 0.500 | 0.198 | 0.053 | 0.564 | 0.511 | 0 | 0.378 | 2.996 |
| non-SF | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.378 | 2.996 |
| GT-GB2 | 0.857 | 0.943 | 0.195 | 0.793 | 0.994 | 0.200 | 0.201 | 0.058 | 0.006 | 0.231 | 0.225 | 0 | 0.391 | 4.713 |
| T-HGT | 0.777 | 0.850 | 0.221 | 0.664 | 0.950 | 0.287 | 0.354 | 0.163 | 0.050 | 0.406 | 0.356 | 0 | 0.392 | 3.234 |
| GT-HGT | 0.777 | 0.850 | 0.221 | 0.664 | 0.950 | 0.287 | 0.354 | 0.163 | 0.050 | 0.406 | 0.356 | 0 | 0.391 | 4.713 |
| GT-HGED | 0.782 | 0.852 | 0.212 | 0.671 | 0.951 | 0.279 | 0.329 | 0.160 | 0.050 | 0.398 | 0.348 | 0 | 0.391 | 4.713 |
| LP-HN | 0.745 | 0.826 | 0.245 | 0.604 | 0.943 | 0.339 | 0.402 | 0.192 | 0.060 | 0.511 | 0.451 | 0 | 0.408 | 4.390 |
| LP-HT | 0.736 | 0.822 | 0.252 | 0.593 | 0.943 | 0.349 | 0.431 | 0.196 | 0.060 | 0.522 | 0.462 | 0 | 0.408 | 4.390 |
| LP-HGED | 0.782 | 0.852 | 0.212 | 0.671 | 0.951 | 0.279 | 0.329 | 0.160 | 0.050 | 0.398 | 0.348 | 0 | 0.408 | 4.390 |
| LP-HGT | 0.777 | 0.850 | 0.221 | 0.664 | 0.950 | 0.287 | 0.354 | 0.163 | 0.050 | 0.406 | 0.356 | 0 | 0.408 | 4.390 |
| GT-GG | 0.862 | 0.944 | 0.187 | 0.799 | 0.994 | 0.194 | 0.191 | 0.057 | 0.006 | 0.224 | 0.218 | 0 | 0.391 | 4.713 |
| GT-HT | 0.736 | 0.822 | 0.252 | 0.593 | 0.943 | 0.349 | 0.431 | 0.196 | 0.060 | 0.522 | 0.462 | 0 | 0.391 | 4.713 |
| GT-HN | 0.745 | 0.826 | 0.245 | 0.604 | 0.943 | 0.339 | 0.402 | 0.192 | 0.060 | 0.511 | 0.451 | 0 | 0.391 | 4.713 |
| GT-EX | 0.719 | 0.820 | 0.272 | 0.563 | 0.945 | 0.382 | 0.500 | 0.198 | 0.053 | 0.564 | 0.511 | 0 | 0.391 | 4.713 |
| T-HT | 0.736 | 0.822 | 0.252 | 0.593 | 0.943 | 0.349 | 0.431 | 0.196 | 0.060 | 0.522 | 0.462 | 0 | 0.392 | 3.234 |
| T-HN | 0.745 | 0.826 | 0.245 | 0.604 | 0.943 | 0.339 | 0.402 | 0.192 | 0.060 | 0.511 | 0.451 | 0 | 0.392 | 3.234 |

Notes: EF is efficiency, here defined as a transformation of inefficiency EF=exp(-u); consequently, priors on EF are induced by priors on u; IQR is interquartile range. Note that some of distributions at hand are potentially heavy-tailed, which considerably influences characteristics based on higher order moments. Hence, we emphasize quantile-based characterization of marginal priors for u and v; as values of EF are bounded, we also report its prior standard deviation D(EF).

# Appendix B: results based on model m0

**Table B1. Basic statistics and posterior estimates of the stochastic parameters in SF models (m0)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **BF** | **ln(p(y))** | **ln(ML)** | **BIC** |  |  |  |  |  |  |  | **av.eff** |
| **N-HN** | 0.00502 | -503.13 | -383.3 | 917.76 | 0.0708(0.0208) | 0.2605(0.0036) |  |  |  |  |  | 0.9441(0.044) |
| **N-EX** | 0.00010 | -506.99 | -386.3 | 923.78 | 0.0457(0.0104) | 0.2603(0.0034) |  |  |  |  |  | 0.9552(0.0435) |
| **non-SF** | 1 | -497.83 | -380.1 | 902.91 |  | 0.2641(0.0028) |  |  |  |  |  | 1(0) |
| **T-HGT** | 6.8E+25 | -438.35 | -319.3 | 814.90 | 0.3031(0.1189) | 0.1974(0.0232) |  | 36.1549(30.7533) |  | 6.5095(1.6272) | 39.9864(31.071) | 0.8264(0.1024) |
| **GT-HGT** | 5.1E+25 | -438.64 | -319.1 | 823.03 | 0.2834(0.1148) | 0.2024(0.0257) |  | 32.5619(28.0187) | 2.5095(1.0633) | 6.43(5.4812) | 40.588(34.615) | 0.8376(0.099) |
| **GT-GB2** | 2.5E+25 | -439.36 | -315.9 | 825.04 | 0.3376(0.1026) | 0.1869(0.0308) | 0.8436(0.1284) | 32.2788(29.8888) | 3.0662(1.4368) | 4.7553(2.3091) | 40.3293(30.679) | 0.8206(0.1049) |
| **GT-HGED** | 1.7E+25 | -439.72 | -319.2 | 814.86 | 0.3416(0.0955) | 0.1942(0.0241) |  | 38.4872(33.287) | 2.1886(0.5474) | 6.8217(6.4554) |  | 0.7944(0.0998) |
| **GT-GG** | 1.4E+24 | -442.20 | -318.7 | 822.10 | 0.3056(0.0841) | 0.1917(0.0274) | 0.9892(0.012) | 11.606(7.7282) | 3.4779(1.5958) | 3.921(1.2632) |  | 0.8144(0.1012) |
| **GT-HN** | 1.6E+23 | -444.43 | -321.2 | 810.40 | 0.1101(0.0327) | 0.2217(0.0084) |  |  | 2.4086(0.5209) | 5.9681(1.2535) |  | 0.9143(0.0642) |
| **T-HN** | 9.6E+22 | -444.91 | -323.1 | 805.81 | 0.1179(0.034) | 0.2181(0.0091) |  |  |  | 7.8067(1.1434) |  | 0.9071(0.0676) |
| **T-HT** | 5.5E+22 | -445.47 | -323.1 | 814.21 | 0.1038(0.031) | 0.2199(0.008) |  |  |  | 7.9189(1.0912) | 43.9715(32.588) | 0.916(0.0633) |
| **GT-HT** | 2.8E+22 | -446.13 | -321.2 | 818.83 | 0.097(0.0309) | 0.2235(0.0076) |  |  | 2.3798(0.2483) | 6.0591(1.2253) | 43.247(32.934) | 0.9224(0.0608) |
| **GT-EX** | 1.7E+21 | -448.95 | -323.8 | 815.65 | 0.059(0.0136) | 0.225(0.0059) |  |  | 2.3943(0.31) | 6.1011(1.2553) |  | 0.9427(0.0537) |

*Notes*: Bayes factors (BF) are calculated in favor (BF<1) or against (BF>1) the non-SF model (i.e., model that assumes full relative efficiency); the best model (T-HGT) has the highest Bayes factor.

**Table B2. Point estimates (posterior means and standard deviations) of the regression coefficients in the models considered in the study (m0)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (intercept) | (trend) | (x1)B&M | (x2)Labor | (x3)Materials | (x4)Land | (x12) | (x22) | (x32) | (x42) | (x1x2) | (x1x3) | (x1x4) | (x2x3) | (x2x4) | (x3x4) |
| N-HN | 11.0432 (0.0196) | -0.0122 (0.001) | 0.0954 (0.0074) | 0.1528 (0.0098) | 0.8362 (0.0094) | -0.0724 (0.0083) | 0.0928 (0.0066) | -0.073 (0.0116) | 0.0614 (0.0116) | 0.0382 (0.0084) | -0.0564 (0.0134) | -0.1228 (0.0138) | 0.0194 (0.0116) | 0.1321 (0.0169) | -0.0074 (0.015) | -0.1068 (0.017) |
| N-EX | 11.032 (0.0145) | -0.0121 (0.001) | 0.0957 (0.0071) | 0.1532 (0.0101) | 0.8363 (0.0094) | -0.0729 (0.0083) | 0.0928 (0.0066) | -0.0729 (0.0117) | 0.0614 (0.0117) | 0.0384 (0.0084) | -0.0562 (0.0134) | -0.1226 (0.0141) | 0.0192 (0.0118) | 0.1322 (0.0174) | -0.0076 (0.0155) | -0.1071 (0.0169) |
| NOTSF | 10.9872 (0.0104) | -0.0122 (0.001) | 0.0953 (0.0073) | 0.1526 (0.01) | 0.8364 (0.0096) | -0.0723 (0.0084) | 0.0925 (0.0066) | -0.073 (0.0114) | 0.0608 (0.0118) | 0.0376 (0.0084) | -0.0565 (0.0131) | -0.1221 (0.0141) | 0.0196 (0.0118) | 0.1315 (0.0169) | -0.0067 (0.015) | -0.1061 (0.0172) |
| GT-GB2 | 11.1639 (0.06) | -0.0122 (0.001) | 0.0906 (0.0073) | 0.1431 (0.0106) | 0.8562 (0.0099) | -0.086 (0.0085) | 0.0837 (0.0069) | -0.0922 (0.0122) | 0.0509 (0.0126) | 0.0529 (0.0116) | -0.0447 (0.0141) | -0.0952 (0.0151) | 0.0077 (0.0126) | 0.1366 (0.0174) | 0.0024 (0.0161) | -0.1232 (0.0209) |
| T-HGT | 11.1601 (0.0672) | -0.0121 (0.001) | 0.0911 (0.0072) | 0.1446 (0.0103) | 0.8556 (0.0094) | -0.0854 (0.0083) | 0.0855 (0.0069) | -0.0902 (0.0116) | 0.0516 (0.0126) | 0.0501 (0.0102) | -0.0456 (0.0135) | -0.0998 (0.0145) | 0.0094 (0.0123) | 0.1362 (0.017) | 0.0004 (0.0159) | -0.1191 (0.0196) |
| GT-HGT | 11.1491 (0.0651) | -0.0121 (0.001) | 0.0902 (0.0073) | 0.1436 (0.0108) | 0.8565 (0.0094) | -0.0855 (0.0085) | 0.0849 (0.007) | -0.0902 (0.012) | 0.0515 (0.0128) | 0.0505 (0.011) | -0.0463 (0.0137) | -0.0981 (0.0146) | 0.0087 (0.0127) | 0.1355 (0.0172) | 0.002 (0.0157) | -0.12 (0.0201) |
| GT-HGED | 11.1771 (0.0545) | -0.0122 (0.001) | 0.0897 (0.0075) | 0.1444 (0.01) | 0.8568 (0.0096) | -0.0857 (0.0083) | 0.0844 (0.0067) | -0.09 (0.0119) | 0.051 (0.0126) | 0.0498 (0.0105) | -0.0468 (0.013) | -0.098 (0.0141) | 0.0093 (0.0121) | 0.135 (0.0164) | 0.0018 (0.0154) | -0.1187 (0.0196) |
| GT-GG | 11.1747 (0.059) | -0.0122 (0.001) | 0.0895 (0.0074) | 0.1432 (0.0103) | 0.8573 (0.0095) | -0.0861 (0.0088) | 0.0836 (0.007) | -0.0924 (0.0117) | 0.049 (0.0146) | 0.0514 (0.0116) | -0.0455 (0.0141) | -0.094 (0.0146) | 0.0069 (0.013) | 0.137 (0.0172) | 0.0024 (0.0163) | -0.1198 (0.0234) |
| GT-HT | 11.0642 (0.0269) | -0.012 (0.001) | 0.091 (0.0072) | 0.1449 (0.0101) | 0.856 (0.0093) | -0.0862 (0.0083) | 0.0849 (0.0067) | -0.0903 (0.0115) | 0.0503 (0.0125) | 0.0502 (0.01) | -0.0457 (0.0137) | -0.0977 (0.0145) | 0.0081 (0.0123) | 0.1366 (0.0172) | 0.0006 (0.0157) | -0.1185 (0.0191) |
| GT-HN | 11.0722 (0.028) | -0.012 (0.001) | 0.0912 (0.0076) | 0.1448 (0.0104) | 0.8556 (0.0096) | -0.0859 (0.0082) | 0.0851 (0.0068) | -0.0903 (0.0117) | 0.0518 (0.0126) | 0.0505 (0.01) | -0.0457 (0.0137) | -0.099 (0.0147) | 0.0093 (0.0124) | 0.1355 (0.017) | 0.0014 (0.0158) | -0.1203 (0.0191) |
| GT-EX | 11.043 (0.0168) | -0.0121 (0.001) | 0.0913 (0.0075) | 0.1447 (0.0101) | 0.8561 (0.0093) | -0.0865 (0.0082) | 0.0852 (0.0067) | -0.0901 (0.0119) | 0.0517 (0.0129) | 0.0511 (0.0102) | -0.0457 (0.0137) | -0.0987 (0.015) | 0.0088 (0.0123) | 0.1359 (0.0172) | 0.0011 (0.0158) | -0.1207 (0.0193) |
| T-HT | 11.0704 (0.0267) | -0.0121 (0.001) | 0.0924 (0.0073) | 0.1453 (0.0102) | 0.8547 (0.0093) | -0.0861 (0.0081) | 0.086 (0.0067) | -0.0905 (0.0118) | 0.0524 (0.0125) | 0.0506 (0.0098) | -0.0444 (0.0138) | -0.1016 (0.0144) | 0.0098 (0.0122) | 0.1366 (0.017) | -0.0006 (0.0158) | -0.12 (0.0189) |
| T-HN | 11.0798 (0.0291) | -0.0121 (0.001) | 0.0926 (0.0073) | 0.1455 (0.0102) | 0.854 (0.0095) | -0.0856 (0.0083) | 0.0857 (0.0068) | -0.0908 (0.0119) | 0.0525 (0.0122) | 0.0506 (0.0098) | -0.0444 (0.0137) | -0.1014 (0.0144) | 0.0104 (0.012) | 0.1368 (0.0168) | -0.0005 (0.0158) | -0.1205 (0.0184) |

Notes: Full names for variables x1-x4 are provided in Table A2; parameters are the output elasticities with respect to the inputs at the geometric mean of the data.

Table B3. Correlation coefficients between efficiency estimates in COLS, HNH and T-HGT (m0)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **COLS** | **N-HN** | **T-HGT** |
| **COLS** | 1 | 0.918 | 0.858 |
| **N-HN** | 0.918 | 1 | 0.939 |
| **T-HGT** | 0.858 | 0.939 | 1 |

Table B4. Efficiency estimates (posterior means) over time at the country and the EU levels (m0)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **2004** | **2005** | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **Avg.** |
| **CZE** | 0.805 | 0.829 | 0.806 | 0.817 | 0.792 | 0.825 | 0.833 | 0.813 | 0.816 | 0.803 | 0.812 | 0.814 | 0.835 | 0.819 | 0.816 |
| **BEL** | 0.888 | 0.886 | 0.842 | 0.822 | 0.822 | 0.867 | 0.899 | 0.843 | 0.859 | 0.843 | 0.908 | 0.868 | 0.857 | 0.881 | 0.863 |
| **BGR** |  |  |  | 0.833 | 0.819 | 0.839 | 0.866 | 0.853 | 0.839 | 0.844 | 0.829 | 0.832 | 0.842 | 0.858 | 0.842 |
| **DAN** | 0.791 | 0.81 | 0.803 | 0.865 | 0.811 | 0.846 | 0.902 | 0.893 | 0.9 | 0.891 | 0.899 | 0.898 | 0.901 | 0.904 | 0.864 |
| **DEU** | 0.871 | 0.895 | 0.873 | 0.829 | 0.807 | 0.876 | 0.858 | 0.814 | 0.828 | 0.823 | 0.852 | 0.861 | 0.879 | 0.879 | 0.853 |
| **ELL** | 0.863 | 0.883 | 0.849 | 0.839 | 0.821 | 0.849 | 0.859 | 0.848 | 0.846 | 0.866 | 0.837 | 0.825 | 0.853 | 0.855 | 0.849 |
| **ESP** | 0.879 | 0.858 | 0.883 | 0.882 | 0.845 | 0.867 | 0.884 | 0.871 | 0.85 | 0.864 | 0.865 | 0.863 | 0.887 | 0.888 | 0.871 |
| **EST** | 0.805 | 0.83 | 0.792 | 0.815 | 0.832 | 0.833 | 0.799 | 0.807 | 0.809 | 0.823 | 0.828 | 0.875 | 0.859 | 0.887 | 0.831 |
| **FRA** | 0.876 | 0.87 | 0.86 | 0.843 | 0.848 | 0.838 | 0.843 | 0.854 | 0.836 | 0.828 | 0.846 | 0.849 | 0.841 | 0.883 | 0.851 |
| **HUN** | 0.839 | 0.847 | 0.848 | 0.798 | 0.821 | 0.807 | 0.824 | 0.816 | 0.793 | 0.797 | 0.817 | 0.815 | 0.857 | 0.848 | 0.823 |
| **ITA** | 0.848 | 0.881 | 0.864 | 0.869 | 0.835 | 0.856 | 0.88 | 0.862 | 0.855 | 0.85 | 0.861 | 0.869 | 0.874 | 0.875 | 0.863 |
| **LTU** | 0.81 | 0.829 | 0.791 | 0.812 | 0.803 | 0.822 | 0.825 | 0.805 | 0.811 | 0.798 | 0.803 | 0.818 | 0.802 | 0.824 | 0.811 |
| **LVA** | 0.818 | 0.802 | 0.817 | 0.801 | 0.81 | 0.806 | 0.799 | 0.795 | 0.808 | 0.804 | 0.834 | 0.855 | 0.845 | 0.858 | 0.819 |
| **MLT** | 0.846 | 0.827 | 0.857 | 0.816 | 0.837 | 0.796 | 0.795 | 0.796 | 0.795 | 0.794 | 0.813 | 0.799 | 0.8 | 0.792 | 0.809 |
| **NED** | 0.825 | 0.89 | 0.879 | 0.893 | 0.896 | 0.905 | 0.903 | 0.894 | 0.906 | 0.878 | 0.893 | 0.902 | 0.879 | 0.884 | 0.888 |
| **OST** | 0.88 | 0.876 | 0.862 | 0.826 | 0.877 | 0.852 | 0.818 | 0.858 | 0.813 | 0.818 | 0.849 | 0.839 | 0.874 | 0.845 | 0.849 |
| **POL** | 0.814 | 0.835 | 0.819 | 0.805 | 0.792 | 0.798 | 0.81 | 0.792 | 0.792 | 0.792 | 0.794 | 0.796 | 0.799 | 0.799 | 0.802 |
| **POR** | 0.831 | 0.83 | 0.869 | 0.841 | 0.83 | 0.848 | 0.834 | 0.842 | 0.837 | 0.838 | 0.844 | 0.846 | 0.841 | 0.852 | 0.842 |
| **ROU** |  |  |  | 0.814 | 0.821 | 0.841 | 0.853 | 0.836 | 0.824 | 0.83 | 0.847 | 0.823 | 0.833 | 0.867 | 0.838 |
| **SUO** | 0.822 | 0.809 | 0.829 | 0.852 | 0.794 | 0.793 | 0.858 | 0.815 | 0.801 | 0.795 | 0.847 | 0.867 | 0.847 | 0.887 | 0.83 |
| **SVE** | 0.835 | 0.858 | 0.841 | 0.837 | 0.829 | 0.812 | 0.836 | 0.827 | 0.818 | 0.824 | 0.818 | 0.84 | 0.866 | 0.856 | 0.836 |
| **SVK** | 0.804 | 0.851 | 0.796 | 0.799 | 0.794 | 0.801 | 0.808 | 0.823 | 0.805 | 0.834 | 0.801 | 0.803 | 0.844 | 0.83 | 0.813 |
| **SVN** |  |  | 0.803 | 0.792 | 0.79 | 0.791 | 0.791 | 0.792 | 0.795 | 0.8 | 0.803 | 0.806 | 0.795 | 0.796 | 0.797 |
| **UKI** | 0.803 | 0.854 | 0.866 | 0.842 | 0.809 | 0.811 | 0.855 | 0.815 | 0.802 | 0.796 | 0.806 | 0.828 | 0.845 | 0.852 | 0.828 |
| **EU** | 0.849 | 0.865 | 0.855 | 0.845 | 0.826 | 0.844 | 0.856 | 0.842 | 0.834 | 0.835 | 0.844 | 0.845 | 0.854 | 0.864 | 0.847 |

Note: Three-letter country codes are according to FADN nomenclature.

Table B5. Efficiency estimates across farm size (1-6) at the country and the EU level (m0)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | Avg. |
| CZE |  | 0.815 | 0.807 | 0.808 | 0.821 | 0.828 | 0.816 |
| BEL |  |  |  | 0.85 | 0.87 | 0.848 | 0.863 |
| BGR | 0.836 | 0.833 | 0.824 | 0.832 | 0.844 | 0.874 | 0.842 |
| DAN |  | 0.862 | 0.861 | 0.863 | 0.87 | 0.867 | 0.864 |
| DEU |  |  | 0.852 | 0.848 | 0.852 | 0.858 | 0.853 |
| ELL | 0.832 | 0.851 | 0.858 | 0.859 | 0.828 | - | 0.849 |
| ESP | 0.871 | 0.867 | 0.869 | 0.87 | 0.878 | 0.902 | 0.871 |
| EST | 0.89 | 0.834 | 0.814 | 0.829 | 0.832 | 0.853 | 0.831 |
| FRA |  |  | 0.817 | 0.842 | 0.862 | 0.875 | 0.851 |
| HUN | 0.817 | 0.811 | 0.812 | 0.82 | 0.825 | 0.855 | 0.823 |
| ITA | 0.848 | 0.861 | 0.863 | 0.865 | 0.869 | 0.871 | 0.863 |
| LTU | 0.828 | 0.81 | 0.797 | 0.804 | 0.809 | 0.826 | 0.811 |
| LVA | 0.847 | 0.814 | 0.81 | 0.811 | 0.816 | 0.847 | 0.819 |
| MLT | 0.806 | 0.819 | 0.8 |  |  |  | 0.809 |
| NED |  |  | 0.865 | 0.896 | 0.887 | 0.889 | 0.888 |
| OST |  | 0.846 | 0.841 | 0.849 | 0.859 |  | 0.849 |
| POL | 0.815 | 0.804 | 0.798 | 0.795 | 0.798 | 0.807 | 0.802 |
| POR | 0.88 | 0.851 | 0.824 | 0.834 | 0.819 |  | 0.842 |
| ROU | 0.826 | 0.833 | 0.831 | 0.835 | 0.846 | 0.869 | 0.838 |
| SUO |  | 0.837 | 0.82 | 0.825 | 0.832 |  | 0.83 |
| SVE |  | 0.831 | 0.821 | 0.837 | 0.853 |  | 0.836 |
| SVK |  | 0.819 | 0.829 | 0.798 | 0.812 | 0.811 | 0.813 |
| SVN | 0.801 | 0.795 | 0.798 | 0.795 | 0.797 |  | 0.797 |
| UKI |  |  | 0.823 | 0.822 | 0.826 | 0.846 | 0.828 |
| EU | 0.837 | 0.845 | 0.844 | 0.845 | 0.852 | 0.855 | 0.847 |