**Appendix**

Full Equations

$$E\left[\left(\sum\_{i}^{M}w\_{ip}s\_{ip}-V\_{p}\right)^{2}\right]=E\left[\left(\sum\_{i}^{M}w\_{ip}s\_{ip}\right)^{2}-2V\_{p}\sum\_{i}^{M}w\_{ip}s\_{ip}+V\_{p}^{2}\right]=E\left[\left(\sum\_{i}^{M}w\_{ip}(V\_{p}+δ\_{ip}+ε\_{ip})\right)^{2}-2V\_{p}\sum\_{i}^{M}w\_{ip}(V\_{p}+δ\_{ip}+ε\_{ip})+V\_{p}^{2}\right]=E\left[\left(\sum\_{i}^{M}w\_{ip}(V\_{p}+δ\_{ip}+ε\_{ip})\right)^{2}-2V\_{p}\sum\_{i}^{M}w\_{ip}(δ\_{ip}+ε\_{ip})-V\_{p}^{2}\right]=E\left[\sum\_{i}^{M}w\_{ip}^{2}(V\_{p}+δ\_{ip}+ε\_{ip})^{2}+2\sum\_{i<j}^{}\sum\_{j}^{M}w\_{ip}w\_{jp}(V\_{p}+δ\_{ip}+ε\_{ip})(V\_{p}+δ\_{jp}+ε\_{jp})-2V\_{p}\sum\_{i}^{M}w\_{ip}(δ\_{ip}+ε\_{ip})-V\_{p}^{2}\right]$$

**Table A1. Regression analysis results. All models do not include contract time remaining. Missing goals and assists are replaced by zeros.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | (1) |  | (2) | (3) | (4) |
|  | Real fee paid |  | Real fee paid | Real fee paid | Real fee paid |
| Real Transfermarkt estimate | 1.089\*\*\* |  | 1.106\*\*\* | 1.109\*\*\* | 1.094\*\*\* |
|  | (37.07) |  | (35.26) | (29.26) | (27.61) |
| Coefficient = 1, p-value | 0.003 |  | 0.001 | 0.004 | 0.017 |
|  |  |  |  |  |  |
| National team player |  |  | -130.5 | -123.8 | -41.97 |
|  |  |  | (-1.27) | (-1.32) | (-0.40) |
|  |  |  |  |  |  |
| Matches played- |  |  | 18.48\*\*\* | 18.58\*\*\* | 13.41\* |
|  |  |  | (3.41) | (3.47) | (2.52) |
|  |  |  |  |  |  |
| Goals per thousand minutes played |  |  | 48.22\* | 47.91\* | 49.62\* |
|  |  |  | (2.35) | (2.35) | (2.46) |
|  |  |  |  |  |  |
| Assists per thousand minutes played |  |  | -94.49\* | -94.08\* | -64.22 |
|  |  |  | (-2.52) | (-2.50) | (-1.70) |
|  |  |  |  |  |  |
| Goals missing |  |  | 84.84 | 84.37 | 17.90 |
|  |  |  | (0.79) | (0.78) | (0.17) |
|  |  |  |  |  |  |
| Assists missing |  |  | 46.98 | 44.94 | 27.02 |
|  |  |  | (0.44) | (0.42) | (0.25) |
|  |  |  |  |  |  |
| Player's age |  |  | -501.4\*\* | -493.7\*\* | -395.0\* |
|  |  |  | (-2.77) | (-2.71) | (-2.16) |
|  |  |  |  |  |  |
| Player's age squared |  |  | 4.862 | 4.761 | 2.600 |
|  |  |  | (1.35) | (1.32) | (0.72) |
|  |  |  |  |  |  |
| Midfielder |  |  | -254.8\* | -255.7\* | -230.1\* |
|  |  |  | (-2.31) | (-2.32) | (-2.09) |
|  |  |  |  |  |  |
| Defender |  |  | 12.79 | 10.99 | 37.00 |
|  |  |  | (0.12) | (0.10) | (0.35) |
|  |  |  |  |  |  |
| FIFA video game rating |  |  |  | -4.700 | -14.26 |
|  |  |  |  | (-0.33) | (-0.95) |
|  |  |  |  |  |  |
| Constant | -85.96 |  | 8621.3\*\*\* | 8811.4\*\*\* | 10022.0\*\*\* |
|  | (-0.95) |  | (3.90) | (3.87) | (4.46) |
| Observations | 5293 |  | 5293 | 5293 | 5293 |
| Adjusted *R*2 | 0.773 |  | 0.788 | 0.788 | 0.800 |
| *AIC* | 100664.2 |  | 100316.8 | 100318.5 | 100114.2 |
| RMSE | 3261.9 |  | 3153.6 | 3153.8 | 3066.7 |

*t* statistics in parentheses \* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001. Model 4 also includes indicator variables for the year and the country to and country from which a player was transferred.

**Table A2. Regression analysis results. All models include contract time remaining. Missing goals and assists are replaced by zeros.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) |
|  | Real fee paid | Real fee paid | Real fee paid | Real fee paid |
| Real Transfermarkt estimate | 1.190\*\*\* | 1.202\*\*\* | 1.216\*\*\* | 1.200\*\*\* |
|  | (26.77) | (25.29) | (21.93) | (20.57) |
| Coefficient = 1, p-value | 0.000 | 0.000 | 0.000 | 0.001 |
|  |  |  |  |  |
| Time left on current contract | 2.052\*\*\* | 1.464\*\*\* | 1.513\*\*\* | 1.787\*\*\* |
|  | (4.95) | (3.45) | (3.57) | (3.99) |
|  |  |  |  |  |
| National team player |  | -56.46 | -7.200 | 69.83 |
|  |  | (-0.22) | (-0.03) | (0.26) |
|  |  |  |  |  |
| Matches played |  | 25.01 | 25.74 | 22.35 |
|  |  | (1.60) | (1.65) | (1.44) |
|  |  |  |  |  |
| Goals per thousand minutes played |  | 136.9 | 130.5 | 92.30 |
|  |  | (1.81) | (1.74) | (1.12) |
|  |  |  |  |  |
| Assists per thousand minutes played |  | -74.56 | -67.28 | -74.83 |
|  |  | (-0.65) | (-0.58) | (-0.62) |
|  |  |  |  |  |
| Goals missing |  | -108.4 | -106.9 | -105.5 |
|  |  | (-0.38) | (-0.37) | (-0.35) |
|  |  |  |  |  |
| Assists missing |  | 158.8 | 166.0 | 255.4 |
|  |  | (0.56) | (0.59) | (0.84) |
|  |  |  |  |  |
| Player's age |  | -328.7 | -247.9 | -260.3 |
|  |  | (-0.61) | (-0.45) | (-0.47) |
|  |  |  |  |  |
| Player's age squared |  | -0.694 | -1.892 | -2.027 |
|  |  | (-0.06) | (-0.17) | (-0.18) |
|  |  |  |  |  |
| Midfielder |  | -444.5 | -463.4 | -561.9 |
|  |  | (-1.42) | (-1.49) | (-1.76) |
|  |  |  |  |  |
| Defender |  | 583.9 | 565.8 | 449.7 |
|  |  | (1.73) | (1.69) | (1.25) |
|  |  |  |  |  |
| FIFA video game rating |  |  | -32.17 | -46.55 |
|  |  |  | (-0.92) | (-1.23) |
|  |  |  |  |  |
| Constant | -2006.6\*\*\* | 5774.0 | 6708.3 | 9834.2 |
|  | (-5.71) | (0.91) | (1.06) | (1.53) |
| Observations | 1313 | 1286 | 1286 | 1286 |
| Adjusted *R*2 | 0.813 | 0.826 | 0.826 | 0.839 |
| *AIC* | 25698.0 | 25108.3 | 25109.1 | 25070.2 |
| RMSE | 4298.0 | 4180.6 | 4180.3 | 4016.4 |

*t* statistics in parentheses \* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001.

**Table A3: Regression analysis results for the subsample of top leagues. All models include contract time remaining. Missing goals and assists are replaced by zeros.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) |
|  | Real fee paid | Real fee paid | Real fee paid | Real fee paid |
| Real Transfermarkt estimate | 1.188\*\*\* | 1.198\*\*\* | 1.187\*\*\* | 1.195\*\*\* |
|  | (22.44) | (16.69) | (24.89) | (18.90) |
| Coefficient = 1, p-value | 0.000 | 0.006 | 0.001 | 0.002 |
|  |  |  |  |  |
| Time left on contract | 2.491\*\* | 1.394 | 2.284\*\*\* | 1.708\*\* |
|  | (2.95) | (1.69) | (4.34) | (2.97) |
|  |  |  |  |  |
| FIFA video game rating |  | -34.87 |  | -60.43 |
|  |  | (-0.50) |  | (-1.17) |
|  |  |  |  |  |
| National team player |  | -74.63 |  | 55.20 |
|  |  | (-0.15) |  | (0.15) |
|  |  |  |  |  |
| Matches played |  | 15.31 |  | 30.71 |
|  |  | (0.50) |  | (1.47) |
|  |  |  |  |  |
| Goals per thousand minutes played |  | 130.4 |  | 162.6 |
|  |  | (0.97) |  | (1.39) |
|  |  |  |  |  |
| Assists per thousand minutes played |  | -190.5 |  | -161.5 |
|  |  | (-1.02) |  | (-1.02) |
|  |  |  |  |  |
| Goals missing |  |  |  | -102.6 |
|  |  |  |  | (-0.26) |
|  |  |  |  |  |
| Assists missing |  |  |  | 372.7 |
|  |  |  |  | (0.86) |
|  |  |  |  |  |
| Player's age |  | -7.166 |  | -265.8 |
|  |  | (-0.01) |  | (-0.38) |
|  |  |  |  |  |
| Player's age squared |  | -9.016 |  | -2.507 |
|  |  | (-0.50) |  | (-0.18) |
|  |  |  |  |  |
| Midfielder |  | -903.3 |  | -614.2 |
|  |  | (-1.70) |  | (-1.41) |
|  |  |  |  |  |
| Defender |  | 160.4 |  | 367.7 |
|  |  | (0.23) |  | (0.72) |
|  |  |  |  |  |
| Constant | -2406.5\*\*\* | 7224.7 | -2177.5\*\*\* | 11168.1 |
|  | (-3.38) | (0.68) | (-4.72) | (1.40) |
| Observations | 653 | 653 | 954 | 934 |
| Adjusted *R*2 | 0.798 | 0.835 | 0.801 | 0.834 |
| *AIC* | 13121.1 | 13033.4 | 18932.9 | 18431.2 |
| RMSE | 5572.4 | 5047.7 | 4926.5 | 4528.8 |

*t* statistics in parentheses \* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001

Table A4: **Regression analysis results for the subsample of lesser leagues. All models include contract time remaining. Missing goals and assists are replaced by zeros**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) |
|  | Real fee paid | Real fee paid | Real fee paid | Real fee paid |
| Real Transfermarkt estimate | 1.227\*\*\* | 1.332\*\*\* | 1.193\*\*\* | 1.278\*\*\* |
|  | (5.52) | (4.55) | (5.79) | (4.71) |
| Coefficient = 1, p-value | 0.308 | 0.260 | 0.350 | 0.307 |
|  |  |  |  |  |
| Time left on current contract | 1.566\*\* | 1.222 | 1.250\*\*\* | 1.339\*\*\* |
|  | (2.89) | (1.89) | (3.76) | (3.50) |
|  |  |  |  |  |
| FIFA video game rating |  | -70.75 |  | -59.71 |
|  |  | (-1.13) |  | (-1.19) |
|  |  |  |  |  |
| National team player |  | -44.72 |  | 71.32 |
|  |  | (-0.11) |  | (0.25) |
|  |  |  |  |  |
| Matches played |  | 5.137 |  | 10.66 |
|  |  | (0.24) |  | (0.89) |
|  |  |  |  |  |
| Goals per thousand minutes played |  | 5.704 |  | 7.718 |
|  |  | (0.07) |  | (0.15) |
|  |  |  |  |  |
| Assists per thousand minutes played |  | 324.7\*\* |  | 287.5\*\* |
|  |  | (3.01) |  | (2.92) |
|  |  |  |  |  |
| Goals missing |  |  |  | 107.1 |
|  |  |  |  | (0.44) |
|  |  |  |  |  |
| Assists missing |  |  |  | 496.9\* |
|  |  |  |  | (2.04) |
|  |  |  |  |  |
| Player's age |  | -80.45 |  | 95.09 |
|  |  | (-0.13) |  | (0.24) |
|  |  |  |  |  |
| Player's age squared |  | -3.230 |  | -5.347 |
|  |  | (-0.25) |  | (-0.64) |
|  |  |  |  |  |
| Midfielder |  | 43.78 |  | -124.1 |
|  |  | (0.12) |  | (-0.50) |
|  |  |  |  |  |
| Defender |  | 845.2 |  | 526.5 |
|  |  | (1.51) |  | (1.78) |
|  |  |  |  |  |
| Constant | -1714.2\*\*\* | 7904.1 | -1384.9\*\*\* | 3733.9 |
|  | (-3.65) | (0.95) | (-3.63) | (0.70) |
| Observations | 230 | 230 | 352 | 352 |
| Adjusted *R*2 | 0.762 | 0.792 | 0.742 | 0.788 |
| *AIC* | 4153.1 | 4143.8 | 6264.6 | 6231.5 |
| RMSE | 2004.2 | 1874.4 | 1764.1 | 1599.8 |

*t* statistics in parentheses \* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001

**Table A5: Regression analysis results. Individual attribute evaluations for EA Sports included**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | (1) | (2) | Top | Lesser |
|  | Real fee paid | Real fee paid | Real fee paid | Real fee paid |
| Real Transfermarkt estimate | 1.223\*\*\* | 1.196\*\*\* | 1.186\*\*\* | 1.261\*\*\* |
|  | (22.85) | (21.01) | (19.50) | (5.15) |
|  |  |  |  |  |
| Time left on current contract | 1.630\*\*\* | 1.769\*\*\* | 1.724\*\* | 1.305\*\*\* |
|  | (3.76) | (3.91) | (2.91) | (3.45) |
|  |  |  |  |  |
| National team player | -11.77 | 92.25 | 37.39 | 207.6 |
|  | (-0.05) | (0.32) | (0.10) | (0.68) |
|  |  |  |  |  |
| Matches played | 21.27 | 18.54 | 23.29 | 6.706 |
|  | (1.40) | (1.20) | (1.13) | (0.58) |
|  |  |  |  |  |
| Goals per thousand minutes played | 198.7\* | 152.4 | 249.3 | -8.190 |
|  | (2.48) | (1.72) | (1.89) | (-0.13) |
|  |  |  |  |  |
| Assists per thousand minutes played | 29.93 | -24.06 | -85.04 | 385.7\*\*\* |
|  | (0.25) | (-0.18) | (-0.51) | (3.37) |
|  |  |  |  |  |
| Goals missing | -57.43 | -7.432 | 55.11 | -6.728 |
|  | (-0.20) | (-0.02) | (0.13) | (-0.02) |
|  |  |  |  |  |
| Assists missing | 277.3 | 250.6 | 330.4 | 703.8\* |
|  | (0.96) | (0.81) | (0.76) | (2.15) |
|  |  |  |  |  |
| Player's age | -356.5 | -472.2 | -420.3 | 36.01 |
|  | (-0.63) | (-0.83) | (-0.57) | (0.09) |
|  |  |  |  |  |
| Player's age squared | 0.775 | 2.425 | 1.046 | -4.274 |
|  | (0.07) | (0.21) | (0.07) | (-0.51) |
|  |  |  |  |  |
| Midfielder | -881.9\* | -897.3\* | -996.7 | -396.8 |
|  | (-2.33) | (-2.23) | (-1.83) | (-1.21) |
|  |  |  |  |  |
| Defender | -153.2 | -96.20 | -373.0 | 445.5 |
|  | (-0.30) | (-0.17) | (-0.50) | (0.78) |
|  |  |  |  |  |
| potential | -17.82 | -5.845 | 7.029 | 17.23 |
|  | (-0.54) | (-0.16) | (0.14) | (0.51) |
|  |  |  |  |  |
| crossing | -28.51 | -19.40 | -13.20 | -17.79 |
|  | (-1.90) | (-1.27) | (-0.59) | (-1.49) |
|  |  |  |  |  |
| finishing | 8.480 | 3.742 | 3.237 | 15.33 |
|  | (0.58) | (0.24) | (0.16) | (1.05) |
|  |  |  |  |  |
| heading\_accuracy | 4.891 | -5.433 | 3.025 | -20.87 |
|  | (0.35) | (-0.40) | (0.17) | (-1.57) |
|  |  |  |  |  |
| short\_passing | -6.973 | -5.265 | -33.47 | 52.89\* |
|  | (-0.27) | (-0.18) | (-0.84) | (2.35) |
|  |  |  |  |  |
| volleys | -18.85 | -6.843 | -9.004 | -24.54 |
|  | (-1.63) | (-0.55) | (-0.52) | (-1.67) |
|  |  |  |  |  |
| dribbling | 24.74 | 4.187 | 5.488 | 15.01 |
|  | (1.40) | (0.21) | (0.18) | (0.87) |
|  |  |  |  |  |
| curve | -16.81 | -21.66 | -29.96 | 1.379 |
|  | (-1.10) | (-1.42) | (-1.37) | (0.11) |
|  |  |  |  |  |
| free\_kick\_accuracy | 11.04 | 28.52\* | 37.76\* | -8.533 |
|  | (0.86) | (1.97) | (2.02) | (-0.70) |
|  |  |  |  |  |
| long\_passing | 14.92 | 0.802 | -7.044 | -5.558 |
|  | (0.77) | (0.04) | (-0.24) | (-0.41) |
|  |  |  |  |  |
| ball\_control | 9.530 | 1.782 | 30.81 | -43.86 |
|  | (0.37) | (0.06) | (0.73) | (-1.62) |
|  |  |  |  |  |
| acceleration | 10.44 | 2.417 | 32.33 | -24.46 |
|  | (0.45) | (0.10) | (0.85) | (-1.24) |
|  |  |  |  |  |
| sprint\_speed | 22.81 | 27.73 | -8.201 | 72.24\*\* |
|  | (0.93) | (1.10) | (-0.23) | (2.89) |
|  |  |  |  |  |
| agility | -12.64 | -7.770 | -0.808 | -43.52\* |
|  | (-0.64) | (-0.40) | (-0.03) | (-2.19) |
|  |  |  |  |  |
| reactions | -36.45 | -18.15 | -30.88 | -51.83\* |
|  | (-1.66) | (-0.83) | (-0.96) | (-2.19) |
|  |  |  |  |  |
| jumping | -2.253 | -4.066 | 2.693 | -4.234 |
|  | (-0.17) | (-0.31) | (0.15) | (-0.36) |
|  |  |  |  |  |
| stamina | 11.06 | 3.180 | -3.314 | 2.833 |
|  | (0.62) | (0.17) | (-0.12) | (0.18) |
|  |  |  |  |  |
| long\_shots | 23.50 | 23.25 | 31.61 | 10.43 |
|  | (1.77) | (1.64) | (1.63) | (0.81) |
|  |  |  |  |  |
| aggression | -1.770 | 1.863 | 0.517 | 13.09 |
|  | (-0.12) | (0.12) | (0.02) | (0.95) |
|  |  |  |  |  |
| interceptions | -11.94 | -3.594 | -7.087 | 7.977 |
|  | (-0.81) | (-0.25) | (-0.38) | (0.62) |
|  |  |  |  |  |
| positioning | -16.46 | -15.63 | -22.05 | -1.392 |
|  | (-1.15) | (-0.98) | (-0.99) | (-0.10) |
|  |  |  |  |  |
| penalties | -23.85 | -28.89 | -41.57 | 16.81 |
|  | (-1.63) | (-1.83) | (-1.96) | (1.26) |
|  |  |  |  |  |
| marking | 7.190 | -2.998 | -17.53 | 13.06 |
|  | (0.35) | (-0.14) | (-0.62) | (0.64) |
|  |  |  |  |  |
| standing\_tackle | 21.59 | 21.24 | 29.06 | -10.01 |
|  | (0.91) | (0.82) | (0.79) | (-0.49) |
|  |  |  |  |  |
| sliding\_tackle | 0.358 | -1.799 | 16.06 | -7.860 |
|  | (0.02) | (-0.09) | (0.58) | (-0.34) |
|  |  |  |  |  |
| Constant | 7073.8 | 11347.6 | 10778.9 | 1458.7 |
|  | (1.03) | (1.58) | (1.17) | (0.26) |
| Observations | 1285 | 1285 | 934 | 351 |
| Adjusted *R*2 | 0.827 | 0.839 | 0.834 | 0.797 |
| *AIC* | 25106.2 | 25077.1 | 18456.7 | 6213.8 |
| RMSE | 4169.0 | 4024.0 | 4539.7 | 1568.9 |

*t* statistics in parentheses \* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001.