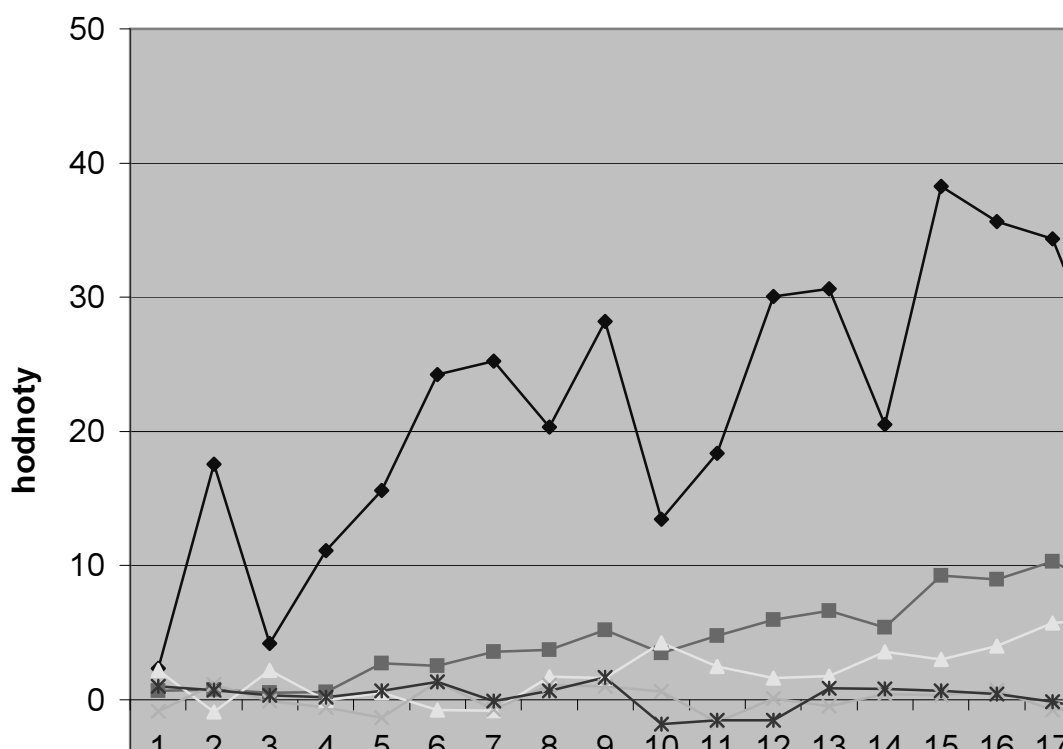


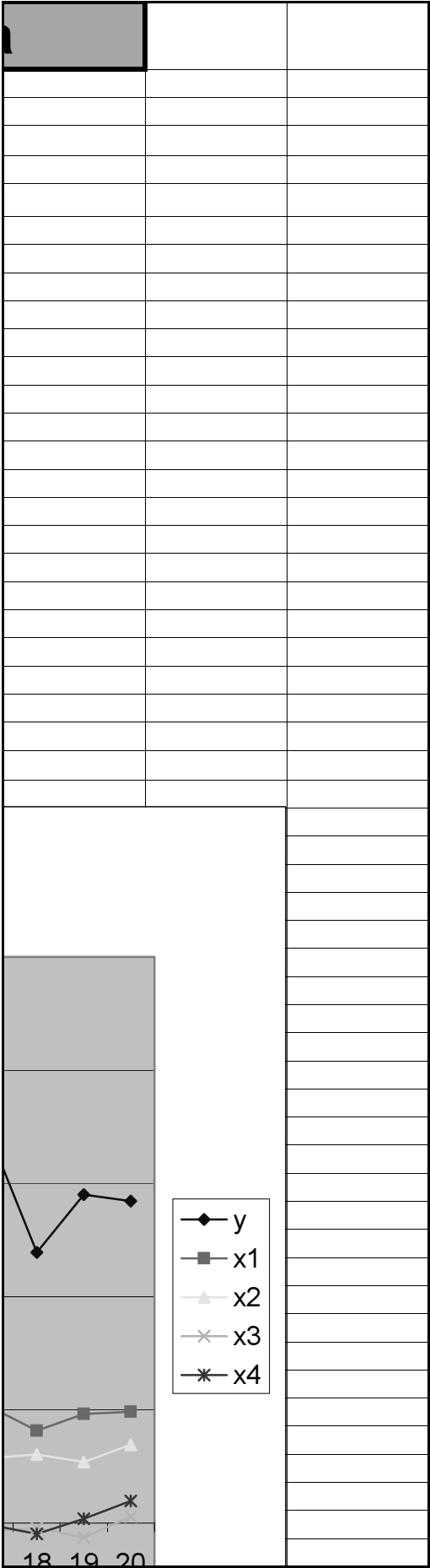
Příklad použití lineární regrese: data

| Logický čas: t | Vysvětlovaná: y | Vysvětlující veličiny: | | | |
|-------------------|--------------------|------------------------|----------------|----------------|----------------|
| | | x ₁ | x ₂ | x ₃ | x ₄ |
| 1 | 2,33 | 0,65 | 2,19 | -0,89 | 0,97 |
| 2 | 17,52 | 0,76 | -0,93 | 1,14 | 0,68 |
| 3 | 4,18 | 0,48 | 2,19 | -0,1 | 0,31 |
| 4 | 11,12 | 0,55 | -0,08 | -0,6 | 0,17 |
| 5 | 15,6 | 2,68 | 0,51 | -1,35 | 0,65 |
| 6 | 24,24 | 2,51 | -0,78 | 1,32 | 1,3 |
| 7 | 25,24 | 3,56 | -0,83 | -0,75 | -0,1 |
| 8 | 20,29 | 3,72 | 1,7 | 1,09 | 0,65 |
| 9 | 28,21 | 5,16 | 1,61 | 0,99 | 1,64 |
| 10 | 13,44 | 3,46 | 4,22 | 0,59 | -1,82 |
| 11 | 18,33 | 4,74 | 2,46 | -1,71 | -1,53 |
| 12 | 30,05 | 5,95 | 1,61 | 0,05 | -1,56 |
| 13 | 30,61 | 6,63 | 1,75 | -0,48 | 0,84 |
| 14 | 20,52 | 5,39 | 3,57 | 0,41 | 0,8 |
| 15 | 38,24 | 9,22 | 2,99 | 0,32 | 0,64 |
| 16 | 35,61 | 8,94 | 3,97 | 0,68 | 0,41 |
| 17 | 34,36 | 10,29 | 5,71 | -0,81 | -0,15 |
| 18 | 23,87 | 8,16 | 6,04 | -0,46 | -0,97 |
| 19 | 28,98 | 9,64 | 5,37 | -1,33 | 0,36 |
| 20 | 28,41 | 9,8 | 6,9 | 0,54 | 1,92 |

Modelované veličiny



| | | | | | | |
|--|-----|--|--|--|--|--|
| | | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 | | | | |
| | -10 | | | | | |
| | | čas | | | | |
| | | | | | | |



Příklad prostého odhadu sezónní

Model

Simulovaná měsíční data, lineární trend.

Model má tvar: $y_t = b_0 + b_1 t + b_2 ut_2 + b_3 ut_3 + \dots + b_{12} ut_{12} + e_t$.

| t | y | t | u ₂ | u ₃ |
|----|--------|----|----------------|----------------|
| 1 | 10,81 | 1 | 0 | 0 |
| 2 | 12,78 | 2 | 1 | 0 |
| 3 | 24,36 | 3 | 0 | 1 |
| 4 | 18,83 | 4 | 0 | 0 |
| 5 | 21,62 | 5 | 0 | 0 |
| 6 | 19,98 | 6 | 0 | 0 |
| 7 | 28,82 | 7 | 0 | 0 |
| 8 | 27,86 | 8 | 0 | 0 |
| 9 | 32,68 | 9 | 0 | 0 |
| 10 | 41,97 | 10 | 0 | 0 |
| 11 | 58,6 | 11 | 0 | 0 |
| 12 | 59,75 | 12 | 0 | 0 |
| 13 | 57,27 | 13 | 0 | 0 |
| 14 | 46,51 | 14 | 1 | 0 |
| 15 | 54,15 | 15 | 0 | 1 |
| 16 | 57,67 | 16 | 0 | 0 |
| 17 | 60,5 | 17 | 0 | 0 |
| 18 | 55,71 | 18 | 0 | 0 |
| 19 | 54,43 | 19 | 0 | 0 |
| 20 | 61,75 | 20 | 0 | 0 |
| 21 | 77,33 | 21 | 0 | 0 |
| 22 | 91,95 | 22 | 0 | 0 |
| 23 | 88,58 | 23 | 0 | 0 |
| 24 | 86,93 | 24 | 0 | 0 |
| 25 | 89,54 | 25 | 0 | 0 |
| 26 | 85,59 | 26 | 1 | 0 |
| 27 | 98,45 | 27 | 0 | 1 |
| 28 | 98,89 | 28 | 0 | 0 |
| 29 | 90,36 | 29 | 0 | 0 |
| 30 | 91,32 | 30 | 0 | 0 |
| 31 | 99,7 | 31 | 0 | 0 |
| 32 | 101,09 | 32 | 0 | 0 |
| 33 | 110,57 | 33 | 0 | 0 |
| 34 | 111,63 | 34 | 0 | 0 |
| 35 | 124,57 | 35 | 0 | 0 |
| 36 | 126,74 | 36 | 0 | 0 |
| 37 | 120,18 | 37 | 0 | 0 |
| 38 | 119,53 | 38 | 1 | 0 |
| 39 | 126,26 | 39 | 0 | 1 |
| 40 | 126,25 | 40 | 0 | 0 |
| 41 | 130,98 | 41 | 0 | 0 |
| 42 | 131,12 | 42 | 0 | 0 |
| 43 | 135,83 | 43 | 0 | 0 |
| 44 | 136,26 | 44 | 0 | 0 |

| Odhad parametrů a diagnostika | | |
|--|----------------|----------------|
| | b ₃ | b ₂ |
| b _i | 3,1173 | -3,6787 |
| s _{b_i} | 5,7394 | 5,7784 |
| R ² , s | 0,8527 | 7,6106 |
| FR, n-k-1 | 30,8641 | 16,0000 |
| | 5363,0967 | 926,7447 |
| b _i /s _{b_i} | 0,5431 | 0,6366 |

Model je statisticky významný, protože FR
 Parametry b₀, b₁ jsou statisticky významné
 Sezónní složky u₂, u₃ významné nejsou, p

| | | | | |
|----|--------|----|---|---|
| 45 | 142,83 | 45 | 0 | 0 |
| 46 | 161 | 46 | 0 | 0 |
| 47 | 162,96 | 47 | 0 | 0 |
| 48 | 160,92 | 48 | 0 | 0 |
| 49 | 161,42 | 49 | 0 | 0 |
| 50 | 157,5 | 50 | 1 | 0 |
| 51 | 166,43 | 51 | 0 | 1 |
| 52 | 167,54 | 52 | 0 | 0 |
| 53 | 169,77 | 53 | 0 | 0 |
| 54 | 161,81 | 54 | 0 | 0 |
| 55 | 172,48 | 55 | 0 | 0 |
| 56 | 173,27 | 56 | 0 | 0 |
| 57 | 173,33 | 57 | 0 | 0 |
| 58 | 192,34 | 58 | 0 | 0 |
| 59 | 200,76 | 59 | 0 | 0 |
| 60 | 198,55 | 60 | 0 | 0 |

Ověření splnění podmínek lineární regrese

| t | yv | e | e ² | e ³ | e ⁴ | e _t - e _{t-1} |
|--------|---------|---------|----------------|----------------|----------------|-----------------------------------|
| 1 | 13,6259 | -2,8159 | 7,9291 | -22,3275 | 62,8713 | 2,8347 |
| 2 | 12,7611 | 0,0189 | 0,0004 | 0,0000 | 0,0000 | 1,9700 |
| 3 | 22,3711 | 1,9889 | 3,9555 | 7,8670 | 15,6462 | -5,2266 |
| 4 | 22,0678 | -3,2378 | 10,4833 | -33,9430 | 109,9005 | -0,0240 |
| 5 | 24,8818 | -3,2618 | 10,6392 | -34,7026 | 113,1919 | -4,4540 |
| 6 | 27,6957 | -7,7157 | 59,5328 | -459,3400 | 3544,1526 | 6,0260 |
| 7 | 30,5097 | -1,6897 | 2,8552 | -4,8244 | 8,1520 | -3,7740 |
| 8 | 33,3237 | -5,4637 | 29,8520 | -163,1024 | 891,1427 | 2,0060 |
| 9 | 36,1377 | -3,4577 | 11,9555 | -41,3383 | 142,9343 | 6,4760 |
| 10 | 38,9516 | 3,0184 | 9,1104 | 27,4985 | 83,0001 | 13,8160 |
| 11 | 41,7656 | 16,8344 | 283,3962 | 4770,7976 | 80313,3958 | -1,6640 |
| 12 | 44,5796 | 15,1704 | 230,1410 | 3491,3315 | 52964,8944 | -5,2940 |
| 13 | 47,3936 | 9,8764 | 97,5438 | 963,3836 | 9514,7860 | -9,8953 |
| 14 | 46,5289 | -0,0189 | 0,0004 | 0,0000 | 0,0000 | -1,9700 |
| 15 | 56,1389 | -1,9889 | 3,9555 | -7,8670 | 15,6462 | 3,8234 |
| 16 | 55,8355 | 1,8345 | 3,3654 | 6,1738 | 11,3258 | 0,0160 |
| 17 | 58,6495 | 1,8505 | 3,4244 | 6,3370 | 11,7268 | -7,6040 |
| 18 | 61,4635 | -5,7535 | 33,1022 | -190,4519 | 1095,7556 | -4,0940 |
| 19 | 64,2774 | -9,8474 | 96,9718 | -954,9227 | 9403,5307 | 4,5060 |
| 20 | 67,0914 | -5,3414 | 28,5306 | -152,3932 | 813,9934 | |
| součty | | | 926,74472 | 7208,176 | 159116,046 | |

Test normality reziduí

| | | | |
|----|--------|--------|--------|
| A3 | 1,1426 | var A3 | 0,2236 |
| A4 | 0,7053 | var A4 | 0,5792 |

| | |
|-----------|---------|
| norm test | 1,95996 |
|-----------|---------|

| | |
|---------|--------|
| test A3 | 2,4164 |
| test A4 | 1,3021 |

Test autokorelace reziduí Durbin - Watsonův

| | |
|---|--------|
| d | 0,6351 |
|---|--------|

Test homoskedasticity reziduí Goldfeld - Quandtův

| t | y | x ₁ | x ₂ | x ₃ | e | e ² |
|----|-------|----------------|----------------|----------------|---------|----------------|
| 3 | 4,18 | 0,48 | 2,19 | -0,1 | 0,0018 | 0,0000 |
| 4 | 11,12 | 0,55 | -0,08 | -0,6 | 0,5486 | 0,3010 |
| 1 | 2,33 | 0,65 | 2,19 | -0,89 | -1,0536 | 1,1101 |
| 2 | 17,52 | 0,76 | -0,93 | 1,14 | 0,1230 | 0,0151 |
| 6 | 24,24 | 2,51 | -0,78 | 1,32 | -0,3238 | 0,1048 |
| 5 | 15,6 | 2,68 | 0,51 | -1,35 | -0,5850 | 0,3423 |
| 10 | 13,44 | 3,46 | 4,22 | 0,59 | 1,8418 | 3,3921 |
| 7 | 25,24 | 3,56 | -0,83 | -0,75 | 0,0843 | 0,0071 |
| 8 | 20,29 | 3,72 | 1,7 | 1,09 | -1,1719 | 1,3734 |
| 11 | 18,33 | 4,74 | 2,46 | -1,71 | 0,3064 | 0,0939 |
| 9 | 28,21 | 5,16 | 1,61 | 0,99 | 0,6597 | 0,4353 |
| 14 | 20,52 | 5,39 | 3,57 | 0,41 | -0,7956 | 0,6329 |
| 12 | 30,05 | 5,95 | 1,61 | 0,05 | 0,9968 | 0,9936 |
| 13 | 30,61 | 6,63 | 1,75 | -0,48 | 0,1671 | 0,0279 |
| 18 | 23,87 | 8,16 | 6,04 | -0,46 | 0,3438 | 0,1182 |
| 16 | 35,61 | 8,94 | 3,97 | 0,68 | 0,2345 | 0,0550 |
| 15 | 38,24 | 9,22 | 2,99 | 0,32 | -0,6619 | 0,4381 |
| 19 | 28,98 | 9,64 | 5,37 | -1,33 | -1,1384 | 1,2960 |
| 20 | 28,41 | 9,8 | 6,9 | 0,54 | -1,1786 | 1,3891 |
| 17 | 34,36 | 10,29 | 5,71 | -0,81 | 1,6009 | 2,5629 |

| |
|--------|
| S1 |
| S2 |
| F21 |
| F test |

Vynechávána 4 prostřední

Vynechávána 4 prostřední

Vynechávána 4 prostřední

Vynechávána 4 prostřední

F-rozdělení s $(T-T_2-2(k+1))$

Řazeno vzestupně podle hodnot proměnné x₁

složky

| další statistiky | |
|------------------|---------|
| b_1 | b_0 |
| 2,8140 | 10,8119 |
| 0,2999 | 3,8083 |
| #N/A | #N/A |
| #N/A | #N/A |
| #N/A | #N/A |
| 9,3830 | 2,8391 |

| alfa | t-test | FR-test |
|------|--------|---------|
| 0,05 | 2,1199 | 3,2389 |

| n |
|----|
| 20 |

(669,122) je větší než FR-test (3,2389).
é, neboť $|b_1|/s_{b_1}$ jsou větší než hodnota t-testu (2,1199),
protože příslušné t-statistiky leží pod kritickou hodnotou testu.

| $(e_t - e_{t-1})^2$ |
|---------------------|
| 8,0357 |
| 3,8809 |
| 27,3179 |
| 0,0006 |
| 19,8379 |
| 36,3130 |
| 14,2429 |
| 4,0241 |
| 41,9389 |
| 190,8825 |
| 2,7688 |
| 28,0262 |
| 97,9165 |
| 3,8809 |
| 14,6180 |
| 0,0003 |
| 57,8204 |
| 16,7606 |
| 20,3043 |
| 588,5703 |

| | |
|--------|--|
| 5,2726 | |
| 6,8809 | |
| 1,3050 | Protože podíl SSE2/SSE1 je menší než teoretická hodnota F-rozdělení o 4 a 4 stupních volnosti na hladině alfa = 0,05 |
| 6,3882 | Není proto důvod zamítnout hypotézu homoskedasticity |

| | | |
|---|----------|----|
| pozorování | T= | 20 |
| pozorování | T2= | 4 |
| pozorování | 2*(k+1)= | 8 |
| pozorování | d.f.= | 4 |
| /2 a (T-T ₂ -2(k+1))/2 stupni volnosti | | |

Sezónnost pomocí lineární regrese: ro

Model

K vysvětlení se použijí všechny veličiny x_0, x_1, u_1, u_2

Model má tvar: $y_t = b_0 + b_1 x_{t1} + b_2 u_{1t} + b_3 u_{2t} + e_t$.

Proměnná $u_{1t} = \cos(2\pi t/12)$.

Proměnná $u_{2t} = \sin(2\pi t/6)$.

| t | y | t | u_{1t} | u_{2t} | Odhady parametrů a průvodní statistiky | | |
|----|--------|----|-----------|----------|---|----------------------|-----------------------|
| 1 | 10,81 | 1 | 0,8660254 | 0,866025 | b_3 | b_2 | b_1 |
| 2 | 12,78 | 2 | 0,5 | 0,866025 | b_0 | -4,1297 | 0,0000 |
| 3 | 24,36 | 3 | 0 | 0 | sb_0 | 0,7490 | 0,7477 |
| 4 | 18,83 | 4 | -0,5 | -0,86603 | R^2, s | 0,9945 | 4,0920 |
| 5 | 21,62 | 5 | -0,866025 | -0,86603 | FR, n-k-1 | 3351,1837 | 56,0000 |
| 6 | 19,98 | 6 | -1 | 0 | | 168344,99 | 937,7104 |
| 7 | 28,82 | 7 | -0,866025 | 0,866025 | $ b_i /sb_i$ | 5,5137 | 0,0000 |
| 8 | 27,86 | 8 | -0,5 | 0,866025 | | | 98,9825 |
| 9 | 32,68 | 9 | 0 | 0 | | | |
| 10 | 41,97 | 10 | 0,5 | -0,86603 | Model je statisticky významný, protože F | | |
| 11 | 58,6 | 11 | 0,8660254 | -0,86603 | Parametry jsou také statisticky významn | | |
| 12 | 59,75 | 12 | 1 | 0 | | | |
| 13 | 57,27 | 13 | 0,8660254 | 0,866025 | | | |
| 14 | 46,51 | 14 | 0,5 | 0,866025 | | | |
| 15 | 54,15 | 15 | 0 | 0 | | | |
| 16 | 57,67 | 16 | -0,5 | -0,86603 | Podíly jednotlivých vysvětlujících promě | | |
| 17 | 60,5 | 17 | -0,866025 | -0,86603 | s_y | s_t | s_{u1} |
| 18 | 55,71 | 18 | -1 | 0 | 53,5649 | 17,4642 | 0,7131 |
| 19 | 54,43 | 19 | -0,866025 | 0,866025 | b_0 | b_1 | b_2 |
| 20 | 61,75 | 20 | -0,5 | 0,866025 | 9,74272 | 3,0295 | 0,0000 |
| 21 | 77,33 | 21 | 0 | 0 | $ \text{cor}(y, "1") $ | $ \text{cor}(y, t) $ | $ \text{cor}(y, u1) $ |
| 22 | 91,95 | 22 | 0,5 | -0,86603 | 29,8821 | 3,0295 | 0,0000 |
| 23 | 88,58 | 23 | 0,8660254 | -0,86603 | | | |
| 24 | 86,93 | 24 | 1 | 0 | beta0 | beta1 | beta2 |
| 25 | 89,54 | 25 | 0,8660254 | 0,866025 | | 94,73% | 0,00% |
| 26 | 85,59 | 26 | 0,5 | 0,866025 | | | |
| 27 | 98,45 | 27 | 0 | 0 | Proměnné t, u_1, u_2 se na vysvětlení rozptylu veli | | |
| 28 | 98,89 | 28 | -0,5 | -0,86603 | | | |
| 29 | 90,36 | 29 | -0,866025 | -0,86603 | | | |
| 30 | 91,32 | 30 | -1 | 0 | | | |
| 31 | 99,7 | 31 | -0,866025 | 0,866025 | | | |
| 32 | 101,09 | 32 | -0,5 | 0,866025 | | | |
| 33 | 110,57 | 33 | 0 | 0 | | | |
| 34 | 111,63 | 34 | 0,5 | -0,86603 | | | |
| 35 | 124,57 | 35 | 0,8660254 | -0,86603 | | | |
| 36 | 126,74 | 36 | 1 | 0 | | | |
| 37 | 120,18 | 37 | 0,8660254 | 0,866025 | | | |
| 38 | 119,53 | 38 | 0,5 | 0,866025 | | | |

| | | | | | | | | |
|----|--------|----|-----------|----------|--|--|--|--|
| 39 | 126,26 | 39 | 0 | 0 | | | | |
| 40 | 126,25 | 40 | -0,5 | -0,86603 | | | | |
| 41 | 130,98 | 41 | -0,866025 | -0,86603 | | | | |
| 42 | 131,12 | 42 | -1 | 0 | | | | |
| 43 | 135,83 | 43 | -0,866025 | 0,866025 | | | | |
| 44 | 136,26 | 44 | -0,5 | 0,866025 | | | | |
| 45 | 142,83 | 45 | 8,575E-16 | 0 | | | | |
| 46 | 161 | 46 | 0,5 | -0,86603 | | | | |
| 47 | 162,96 | 47 | 0,8660254 | -0,86603 | | | | |
| 48 | 160,92 | 48 | 1 | 0 | | | | |
| 49 | 161,42 | 49 | 0,8660254 | 0,866025 | | | | |
| 50 | 157,5 | 50 | 0,5 | 0,866025 | | | | |
| 51 | 166,43 | 51 | 0 | 0 | | | | |
| 52 | 167,54 | 52 | -0,5 | -0,86603 | | | | |
| 53 | 169,77 | 53 | -0,866025 | -0,86603 | | | | |
| 54 | 161,81 | 54 | -1 | 0 | | | | |
| 55 | 172,48 | 55 | -0,866025 | 0,866025 | | | | |
| 56 | 173,27 | 56 | -0,5 | 0,866025 | | | | |
| 57 | 173,33 | 57 | 0 | 0 | | | | |
| 58 | 192,34 | 58 | 0,5 | -0,86603 | | | | |
| 59 | 200,76 | 59 | 0,8660254 | -0,86603 | | | | |
| 60 | 198,55 | 60 | 1 | 0 | | | | |

Ověření splnění podmínek lineární regrese

| t | yv | e | e_t^2 | e_t^3 | e_t^4 | $e_t - e_{t-1}$ | |
|----|---------|---------|----------|-----------|------------|-----------------|--------|
| 1 | 15,6163 | -4,8063 | 23,1003 | -111,0264 | 533,6239 | 1,7351 | |
| 2 | 15,8512 | -3,0712 | 9,4323 | -28,9686 | 88,9688 | 8,6146 | |
| 3 | 18,8167 | 5,5433 | 30,7287 | 170,3398 | 944,2528 | -8,4954 | |
| 4 | 21,7821 | -2,9521 | 8,7149 | -25,7271 | 75,9490 | 2,5551 | |
| 5 | 22,0170 | -0,3970 | 0,1576 | -0,0626 | 0,0248 | 0,1052 | |
| 6 | 20,2719 | -0,2919 | 0,0852 | -0,0249 | 0,0073 | 8,5350 | |
| 7 | 20,5769 | 8,2431 | 67,9486 | 560,1072 | 4617,0173 | -6,7962 | |
| 8 | 26,4131 | 1,4469 | 2,0936 | 3,0294 | 4,3833 | -5,7969 | |
| 9 | 37,0299 | -4,3499 | 18,9218 | -82,3081 | 358,0336 | -1,3269 | |
| 10 | 47,6468 | -5,6768 | 32,2258 | -182,9384 | 1038,4998 | 10,7938 | |
| 11 | 53,4829 | 5,1171 | 26,1844 | 133,9875 | 685,6233 | 0,8450 | |
| 12 | 53,7880 | 5,9620 | 35,5459 | 211,9260 | 1263,5106 | -0,7348 | |
| 13 | 52,0428 | 5,2272 | 27,3236 | 142,8256 | 746,5776 | -10,9949 | |
| 14 | 52,2777 | -5,7677 | 33,2668 | -191,8741 | 1106,6792 | 4,6746 | |
| 15 | 55,2432 | -1,0932 | 1,1950 | -1,3064 | 1,4281 | 0,5546 | |
| 16 | 58,2086 | -0,5386 | 0,2901 | -0,1563 | 0,0842 | 2,5951 | |
| 17 | 58,4436 | 2,0564 | 4,2290 | 8,6966 | 17,8841 | -3,0448 | |
| 18 | 56,6984 | -0,9884 | 0,9769 | -0,9656 | 0,9544 | -1,5850 | |
| 19 | 57,0034 | -2,5734 | 6,6225 | -17,0427 | 43,8581 | 1,4838 | |
| 20 | 62,8396 | -1,0896 | 1,1872 | -1,2936 | 1,4094 | | |
| | | součty: | 330,2303 | 587,2173 | 11528,7695 | 0,0000 | 3,7167 |

Test normality reziduí

| | | | | | | |
|----|---------|--------|---------|-----------|---------|--------|
| A3 | 3,6233 | var A3 | 0,22360 | norm test | test A3 | 7,6623 |
| A4 | -3,0000 | var A4 | 0,57924 | 1,95996 | test A4 | 3,5664 |

| Test autokorelace reziduí | | Durbin - Watsonův | | | | | |
|---|---------|---------------------|----------------|-----------------|-----------------|---------|-----------------|
| DW | 1,79226 | | | | | | |
| Test homoskedasticity reziduí | | Goldfeld - Quandtův | | | | | |
| t | y | x ₁ | x ₂ | x ₃ | x ₄ | e | e ² |
| 3 | 4,18 | 0,48 | 2,19 | -0,1 | 0,31 | 0,1786 | 0,0319 |
| 4 | 11,12 | 0,55 | -0,08 | -0,6 | 0,17 | 0,6290 | 0,3957 |
| 1 | 2,33 | 0,65 | 2,19 | -0,89 | 0,97 | -0,2804 | 0,0786 |
| 2 | 17,52 | 0,76 | -0,93 | 1,14 | 0,68 | 0,0484 | 0,0023 |
| 6 | 24,24 | 2,51 | -0,78 | 1,32 | 1,3 | -0,1052 | 0,0111 |
| 5 | 15,6 | 2,68 | 0,51 | -1,35 | 0,65 | -0,0632 | 0,0040 |
| 10 | 13,44 | 3,46 | 4,22 | 0,59 | -1,82 | 0,5363 | 0,2876 |
| 7 | 25,24 | 3,56 | -0,83 | -0,75 | -0,1 | -0,1109 | 0,0123 |
| 8 | 20,29 | 3,72 | 1,7 | 1,09 | 0,65 | -1,2057 | 1,4536 |
| 11 | 18,33 | 4,74 | 2,46 | -1,71 | -1,53 | -0,4060 | 0,1649 |
| 9 | 28,21 | 5,16 | 1,61 | 0,99 | 1,64 | 1,2145 | 1,4751 |
| 14 | 20,52 | 5,39 | 3,57 | 0,41 | 0,8 | -0,5236 | 0,2742 |
| 12 | 30,05 | 5,95 | 1,61 | 0,05 | -1,56 | -0,2462 | 0,0606 |
| 13 | 30,61 | 6,63 | 1,75 | -0,48 | 0,84 | 0,5347 | 0,2859 |
| 18 | 23,87 | 8,16 | 6,04 | -0,46 | -0,97 | -0,2347 | 0,0551 |
| 16 | 35,61 | 8,94 | 3,97 | 0,68 | 0,41 | 0,1010 | 0,0102 |
| 15 | 38,24 | 9,22 | 2,99 | 0,32 | 0,64 | -0,6295 | 0,3962 |
| 19 | 28,98 | 9,64 | 5,37 | -1,33 | 0,36 | -0,7646 | 0,5847 |
| 20 | 28,41 | 9,8 | 6,9 | 0,54 | 1,92 | -0,2009 | 0,0404 |
| 17 | 34,36 | 10,29 | 5,71 | -0,81 | -0,15 | 1,5284 | 2,3359 |
| Razeno vzestupně podle hodnot proměnné x ₁ | | | | | | | |
| Předpověď | | | | | | | |
| t | y | konst. | t | u _{1t} | u _{2t} | yv | yv _d |
| 1 | 10,81 | 1 | 1 | 0,866025 | 0,866025404 | 9,1958 | 0,9985 |
| 2 | 12,78 | 1 | 2 | 0,5 | 0,866025404 | 12,2254 | 4,0280 |
| 3 | 24,36 | 1 | 3 | 0 | 0 | 18,8313 | 10,6340 |
| 4 | 18,83 | 1 | 4 | -0,5 | -0,8660254 | 25,4373 | 17,2399 |
| 5 | 21,62 | 1 | 5 | -0,86603 | -0,8660254 | 28,4668 | 20,2695 |
| 6 | 19,98 | 1 | 6 | -1 | 0 | 27,9199 | 19,7226 |
| 7 | 28,82 | 1 | 7 | -0,86603 | 0,866025404 | 27,3730 | 19,1757 |
| 8 | 27,86 | 1 | 8 | -0,5 | 0,866025404 | 30,4026 | 22,2052 |
| 9 | 32,68 | 1 | 9 | 0 | 0 | 37,0085 | 28,8112 |
| 10 | 41,97 | 1 | 10 | 0,5 | -0,8660254 | 43,6145 | 35,4171 |
| 11 | 58,6 | 1 | 11 | 0,866025 | -0,8660254 | 46,6440 | 38,4467 |
| 12 | 59,75 | 1 | 12 | 1 | 0 | 46,0971 | 37,8998 |
| 13 | 57,27 | 1 | 13 | 0,866025 | 0,866025404 | 45,5502 | 37,3529 |
| 14 | 46,51 | 1 | 14 | 0,5 | 0,866025404 | 48,5798 | 40,3824 |
| 15 | 54,15 | 1 | 15 | 0 | 0 | 55,1857 | 46,9884 |
| 16 | 57,67 | 1 | 16 | -0,5 | -0,8660254 | 61,7917 | 53,5943 |
| 17 | 60,5 | 1 | 17 | -0,86603 | -0,8660254 | 64,8212 | 56,6239 |
| 18 | 55,71 | 1 | 18 | -1 | 0 | 64,2743 | 56,0770 |
| 19 | 54,43 | 1 | 19 | -0,86603 | 0,866025404 | 63,7274 | 55,5301 |
| 20 | 61,75 | 1 | 20 | -0,5 | 0,866025404 | 66,7570 | 58,5596 |

| | | | | | | | |
|----|--------|---|----|----------|-------------|----------|---------------------|
| 21 | 77,33 | 1 | 21 | 0 | 0 | 73,3629 | 65,1656 |
| 22 | 91,95 | 1 | 22 | 0,5 | -0,8660254 | 79,9689 | 71,7715 |
| 23 | 88,58 | 1 | 23 | 0,866025 | -0,8660254 | 82,9984 | 74,8011 |
| 24 | 86,93 | 1 | 24 | 1 | 0 | 82,4515 | 74,2542 |
| 25 | 89,54 | 1 | 25 | 0,866025 | 0,866025404 | 81,9046 | 73,7073 |
| 26 | 85,59 | 1 | 26 | 0,5 | 0,866025404 | 84,9342 | 76,7368 |
| 27 | 98,45 | 1 | 27 | 0 | 0 | 91,5401 | 83,3428 |
| 28 | 98,89 | 1 | 28 | -0,5 | -0,8660254 | 98,1461 | 89,9487 |
| 29 | 90,36 | 1 | 29 | -0,86603 | -0,8660254 | 101,1756 | 92,9783 |
| 30 | 91,32 | 1 | 30 | -1 | 0 | 100,6287 | 92,4314 |
| 31 | 99,7 | 1 | 31 | -0,86603 | 0,866025404 | 100,0819 | 91,8845 |
| 32 | 101,09 | 1 | 32 | -0,5 | 0,866025404 | 103,1114 | 94,9140 |
| 33 | 110,57 | 1 | 33 | 0 | 0 | 109,7173 | 101,5200 |
| 34 | 111,63 | 1 | 34 | 0,5 | -0,8660254 | 116,3233 | 108,1259 |
| 35 | 124,57 | 1 | 35 | 0,866025 | -0,8660254 | 119,3528 | 111,1555 |
| 36 | 126,74 | 1 | 36 | 1 | 0 | 118,8059 | 110,6086 |
| 37 | 120,18 | 1 | 37 | 0,866025 | 0,866025404 | 118,2591 | 110,0617 |
| 38 | 119,53 | 1 | 38 | 0,5 | 0,866025404 | 121,2886 | 113,0912 |
| 39 | 126,26 | 1 | 39 | 0 | 0 | 127,8945 | 119,6972 |
| 40 | 126,25 | 1 | 40 | -0,5 | -0,8660254 | 134,5005 | 126,3031 |
| 41 | 130,98 | 1 | 41 | -0,86603 | -0,8660254 | 137,5300 | 129,3327 |
| 42 | 131,12 | 1 | 42 | -1 | 0 | 136,9831 | 128,7858 |
| 43 | 135,83 | 1 | 43 | -0,86603 | 0,866025404 | 136,4363 | 128,2389 |
| 44 | 136,26 | 1 | 44 | -0,5 | 0,866025404 | 139,4658 | 131,2684 |
| 45 | 142,83 | 1 | 45 | 8,57E-16 | 0 | 146,0717 | 137,8744 |
| 46 | 161 | 1 | 46 | 0,5 | -0,8660254 | 152,6777 | 144,4803 |
| 47 | 162,96 | 1 | 47 | 0,866025 | -0,8660254 | 155,7072 | 147,5099 |
| 48 | 160,92 | 1 | 48 | 1 | 0 | 155,1603 | 146,9630 |
| 49 | 161,42 | 1 | 49 | 0,866025 | 0,866025404 | 154,6135 | 146,4161 |
| 50 | 157,5 | 1 | 50 | 0,5 | 0,866025404 | 157,6430 | 149,4456 |
| 51 | 166,43 | 1 | 51 | 0 | 0 | 164,2489 | 156,0516 |
| 52 | 167,54 | 1 | 52 | -0,5 | -0,8660254 | 170,8549 | 162,6575 |
| 53 | 169,77 | 1 | 53 | -0,86603 | -0,8660254 | 173,8844 | 165,6871 |
| 54 | 161,81 | 1 | 54 | -1 | 0 | 173,3375 | 165,1402 |
| 55 | 172,48 | 1 | 55 | -0,86603 | 0,866025404 | 172,7907 | 164,5933 |
| 56 | 173,27 | 1 | 56 | -0,5 | 0,866025404 | 175,8202 | 167,6228 |
| 57 | 173,33 | 1 | 57 | 0 | 0 | 182,4261 | 174,2288 |
| 58 | 192,34 | 1 | 58 | 0,5 | -0,8660254 | 189,0321 | 180,8347 |
| 59 | 200,76 | 1 | 59 | 0,866025 | -0,8660254 | 192,0616 | 183,8643 |
| 60 | 198,55 | 1 | 60 | 1 | 0 | 191,5147 | 183,3174 |
| 61 | | 1 | 61 | 0,866025 | 0,866025404 | 190,9679 | 182,2891 |
| 62 | | 1 | 62 | 0,5 | 0,866025404 | 193,9974 | 185,3645 |
| 63 | | 1 | 63 | -4,9E-16 | -9,799E-16 | 200,6033 | 192,1012 |
| 64 | | 1 | 64 | -0,5 | -0,8660254 | 207,2093 | 198,5764 |
| 65 | | 1 | 65 | -0,86603 | -0,8660254 | 210,2388 | 201,5217 |
| 66 | | 1 | 66 | -1 | 4,4101E-15 | 209,6919 | 200,9992 |
| | | | | | | | dolní / horní mez i |

| | | | | | | |
|-----------------------|--|---------|--|--|--|--|
| 81,5603 | | 1 | | | | |
| 88,1662 | | 1 | | | | |
| 91,1958 | | 1 | | | | |
| 90,6489 | | 1 | | | | |
| 90,1020 | | 1 | | | | |
| 93,1315 | | 1 | | | | |
| 99,7375 | | 1 | | | | |
| 106,3434 | | 1 | | | | |
| 109,3730 | | 1 | | | | |
| 108,8261 | | 1 | | | | |
| 108,2792 | | 1 | | | | |
| 111,3087 | | 1 | | | | |
| 117,9147 | | 1 | | | | |
| 124,5206 | | 1 | | | | |
| 127,5502 | | 1 | | | | |
| 127,0033 | | 1 | | | | |
| 126,4564 | | 1 | | | | |
| 129,4859 | | 1 | | | | |
| 136,0919 | | 1 | | | | |
| 142,6978 | | 1 | | | | |
| 145,7274 | | 1 | | | | |
| 145,1805 | | 1 | | | | |
| 144,6336 | | 1 | | | | |
| 147,6631 | | 1 | | | | |
| 154,2691 | | 1 | | | | |
| 160,8750 | | 1 | | | | |
| 163,9046 | | 1 | | | | |
| 163,3577 | | 1 | | | | |
| 162,8108 | | 1 | | | | |
| 165,8403 | | 1 | | | | |
| 172,4463 | | 1 | | | | |
| 179,0522 | | 1 | | | | |
| 182,0818 | | 1 | | | | |
| 181,5349 | | 1 | | | | |
| 180,9880 | | 1 | | | | |
| 184,0175 | | 1 | | | | |
| 190,6235 | | 1 | | | | |
| 197,2294 | | 1 | | | | |
| 200,2590 | | 1 | | | | |
| 199,7121 | | 1 | | | | |
| 199,6466 | | 1,05872 | | | | |
| 202,6303 | | 1,05313 | | | | |
| 209,1055 | | 1,03719 | | | | |
| 215,8422 | | 1,05313 | | | | |
| 218,9559 | | 1,06340 | | | | |
| 218,3847 | | 1,06044 | | | | |
| ntervalu spoehlivosti | | | | | | |

Příklad použití lineární regrese: pře

Model

K vysvětlení se použijí pouze veličiny x_1 až x_3 .

Model má tvar: $y_t = b_0 + b_1 x_{t1} + b_2 x_{t2} + b_3 x_{t3} + e_t$.

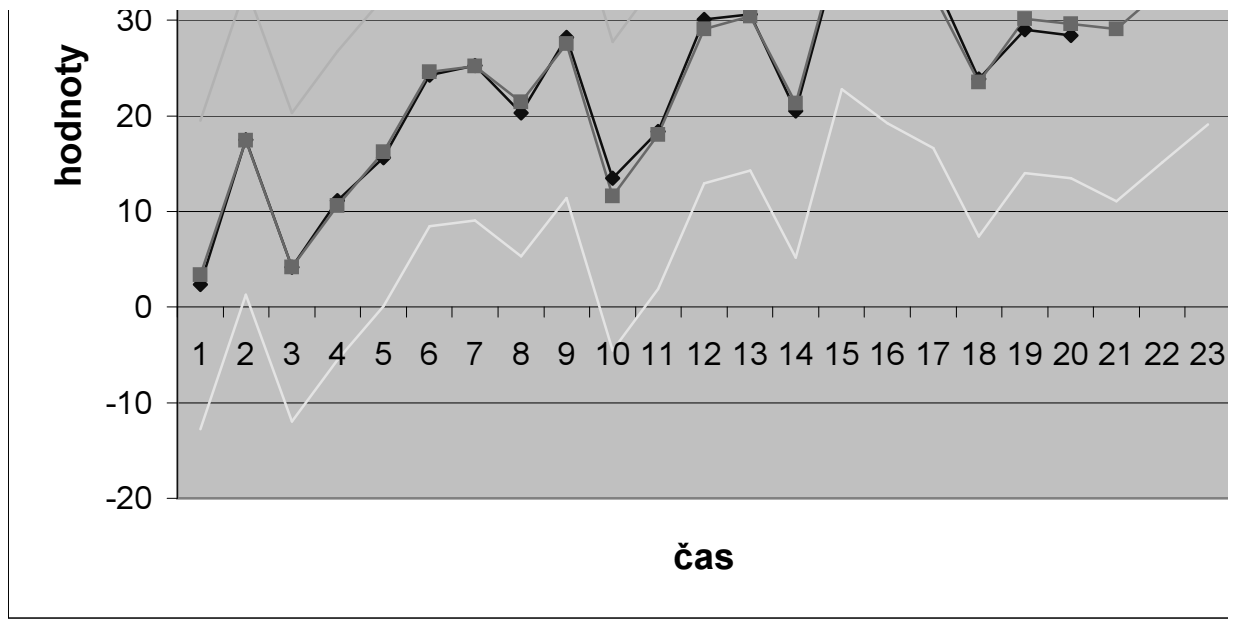
| t | y | konst. | x_1 | x_2 | x_3 | intervaly spolehlivosti pozorovar | |
|----|-------|--------|-------|-------|-------|-----------------------------------|-----------|
| | | | | | | y_v | $y_{v,d}$ |
| 1 | 2,33 | 1 | 0,65 | 2,19 | -0,89 | 3,3836 | -12,7502 |
| 2 | 17,52 | 1 | 0,76 | -0,93 | 1,14 | 17,3970 | 1,2632 |
| 3 | 4,18 | 1 | 0,48 | 2,19 | -0,1 | 4,1782 | -11,9556 |
| 4 | 11,12 | 1 | 0,55 | -0,08 | -0,6 | 10,5714 | -5,5624 |
| 5 | 15,6 | 1 | 2,68 | 0,51 | -1,35 | 16,1850 | 0,0512 |
| 6 | 24,24 | 1 | 2,51 | -0,78 | 1,32 | 24,5638 | 8,4300 |
| 7 | 25,24 | 1 | 3,56 | -0,83 | -0,75 | 25,1557 | 9,0219 |
| 8 | 20,29 | 1 | 3,72 | 1,7 | 1,09 | 21,4619 | 5,3281 |
| 9 | 28,21 | 1 | 5,16 | 1,61 | 0,99 | 27,5503 | 11,4165 |
| 10 | 13,44 | 1 | 3,46 | 4,22 | 0,59 | 11,5982 | -4,5356 |
| 11 | 18,33 | 1 | 4,74 | 2,46 | -1,71 | 18,0236 | 1,8898 |
| 12 | 30,05 | 1 | 5,95 | 1,61 | 0,05 | 29,0532 | 12,9194 |
| 13 | 30,61 | 1 | 6,63 | 1,75 | -0,48 | 30,4429 | 14,3091 |
| 14 | 20,52 | 1 | 5,39 | 3,57 | 0,41 | 21,3156 | 5,1818 |
| 15 | 38,24 | 1 | 9,22 | 2,99 | 0,32 | 38,9019 | 22,7681 |
| 16 | 35,61 | 1 | 8,94 | 3,97 | 0,68 | 35,3755 | 19,2417 |
| 17 | 34,36 | 1 | 10,29 | 5,71 | -0,81 | 32,7591 | 16,6253 |
| 18 | 23,87 | 1 | 8,16 | 6,04 | -0,46 | 23,5262 | 7,3924 |
| 19 | 28,98 | 1 | 9,64 | 5,37 | -1,33 | 30,1184 | 13,9846 |
| 20 | 28,41 | 1 | 9,8 | 6,9 | 0,54 | 29,5886 | 13,4548 |
| | | | | | | střed | dolní mez |

Předpovědi

| | y | konst. | x_{1p} | x_{2p} | x_{3p} | intervaly spolehlivosti předpovídat | |
|----|---|--------|----------|----------|----------|-------------------------------------|-----------|
| | | | | | | y_p | $y_{p,d}$ |
| 21 | | 1 | 10 | 7 | 0 | 29,0839 | 11,0464 |
| 22 | | 1 | 11 | 7 | 0 | 33,2498 | 15,1393 |
| 23 | | 1 | 12 | 7 | 0 | 37,4158 | 19,0750 |
| | | | | | | střed | dolní mez |

Skutečné a vyrovnané hodnoty a předpověď





odpověď prvního modelu

| výhodných hodnot | |
|------------------|-------|
| y_vh | f_t |
| 19,5174 | 1,0 |
| 33,5308 | 1,0 |
| 20,3120 | 1,0 |
| 26,7052 | 1,0 |
| 32,3188 | 1,0 |
| 40,6976 | 1,0 |
| 41,2895 | 1,0 |
| 37,5957 | 1,0 |
| 43,6840 | 1,0 |
| 27,7320 | 1,0 |
| 34,1574 | 1,0 |
| 45,1870 | 1,0 |
| 46,5767 | 1,0 |
| 37,4494 | 1,0 |
| 55,0357 | 1,0 |
| 51,5093 | 1,0 |
| 48,8929 | 1,0 |
| 39,6600 | 1,0 |
| 46,2522 | 1,0 |
| 45,7224 | 1,0 |

horní mez

| |
|--------|
| s |
| 7,6106 |

| |
|--------------------------|
| $t_{n-k-1}(\text{alfa})$ |
| 2,1199 |

| |
|------|
| alfa |
| 0,05 |

| výhodných hodnot | |
|------------------|--------|
| y_{ph} | f_t |
| 47,1213 | 1,1180 |
| 51,3604 | 1,1225 |
| 55,7565 | 1,1368 |

horní mez

