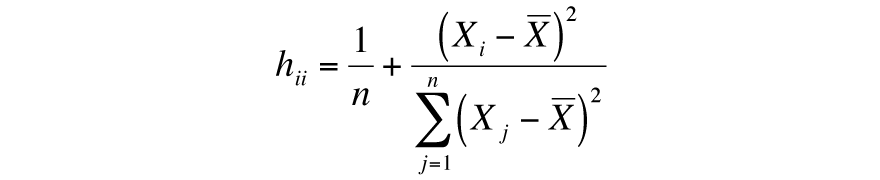
Leverage: how much a point has the ability to change parameters/regression line

Influence: How much the data point actually changes parameters/line

**The Leverage Statistic**

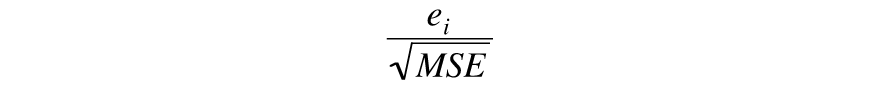
* *hii* measures the role of the *X* values in determining the predicted value.
* *hii* > 2*p/n* indicates high leverage. P = # parameters



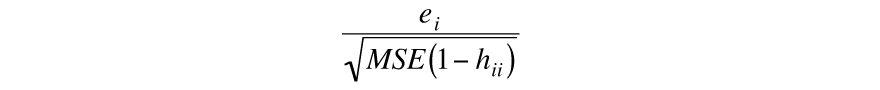
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**Other Types of Residuals**

* Standardized residuals: e is residual, MSE is mean square error



* Studentized residuals: adjustment for high leverage residuals



* Studentized-deleted residuals
  + *ith* residual is the studentized residual based on a regression of *Y* on *X* for all observations except the *ith* one.
  + *ith* point is influential if the residual is very large in magnitude.

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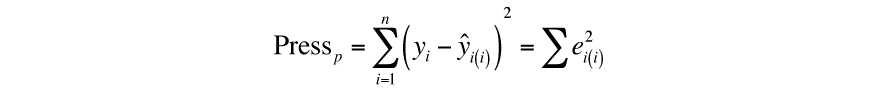
**Why Do We Need Other Residuals?**

* Standardization and/or studentization is necessary.
* Residuals are estimates of true errors.
  + Unlike true errors, residuals do not have constant variance. (Variance increases as the distance from the mean increases.)
  + Accounting for this with standardization/  
    studentization allows departures from nonconstant variance to be seen more easily.

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**Leave-One-Out Statistics: PRESS**

Predicted residual sum of squares:



* Smaller values are better. Predictions are closer

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**Leave-One-Out Statistics:   
Cook's Distance**

Measure of leverage:

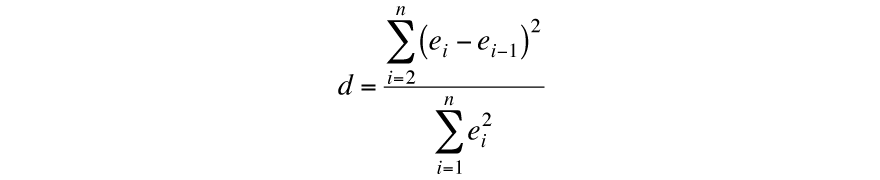
* *p* = number of parameters

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**Durbin-Watson Test**

Detects departures from independence:



* Always between 0 and 4 (inclusive)
* Close to 0 for positively correlated residuals
* Close to 4 for negatively correlated residuals
* Distributed symmetrically about 2

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**Recap**

|  |  |  |
| --- | --- | --- |
| Name | Expression | Use |
| Residual | https://s3-us-west-2.amazonaws.com/smu-mds/prod/Experimental+Statistics+I/Week+11/11.4/ES1_11.4_recap-01_0.png | Residual plots |
| Standardized residual | https://s3-us-west-2.amazonaws.com/smu-mds/prod/Experimental+Statistics+I/Week+11/11.4/ES1_11.4_recap-02_0.png | Identify outliers |
| Studentized residual | https://s3-us-west-2.amazonaws.com/smu-mds/prod/Experimental+Statistics+I/Week+11/11.4/ES1_11.4_recap-03_0.png | Test outlying *Y*'s |
| Deleted residual | https://s3-us-west-2.amazonaws.com/smu-mds/prod/Experimental+Statistics+I/Week+11/11.4/ES1_11.4_recap-04_0.png | Calculate PRESS |

* PRESS: Models with smaller values are better fitting.
* Durbin–Watson test: Use to detect independence violations.