

# Letter to the Editor

## Big Macs and Eigenfactor Scores: The Correlation Conundrum

Sir,

West, Bergstrom, and Bergstrom (2010) use an interesting, but inappropriate analogy to warn about spurious correlations, and to suggest that Davis (2008) erred in concluding that unweighted citation counts (as expressing *popularity* of a journal) and weighted citations (i.e., eigenfactors, expressing *prestige* of a journal) convey very similar information.

The Big Macs analogy used by West, Bergstrom, and Bergstrom (2010) is very sensitive to currency denominations and inter se exchange rates. To use such data to obtain correlation coefficients is meaningless. Table 1 of West, Bergstrom,

TABLE 1. Original table from West, Bergstrom, and Bergstrom (2010) before currency reform.

Country	Burger price	Hourly wage	Burger wage
Denmark	24.75	211.13	8.53
Australia	3	19.86	6.62
New Zealand	3.6	21.94	6.09
Switzerland	6.3	37.85	6.01
United States	2.54	14.32	5.64
Britain/UK	1.99	11.15	5.60
Germany	2.61	14.32	5.49
Canada	3.33	16.78	5.04
Singapore	3.3	15.65	4.74
Sweden	24	110.9	4.62
Hong Kong	10.7	44.26	4.14
Spain	2.37	8.59	3.62
South Africa	9.7	30.86	3.18
France	2.82	8.5	3.01
Poland	5.9	11.8	2.00
Hungary	399	704.34	1.77
Czech Rep.	56	85.34	1.52
Brazil	3.6	4.58	1.27
South Korea	3000	3134	1.04
Mexico	21.9	17.61	0.80
Thailand	55	31.69	0.58
China	9.9	5.56	0.56
Mean	166.01	207.32	3.72
Std. dev.	638.49	670.63	2.29
Std. dev./Mean	3.85	3.23	0.62
Intercept		33.92	
Slope		1.04	
Correlation		0.99	

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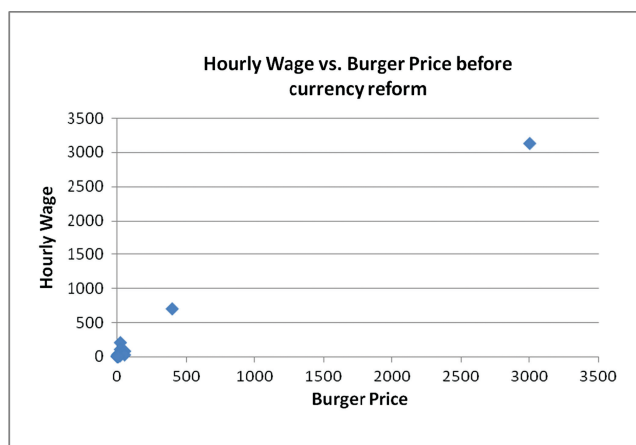


FIG. 1. The relationship between hourly wage and burger price before currency reform.

and Bergstrom (2010) is reproduced here and describes the relationship between burger price and hourly wage in the extant currency denominations. Here, three additional rows are added, which keep track of mathematical coefficients that arise in any least squares linear regression process: the intercept, slope, and correlation. The process is reflected in Figure 1. The huge value of burger price (3000 won converts to  $\approx$ USD \$2.50) and correspondingly the hourly wage, in South Korea, completely dominates the linear regression process and determines the values of intercept, slope, and correlation coefficient.

Assume that there is currency reform everywhere so that more manageable denominations are used. Korea is encouraged to have a superwon (1 superwon = 1000 won). Similarly, some other countries are imagined to follow suit. Table 2 shows what happens when this is done and Figure 2 captures the resulting graphical dispersion. The values of intercept, slope, and correlation coefficient change dramatically. The correlation coefficient has in fact changed from 0.99 to 0.31.

The paradox arises because from row to row in Tables 1 and 2, the Big Mac prizes are expressed in different currency units, and there is a huge range from the lowest value (1.99 in Britain/UK) to the highest (3000 in South Korea) in Table 1. This is not what happens in Davis' comparison of weighted and unweighted (raw) citation counts. The units remain citations and the correlation coefficient of 0.95 that results show the effect of recursive weighting resulting from the eigenvalue process.

TABLE 2. Table from West, Bergstrom, and Bergstrom (2010) after currency reform.

Country	Burger price	Hourly wage	Burger wage
<b>Denmark</b>	<b>2.48</b>	<b>21.11</b>	8.53
Australia	3.00	19.86	6.62
New Zealand	3.60	21.94	6.09
Switzerland	6.30	37.85	6.01
United States	2.54	14.32	5.64
Britain/UK	1.99	11.15	5.60
Germany	2.61	14.32	5.49
Canada	3.33	16.78	5.04
Singapore	3.30	15.65	4.74
<b>Sweden</b>	<b>2.40</b>	<b>11.09</b>	4.62
<b>Hong Kong</b>	<b>1.07</b>	<b>4.43</b>	4.14
Spain	2.37	8.59	3.62
South Africa	9.70	30.86	3.18
France	2.82	8.50	3.01
Poland	5.90	11.80	2.00
<b>Hungary</b>	<b>3.99</b>	<b>7.04</b>	1.77
<b>Czech Rep.</b>	<b>5.60</b>	<b>8.53</b>	1.52
Brazil	3.60	4.58	1.27
<b>South Korea</b>	<b>3.00</b>	<b>3.13</b>	1.04
Mexico	2.19	1.76	0.80
<b>Thailand</b>	<b>5.50</b>	<b>3.17</b>	0.58
China	9.90	5.56	0.56
<i>Mean</i>	3.96	12.82	3.72
<i>Std. dev.</i>	2.32	9.20	2.29
<i>Std. dev./Mean</i>	0.59	0.72	0.62
<i>Intercept</i>		7.99	
<i>Slope</i>		1.22	
<i>Correlation</i>		0.31	

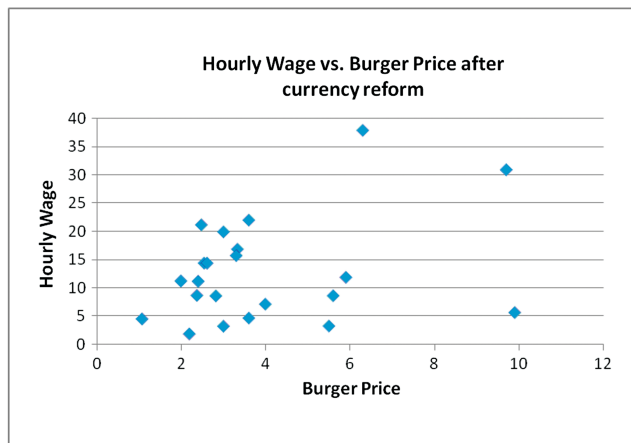


FIG. 2. The relationship between hourly wage and burger price after currency reform.

## References

- West, J., Bergstrom, T., & Bergstrom, C.T. (2010). Big Macs and Eigenfactor scores: Don't let correlation coefficients fool you. *Journal of the American Society for Information Science and Technology*, 61(9), 1800–1807.
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