The Readability of the US Federal Income Tax System: Some First Results

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1.0 Introduction

Federal tax reform is a frequent even-numbered year refrain among elected officials and various media commentators. As observers of the public's finances have noted, however, one person's tax reform can be another's financial anathema. No doubt conflict between personal tax-minimizing goals and a responsible society's budgetary objectives is just one awkward tradeoff that lies in the fine print of campaign pledges. While such policy conflicts are inevitable, and perhaps explain why tax reform is easier to promise for than garner majorities in the US House and Senate, we suspect, even hope, that most of us can agree that the tax system ought to be understandable, and readable in order to result in what we like to call voluntary compliance.

Whether or not our federal income tax system's instructions to its taxpayers is readable is the subject matter of this paper, as well as whether or not the underlying tax law, compared to all federal laws, is readable.

This frankly empirical investigation into the readability of our federal tax system is organized as follows. Section 2 motivates the inquiry by a recollection of how the redesign of the 1040 tax table instructions came about in the 1970. Section 3 presents two empirical measures of readability, the Flesch Reading Ease (FRE) index, and the Flesch-Kincaid Grade Level (FKG) readability index, the research questions and methodology; Section 4 presents the application of the FRE and FKG to the 1040, 1120 and 1120S income tax instructions over time; Section 5 presents FRE and FKG measures to the Internal Revenue Code, and compares results to the entirety of the US Code; and Section 6 concludes.

2.0 A Federal Tax Administration Historical Anecdote

Section 507 of the Tax Reform Act of 1976, PL 94-455 obligated the Staff of the Joint Committee on Taxation of the US Congress to conduct a tax simplification study.[2] In conjunction with that study, certain experimental psychology literature was identified which showed that experimental subjects made fewer errors of inference when reading the results of a multiplication table rather than performing the multiplication themselves. It occurred that extending the entries and size of the tax tables in the 1040 instructions should materially reduce math error rates; at that time there was some sensitivity that math error rates in the individual income tax were becoming a nuisance if not a problem. At A 1976 meeting with IRS that was convened by JCT Chief of Staff Lawrence Woodworth, the IRS was advised to extend the tax tables in the 1040 instruction booklet, and the IRS subsequently did so.

With the benefit of hindsight and public records, one can reconstruct a few aspects of what transpired as a result of that JCT meeting with the IRS. The tax table in the 1975

[2] The resulting JCT Pamphlet was released in September, 1977 as JCS 57-77 and may be viewed/downloaded at https://www.jct.gov/publications.html?func=showdown&id=4126

instruction booklet allowed taxpayers with up to $15,000 in taxable income to read off their taxes due rather than compute them. Based on an analysis of the 1975 Public Use File for individual income tax returns, taxpayers with $15,000 or less of taxable income accounted for 85% of all returns. The 1978 the tax table, then reflecting Congressional staff advice, displayed tax calculations for up to $40,000 of tax table income or 98% of all returns in 1978. As can be seen, the error rate fell from 1976 to 1977 by 37%. There were, of course, other factors at work that lowered the math error rate, including the simplification of the 1040A. However, maintaining coverage of the tax table in the instruction booklet have been an easy way to help avoid some common taxpayer calculation errors.

Table1: The Rise and Fall of 1040 Math Error Rates 1975-1978

Item	1975	1976	1977
1040 Math Error Rate 1/	8.90%	10.40% %Δ=16.9%	6.44% %Δ= -38.1%
1040 Instructions Tax Table Last Taxable Income Entry 2/	$15,000	$20,000 % Δ=33.3%	$40,000 % Δ=100%
Percentile of Highest Entry for Tax Table Taxable Income 3/	85%	91% % Δ=7.1%	98% %Δ=7.7%

Sources:

1/ 1997-1999 Annual Reports of the Commissioner of Internal Revenue Service

2/ 1040 Instruction Booklets, 1975-1978

3/Author's tabulations of Annual Public Use Files for 1975-1978.

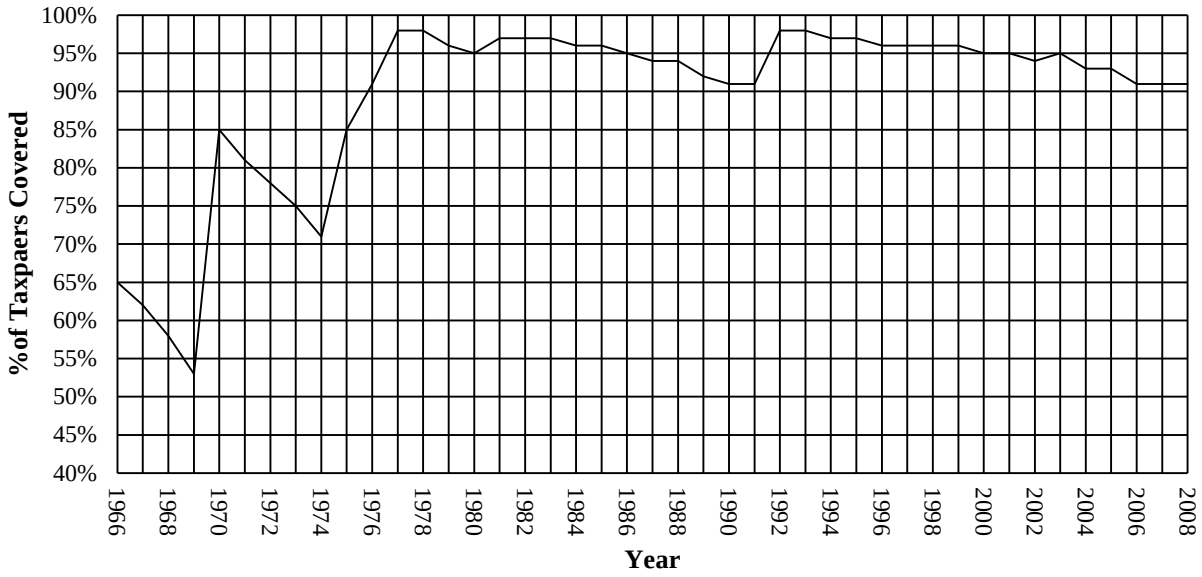
The availability of PUF files from 1966 to 2008 allows a retrospective analysis of the percentile of the highest tax table income in the instructions over a longer period of time and thus a long look at "coverage." As is evident from Table 2, the largest taxable income entry in the 1040 instructions tax table tends to persist for a long period of time, and has been "stuck" at $100,000 since 1992 or better than 20 years. Figure 1 makes this point graphically. Since each additional printed page of the tax table covers $9,000 of taxable income across the various filing status and exemption classes, increasing the coverage to, say, $120,000 would entail no more than 3 pages to the booklet or less than a 1.5% increase in pages.

Table 2: 1040 Instruction Tax Table Coverage of Highest Taxable Income

Year	Largest Tax Table Number	Percentile of Taxable Income	Year	Largest Tax Table Number	Percentile of Taxable Income
1966	$5,000	65%	1987	$50,000	94%
1967	$5,000	62%	1988	$50,000	94%
1968	$5,000	58%	1989	$50,000	92%
1969	$5,000	53%	1990	$50,000	91%
1970	$10,000	85%	1991	$50,000	91%
1971	$10,000	81%	1992	$100,000	98%
1972	$10,000	78%	1993	$100,000	98%
1973	$10,000	75%	1994	$100,000	97%
1974	$10,000	71%	1995	$100,000	97%
1975	$15,000	85%	1996	$100,000	96%
1976	$20,000	91%	1997	$100,000	96%
1977	$40,000	98%	1998	$100,000	96%
1978	$40,000	98%	1999	$100,000	96%
1979	$40,000	96%	2000	$100,000	95%
1980	$40,000	95%	2001	$100,000	95%
1981	$50,000	97%	2002	$100,000	94%
1982	$50,000	97%	2003	$100,000	95%
1983	$50,000	97%	2004	$100,000	93%
1984	$50,000	96%	2005	$100,000	93%
1985	$50,000	96%	2006	$100,000	91%
1986	$50,000	95%	2007	$100,000	91%
			2008	$100,000	91%

Source: Authors' analysis of online 1040 instructions from IRS.Gov, and tabulations of Annual Public Use File.

Figure 1: Fraction of Taxpayers Covered in 1040 Tax Table: 1966-2008



3.0 Readability in more detail: Two Readability Measures and Research Methodology

The plain English movement[3] has developed a wide array of metrics to gauge whether or not particular text is difficult to read and comprehend. Generally, word length and sentence length are the two key variables used in a variety of readability scoring formulae. Smith and Taffler(1992) review of several reading formulae, general issues of understandability and complexity, and those problems that arise in accounting. Barney, Tschopp and Wells(2013) applied several readability formulae to selected sections of the Internal Revenue Code, certain Treasury regulations, FASB statements, and other reference documents, while Mailloux, Johnson, Fisher, and Pettibone(1994) for applications of readability formulae in the field of nursing. According to Pyrezak(1976), the IRS first began to investigate readability of the 1040 instructions in 1971 through the application of the Dale-Chall formula to sampled lines from the 1040 instruction booklet. They go on to report results of readability experiments with 35 graduate education students. Daily, Dorsey and Kumar(2010) examined the readability of US Tax Court cases over time, and found a statistically significant *decline* in the readability of opinions. Chiang, Englebrecht, T. J. Phillips, and Y. Wang(2008) compared various readability scoring formulae when applied to a variety of accounting textbooks, and concluded that the scores from various formulae were highly correlated, and therefore contained the same information content. This finding by Chiang et al. motivates our use of two of the most popular and convenient readability formulae. Below we explain the widely used Flesch Ease of Readability Formula and the Frisch-Kincaid Grade Level Formula. The latter is the standard required by the US Department of Defense in their written communications.

3.1 The Flesch Reading Ease Formula (FRE)

In 1948, the noted reading specialist, Rudulf Flesch(1948) proposed and demonstrated the utility of a readability ease (FRE) measure based on word and sentence length:

$$FRE = 206.835 – (1.015 \times ASL) – (84.6 \times ASW) \quad (1)$$

RE = Readability Ease
ASL = Average Sentence Length (i.e., the number of words divided by the number of sentences)
ASW = Average number of syllables per word (i.e., the number of syllables divided by the number of words)

One widely available readability service due to Brian Scott classifies the values of RE as follows[4]:

[3] For example, see Locke(2004) for a history of the plain English movement in the US Government.
[4] See http://www.readabilityformulas.com/flesch-reading-ease-readability-formula.php

90-100 : Very Easy
80-89 : Easy
70-79 : Fairly Easy
60-69 : Standard
50-59 : Fairly Difficult
30-49 : Difficult
0-29 : Very Confusing

3.2 The Flesch-Kinkaid Grade Level Formula (FKG)

Rudolf Flesch and John Kincaid also proposed a second formula which establishes school grade levels of readability on the basis of average sentence length and the average number of syllables per word, several empirical parameters, and a constant:

$$FKG = (0.39 \times ASL) + (11.8 \times ASW) - 15.59 \quad (2)$$

Where,

FKG = Flesch-Kincaid Grade Level
ASL = Average Sentence Length (i.e., the number of words divided by the number of sentences)
ASW = Average number of Syllable per Word (i.e., the number of syllables divided by the number of words)

3.3 Research Questions and General Text Processing Methodology:

Our general purpose is to compare and contrast the above two readability measures for three federal income tax instructions: the instructions for the individual income tax on federal form 1040, the instructions on federal form 1120, the corporate income tax, and the instructions for the small corporation income tax, federal form 1120s. Also, we seek to place the readability of the Internal Revenue Code (IRC) among other parts of law through the analysis of the readability of the entire US Code. To that end, we obtained these tax documents from IRS.Gov in Portable Display Format (PDF), then using Adobe Professional X, created MS Word 2010 documents, and then used MS Word 2010 and specialized Visual Basic macros to "score" readability via the FRE and FKRA formulae. Additionally we collected the number of words, sentences, and paragraphs. Of interest are the relative levels of FRE and FKRA values for the three types of income tax instructions, their patterns over time, as well as relative variability. Similarly, we obtained the entire US Code in PDF, and then translated it into MS Word with Adobe Acrobat, and make similar comparisons across the US Code.

To put the FRE and FKG values in perspective, we obtained and computed FRE and FKG values for the Gettysburg Address and US Constitution; the results are shown in Table 3 below. We see that the Gettysburg address was at the 10.6 grade level with a Reading Ease Score of

67.1, which is at the "standard" level of reading ease, while the US Constitution, including amendments, is slightly above the high school graduate level with a Reading Ease Score of 46.6 which is at the "difficult" level of reading ease.

Table 3: Flesch Reading Ease and Flesch-Kinkaid Grade Level Scores for the Gettysburg Address and the US Constitution

Document	Words	Sentences	Flesch_Reading Ease	Flesch-Kincaid Grade_Level
Gettysburg Address	271	10	67.1 ("standard")	10.6
US Constitution (Including Amendments)	7,830	198	46.6 ("difficult")	12.3

Source: Documents retrieved from online sources, evaluated with MS Word 2010.

4.0 The Readability of Federal Individual and Corporate Income Tax Instructions

Before displaying the results of the text processing, we should remind the reader that our calculations are based on the Acrobat translations of the various downloaded instructions into MS Word versions. As such, they do *not* reflect the elimination of numerical tables which may distract the calculations. Since all text was processed in the same manner under the same assumptions, it is likely that the relationships we observe are reasonably stable since there is no reason to believe that the tables and section headings are systematically variable over time. A second pass analysis of the various instructions is planned to deal with these and related possible measurement issues.

4.1 Individual 1040 Instructions over time

Table 4 displays the summary FRE and FKG when applied to the 1040 instructions booklet across the years 1938-2012. The individual income tax instructions were "very confusing" in 1941 when the FRE value was only 17.4, and "fairly difficult" at 53.9 in 2003. In terms of grade level, the individual income tax instructions required over the entire period 1938-2013 ranged, in terms of the inter-quartile range, between a 9^{th} and 10^{th} grade level of reading difficulty. Also the instructions in 1941 were at the college level. Long term trends in FRE and FKG are more evident when viewed graphically; see Figure 2 and Figure 3 below. Since the late 1960's, Reading Ease slowly rose from the "difficult" range, and has persisted to the mid 50 to high 50 range ("fairly difficult"). Similarly we see that Reading Grade Level was quite high in the 1940's, declined, and has been at about the 8'th grade level since the 1990's.

Table 4: Summary FRE and FKG Values for the 1040 Individual Income Tax Instruction Booklet: 1938-2012

Statistic	FRE_1040	FKG_1040
Minimum	17.4	7.2
25%	48.7	8.8
Median	53.9 "fairly difficult"	9.4 Years of grade level
Mean	52.1	9.6
75%	57.2	10.2
Maximum	59.8	14.7
CV	13.0%	15.3%

Source: Authors' calculations with MS Word 2010 and Visual Basic Macro

Figure 2: Flesch Reading Ease Scores for 1040 Instructions: 1938-2013

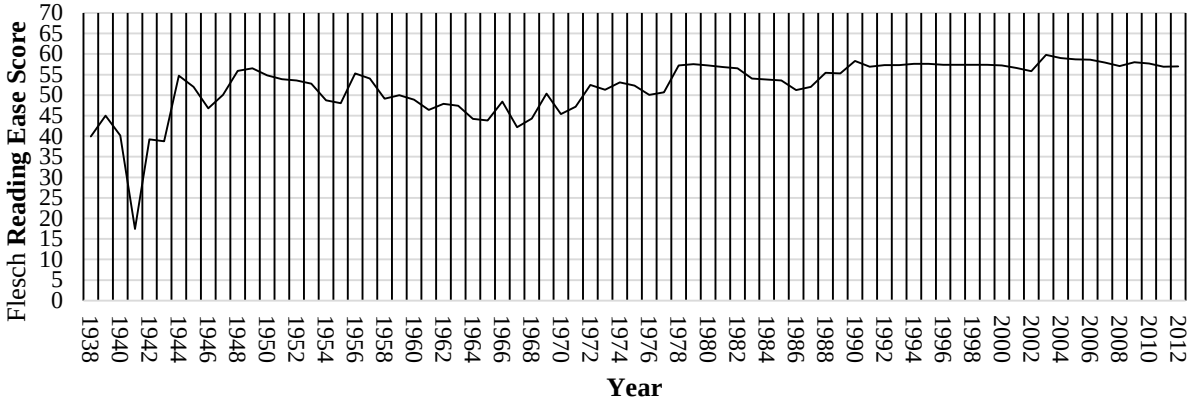
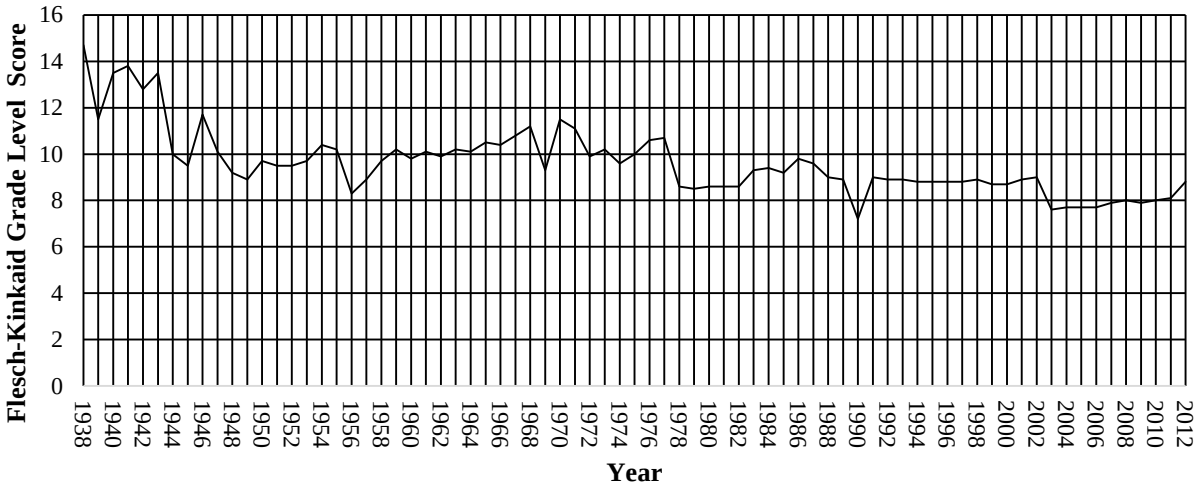


Figure 3: Flesch-Kincaid Grade Level Scores for 1040 Instructions: 1938-2012



When we align the Flesch Reading Ease scores by type of income tax instruction booklet over the same time period, 1990-2012, we find that the individual income tax instructions range from 55.8 to 59.8, or are generally "Fairly Difficult." See Table 5. Note that compared to the longer time period (compare Table 5 and Table 4), we find that the more recent individual income tax instruction booklets have been a bit easier to read—compare the median of 57.4 for the more recent time interval to 53.9 for the longer time interval. For the most recent period, both corporate income tax instruction booklets are by contrast "Difficult," and on average the 1120 is slightly less difficult to read than is the 1120s. Whether the differences in reading ease between the 1120 and 1120s are material is a matter for further research. Finally, we find that the variability, as measured by the coefficient of variation (CV) , in reading ease over the last 12 study years is much smaller for the individual income tax instructions than for the corporate income tax instructions, and that the Subchapter S instructions are *more* variable than the general corporate income tax instructions.

Table 5: Comparison of 1040,1120 and 1120S Instructions Flesch Reading Ease Scores: 1990-2012

FRE	1040 Individual	1120 Corporate	1120s Small Corporation
Min	55.8	41.4	40.6
Q1	57.2	42.6	43.3
Median	57.4 "Fairly Difficult"	43.0 "Difficult"	45.5 "Difficult"
Mean	57.6	43.0	44.7
Q3	58.0	43.7	45.9
Max	59.8	44.6	46.4
CV	1.5%	2.1%	3.7%

The pattern for Flesch-Kincaid Grade Level Scores in Table 6 follows the general pattern of the Reading Ease Scores. The average reading grade level for the individual income tax instructions is between 8th and 9th grade, while the average reading grade level for the general corporate tax instructions are between 9th and 10th grade, and between 8th and 9th grade for the Subchapter S instructions. Note, however, that the variability in grade level score for small corporations is now *smaller* than either the individual or general corporate instructions. See Table 6.

Table 6: Comparison of 1040, 1120 and 1120S Instructions Flesch-Kinkaid Grade Level Scores: 1990-2012

FKG	1040 Individual	1120 Corporate	1120s Small Corporation
Min	7.2	9.1	8.3
Q1	7.9	9.4	8.4
Median	8.7	9.9	8.6
Mean	8.4	10.0	8.6
Q3	8.8	10.5	8.9
Max	9.0	11.1	9.3
CV	6.8	7.0%	3.6%

Pearson correlation coefficients calculated among the two types of readability measures across 1990-2012 indicate the same general patterns of association over time. The Flesch Reading Ease measure for the Subchapter S instructions gets easier to read over time in a

statistically significant fashion, although this is not true for the 1040 instructions. Surprisingly, while the readability ease scores for the two corporate instructions move together over time, only the 1120s shows improved readability over time. (See Table 7).

The grade level readability scores display a more consistent pattern across time. As time progressed between 1990 and 2012, the reading grade level of two corporate income tax instruction booklets declined in a statistically significant fashion; however, this was not the case for the individual income tax instruction booklet. (See Table 8).

Table 7: Pearson Correlation Coefficients (n=22) for Flesch Reading Ease Scores for Federal Tax Form Instructions: 1990-2012

	Year	fre_1040	fre_1120	fre_1120s
Year	1	.0440	.4774*	.7463***
fre_1040		1	.2144	.0180
fre_1120			1	.5202*
fre_11120s				1

*p <.05 **p<.01 ***p<.001

Table 8: Pearson Correlation Coefficients (n=22) for Flesch-Kincaid Grade Level Readability Scores for Federal Tax Form Instructions: 1990-2012

	Year	fkg_1040	fkg_1120	fkg_1120s
Year	1	-.3506	-.7647***	-.8823***
fkg_1040		1	.5754**	.3230
fkg_11120			1	.7772***
fkg_11120s				1

*p <.05 **p<.01 ***p<.001

5.0 Mirror, Mirror on the Wall, What Parts of the US Code are the Most Readable of Them All?

It is likely that very few taxpayers take it upon themselves to read the entire Internal Revenue Code, *per se*, in conjunction with filing their personal or business tax returns. A question arises, however, just how readable or not the Internal Revenue Code is. To explore this question, the entire US Code was downloaded, and the methodology used to score the instructions was applied to each title. Table 9 shows a number of characteristics of Title 26, the Internal Revenue Code, and the distribution of reading ease, grade level of reading and several other characteristics across the 53 titles of the US Code.

What we observe about the Internal Revenue Code is that it is the largest title among those in the US code in terms of words and sentences, and while its Reading Ease is "Difficult" at 39.6, it is far easier to read than the average or median title of the US code which is between 37.5 and 38. Interestingly, the reading level of the Internal Revenue Code is just below 12th grade level, whereas most titles of the US Code are between 11th and 12th grade levels. However, in terms of words per sentence, the IRC at 19.2 words per sentence is quite extreme; the median number of words per sentence is 18. Evidently, verbosity at about a 12th grade level seems to characterize how we write and implement our tax laws.

Table 9: Comparison of Characteristics of Title 26 of the US Code to the Distribution of Characteristics across All Titles

US Code Title	Count of Words	Count of Sentences	Flesch Reading Ease	Flesch Kincaid Grade Level	Words/ Sentence
Title 26 Internal Revenue Code	2,394,955	65,409	39.6	11.8	19.2
Across Each Title of US Code (n=53)	Words	Sentences	Flesch Reading Ease	Flesch Kincaid Grade Level	Words/ Sentence
25%	106,806	4,157	31.3	11.7	16.1
Mean	562,406	18,535	35.1	12.4	18.4
Median	316,991	10,992	34.0	12.4	18.0
75%	797,050	24,522	37.3	13.2	19.4

Source Authors' calculations.

6.0 Summary and Research Plans

This first systematic look at the readability of the US personal and business income tax instructions and the underlying statute, Title 26 of the US Code, from which these instructions are derived, indicates that the general readability of our federal tax system is "difficult" but at around the 12th grade reading level. The individual income tax instructions are less difficult to read and at a lower grade level than the corporate and small corporation income tax instructions. Over time there has been less variability in the measured reading ease of the individual income tax instructions compared to the two business income tax instructions. Over time, the general readability of our tax system, as reflected in the two measures of readability, seems to have been improved, although any final conclusion must await further analysis and double checking of data.

Perhaps most surprising to these authors is the finding that the reading grade level of the Internal Revenue Code is actually *lower* on average than the rest of the US Code, although the

sentences in the Internal Revenue Code, as tax practitioners undoubtedly know, are longer than other parts of federal law.

Besides double-checking the calculations reported here, an obvious area to explore with this methodology is the investigation of the readability of tax regulations, and the parsing of various parts of instructions, law, and regulations into those which are more readable, and those which are less readable. Another area worthy of further exploration involves the relationship between readability of forms, laws, and regulations and observed mathematical errors observed by the IRS in the administration of tax law. Here, the more complete reporting of error rates by tax year, Code section, would enable this research.

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Appendix 1: FRE and KFG Scores for 1040 Instructions: 1938-2012

Year	FRE_1040	FKG_1040	Year	FRE_1040	FKG_1040
1938	39.9	14.7	1976	50.1	10.6
1939	45	11.5	1977	50.7	10.7
1940	40.2	13.5	1978	57.2	8.6
1941	17.4	13.8	1979	57.5	8.5
1942	39.2	12.8	1980	57.2	8.6
1943	38.8	13.5	1981	56.8	8.6
1944	54.7	10	1982	56.5	8.6
1945	52	9.5	1983	54	9.3
1946	46.8	11.7	1984	53.8	9.4
1947	50.1	10.1	1985	53.6	9.2
1948	55.9	9.2	1986	51.2	9.8
1949	56.5	8.9	1987	52	9.6
1950	54.8	9.7	1988	55.4	9
1951	53.9	9.5	1989	55.3	8.9
1952	53.6	9.5	1990	58.3	7.2
1953	52.8	9.7	1991	56.9	9
1954	48.7	10.4	1992	57.3	8.9
1955	48	10.2	1993	57.3	8.9
1956	55.3	8.3	1994	57.6	8.8
1957	54	8.9	1995	57.6	8.8
1958	49.1	9.7	1996	57.4	8.8
1959	50	10.2	1997	57.4	8.8
1960	48.9	9.8	1998	57.4	8.9
1961	46.4	10.1	1999	57.4	8.7
1962	47.9	9.9	2000	57.2	8.7
1963	47.4	10.2	2001	56.6	8.9
1964	44.2	10.1	2002	55.8	9
1965	43.8	10.5	2003	59.8	7.6
1966	45.4	10.4	2004	59	7.7
1967	42.2	10.8	2005	58.7	7.7
1968	44.3	11.2	2006	58.6	7.7
1969	50.4	9.3	2007	57.9	7.9
1970	45.4	11.5	2008	57.1	8
1971	47.2	11.1	2009	58	7.9
1972	52.5	9.9	2010	57.7	8
1973	51.3	10.2	2011	56.9	8.1
1974	52.3	10	2012	57	8.8
1975	39.9	14.7			

Source : Authors' calculations.

Appendix 2: 1120 and 1120S FRE and FKG Values across 1990-2012 Instructions

Year	FRE_1120	FKG_1120	FRE_1120s	FKG_1120s
1990	42.7	10.3	40.6	9.3
1991	43.2	10.6	42.4	9.1
1992	43	10.8	42.4	9.1
1993	41.9	11	42.9	9
1994	41.7	11.1	43.9	8.8
1995	41.4	11	43.3	8.9
1996	41.6	10.6	42.4	9.1
1997	42.6	10.5	46.4	8.6
1998	42.8	10.4	45.9	8.7
1999	42.7	10.5	46.1	8.6
2000	42.9	10.4	46.4	8.4
2001	44.2	9.4	44.9	8.6
2002	43.6	9.1	45.5	8.4
2003	43.7	9.4	46	8.4
2004	44	9.5	45.1	8.4
2005	43.5	9.4	45.9	8.3
2006	44.6	9.1	46.1	8.3
2007	44.1	9.3	45.1	8.5
2008	43.3	9.4	45.5	8.4
2009	42.8	9.5	45.7	8.4
2010	43.1	9.4	45.6	8.4
2011	44	9.3	45.9	8.4
2012	41.8	10.4	45.4	8.5

Authors' calculations.