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Use of the journal impact factor for assessing individual articles need not be wrong

CWTS, Leiden University

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Impact Factor Debate

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- DORA (2013)

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Impact Factor Debate

- DORA (2013)
- Seglen (1997):
  "the most cited half of the articles (in a journal) are cited, on average, 10 times as often as the least cited half. Assigning the same score (the JIF) to all articles masks this tremendous difference–which is the exact opposite of what an evaluation is meant to achieve"

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- Garfield (2006):
  "Typically, when the author's work is examined, the impact factors of the journals involved are substituted for the actual citation count. Thus, the JIF is used to estimate the expected count of individual papers, which is rather dubious considering the known skewness observed for most journals"

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Impact Factor Debate

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- Abramo et al. (2010):
  "Citations observed at a moment too close to the date of publication will not necessarily offer a proxy of quality that is preferable to impact factor"

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  "Citations observed at a moment too close to the date of publication will not necessarily offer a proxy of quality that is preferable to impact factor"
- Levitt & Thelwall (2011):
  "Particularly for very recently published articles, an indicator based on the average of the standard indicator of citation and the IF of the journal . . . could form the basis of a useful indicator for peer review panels"

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Skewness

- Skewness in citations main statistical argument against IF.
- Assumption that skewness in citations represent ‘real’ differences in value.
- However, skewness may also result from citations being a ‘noisy signal’ for value.

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Scenario 1 (Citations accurate)

Citations in journals are clearly skewed. But why?

Scenario 1 (citations accurate)

1. Citations reasonably accurate proxy of the value of an article.
2. Value of articles in a journal is skewed distributed.
3. Skewness of journal citation distributions results mainly from 2.

Scenario 2 (citations noisy)

1. Citations are a weak proxy of the value of an article.
2. Value of articles in a journal is distributed homogeneous.
3. Skewness of journal citation distributions results mainly from 1.

Scenario 1 (Citations accurate) example

		Journal A		
		Citations		
		Low	High	**Total**
Value	Low			
	High			
	Total			

Scenario 1 (Citations accurate) example

		Journal A		
		Citations		
		Low	High	**Total**
Value	Low			
	High			
	Total			**100**

Scenario 1 (Citations accurate) example

Journal A			
		Citations	
		Low	High	**Total**
Value	Low			**20**
	High			**80**
	Total			**100**

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Scenario 1 (Citations accurate) example

Journal A

		Citations		
		Low	High	**Total**
Value	Low	18	2	**20**
	High	8	72	**80**
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Scenario 1 (Citations accurate) example

Journal A				
		Citations		
		Low	High	**Total**
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Journal B

		Citations		
		Low	High	**Total**
Value	Low			
	High			
	Total			

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	High			
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Select papers: how many have a high value?

1. Select highly cited publications:

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1. Select highly cited publications: $\frac{72+18}{74+26} = \frac{90}{100} = 0.9$.

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Citations more accurate.

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Scenario 2 (Citations noisy) example

Journal A

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Journal more accurate.

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Simulation

Procedure

1. Create articles with some value .

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1. Create articles with some value .
2. Articles are peer reviewed with some error.

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Simulation

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1. Create articles with some value .
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3. Articles are selected for a journal based on peer review.

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1. Create articles with some value .
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4. Articles attract citations according to their value.

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Simulation

Procedure

1. Create articles with some value $v_i \sim \text{LogN}(\sigma_v^2)$.
2. Articles are peer reviewed with some error.
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4. Articles attract citations according to their value.

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Procedure

1. Create articles with some value $v_i \sim \text{LogN}(\sigma_v^2)$.
2. Articles are peer reviewed with some error.
   - Estimated value $e_{ik} = v_i \epsilon_{ik}$.
   - Error is $\epsilon_{ik} \sim \text{LogN}(\sigma_r^2)$.
3. Articles are selected for a journal based on peer review.
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3. Articles are selected for a journal based on peer review.
   - All articles submitted to highest journal.
   - Only top x articles accepted, others rejected.
   - If rejected, submit to next highest journal, and so on ....
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4. Articles attract citations according to their value.
   - Citations $c_i = v_i \epsilon_i$ where $\epsilon_i \sim \text{LogN}(\sigma_c^2)$.
   - Citations distributed as $c_i \sim \text{LogN}(\sigma_v^2 + \sigma_c^2)$.
   - Consistent with empirical observation that $c_i \sim \text{LogN}(1.3)$.

Simulation

Procedure

1. Create articles with some value $v_i \sim \text{LogN}(\sigma_v^2)$.
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   - Consistent with empirical observation that $c_i \sim \text{LogN}(1.3)$.

IF is average of all citations to articles published in journal.

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Article selection

Two possible ways to try to select high value (top 10%) articles.

1. Select top 10% most highly cited articles.
2. Select top 10% highest impact factor articles.

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Accuracy

Proportion of articles that fall in the top 10% highest value.

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Accuracy

Proportion of articles that fall in the top 10% highest value.

Parameters: 20 journals, 100 articles/journal, 1000 simulations.

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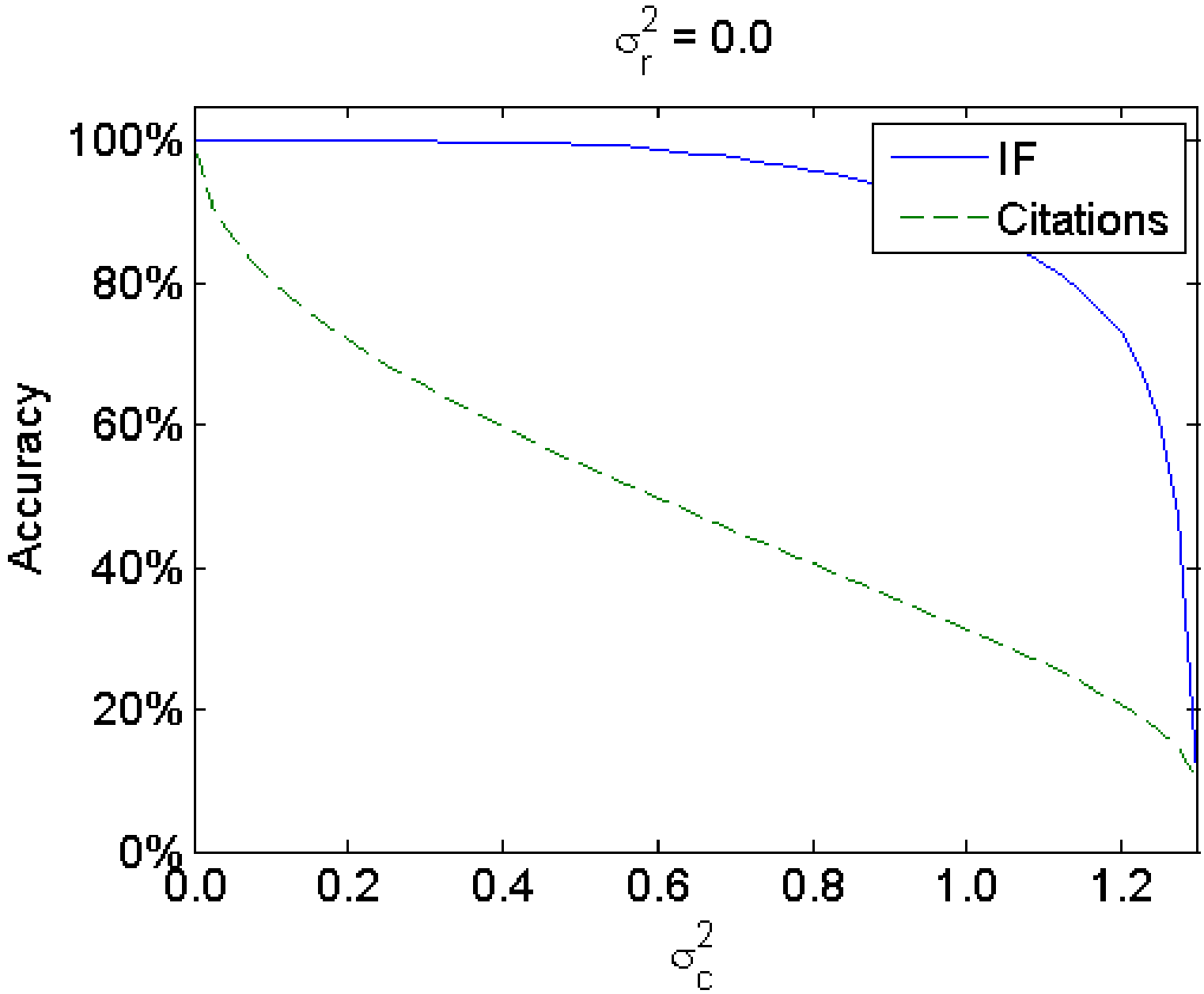
Results



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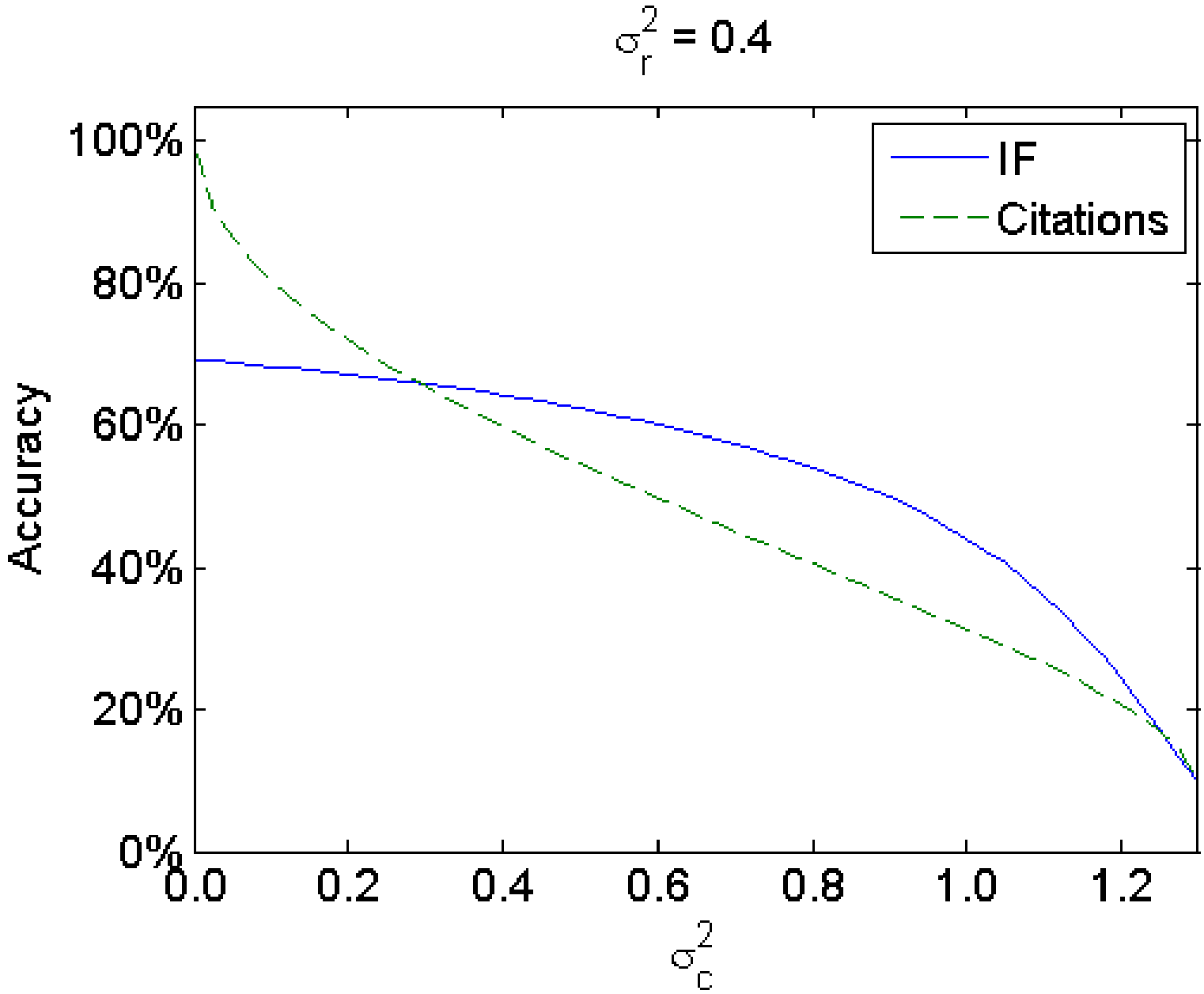

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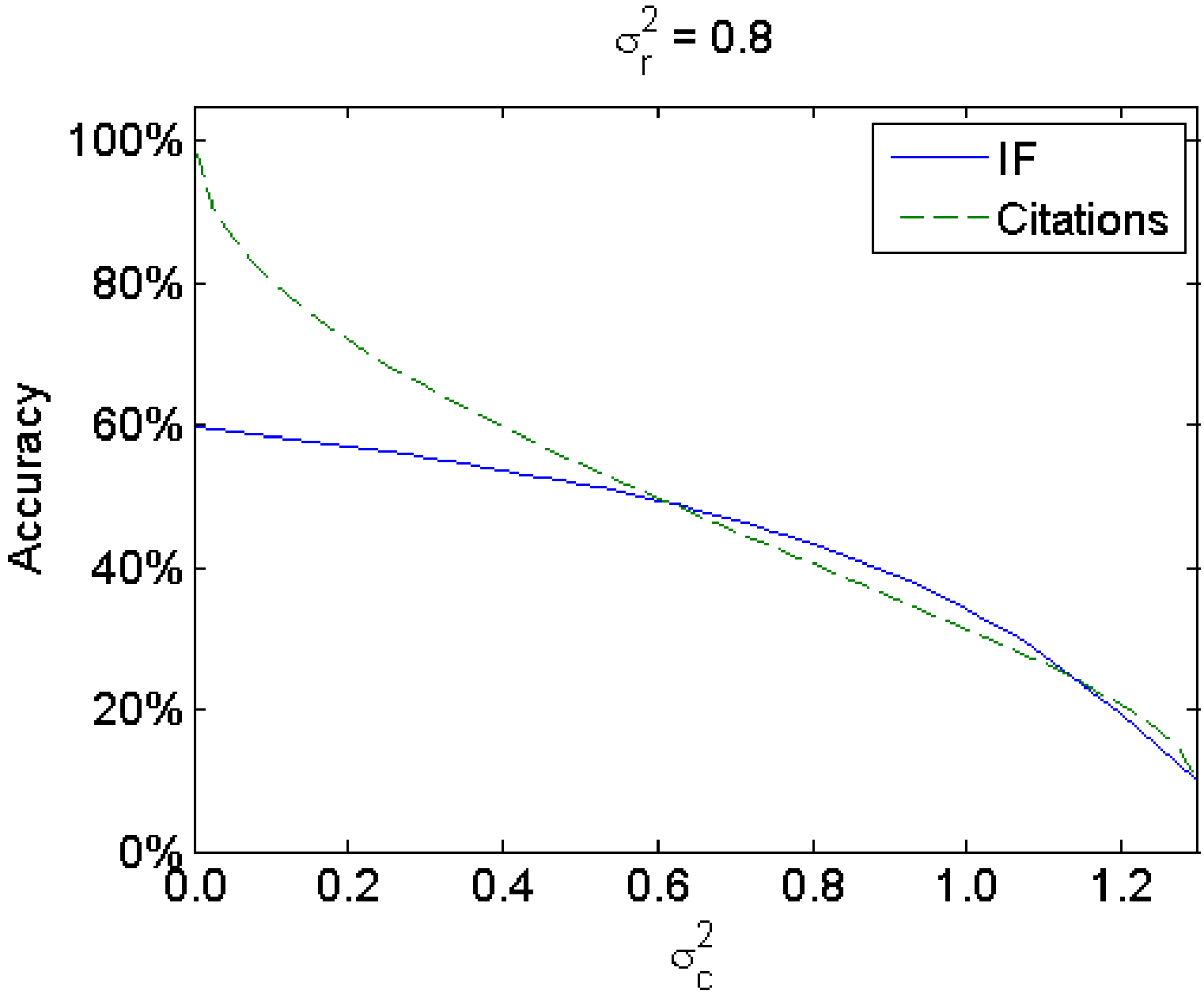

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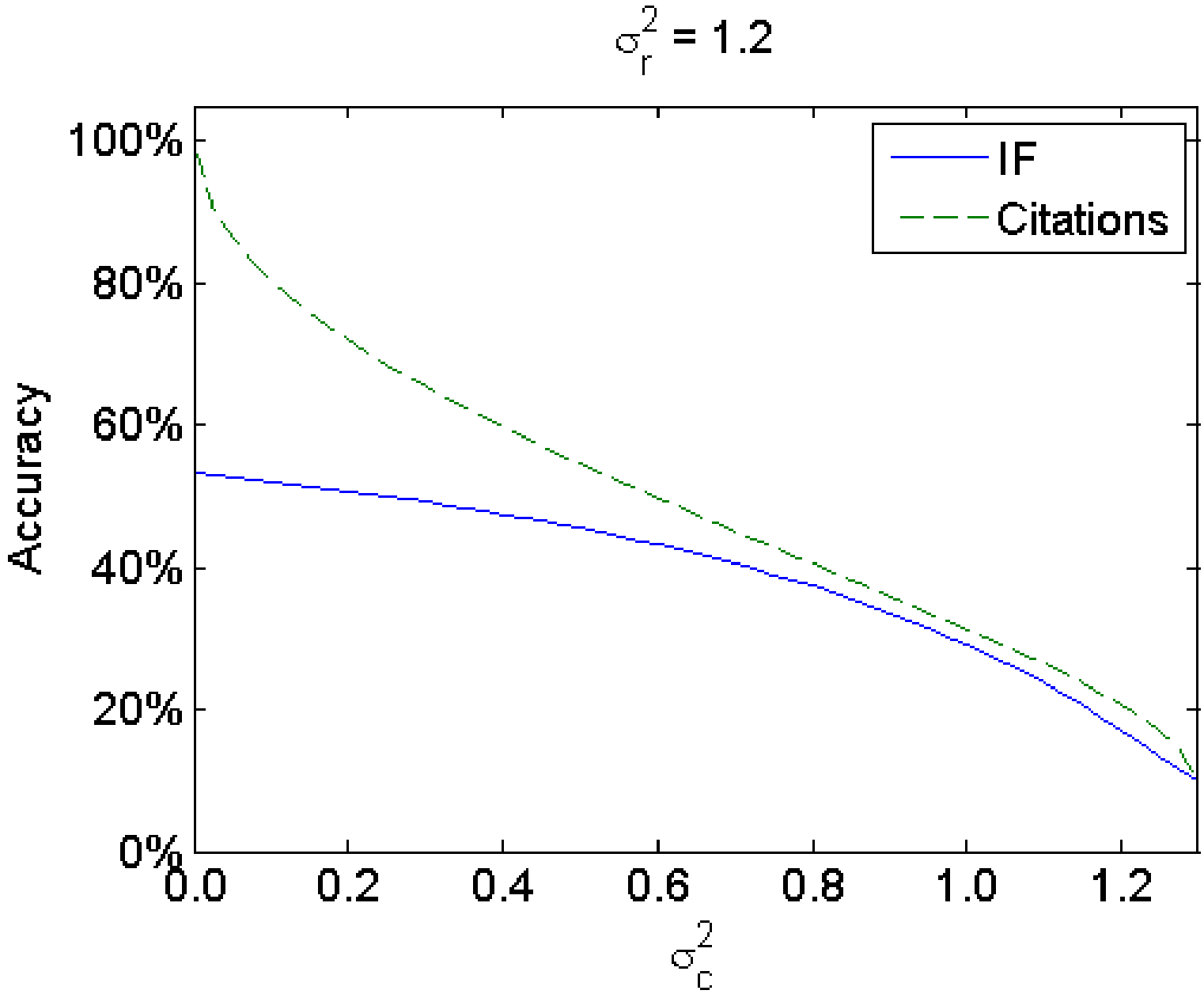

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Conclusions

- Skewness alone is no argument for rejecting the IF.
- If citations are reasonably accurate while peer review is noisy, then IF may be less accurate than citations.
- If citations are noisy while peer review is reasonably accurate, then IF may be more accurate than citations.
- In practice, parameters used in this model unknown, so requires further (empirical) analysis.
- There may be good non-statistical arguments against the IF (e.g. goal displacement).

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Statistics is hard. Make assumptions and arguments explicit.

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Thank you!

Questions?

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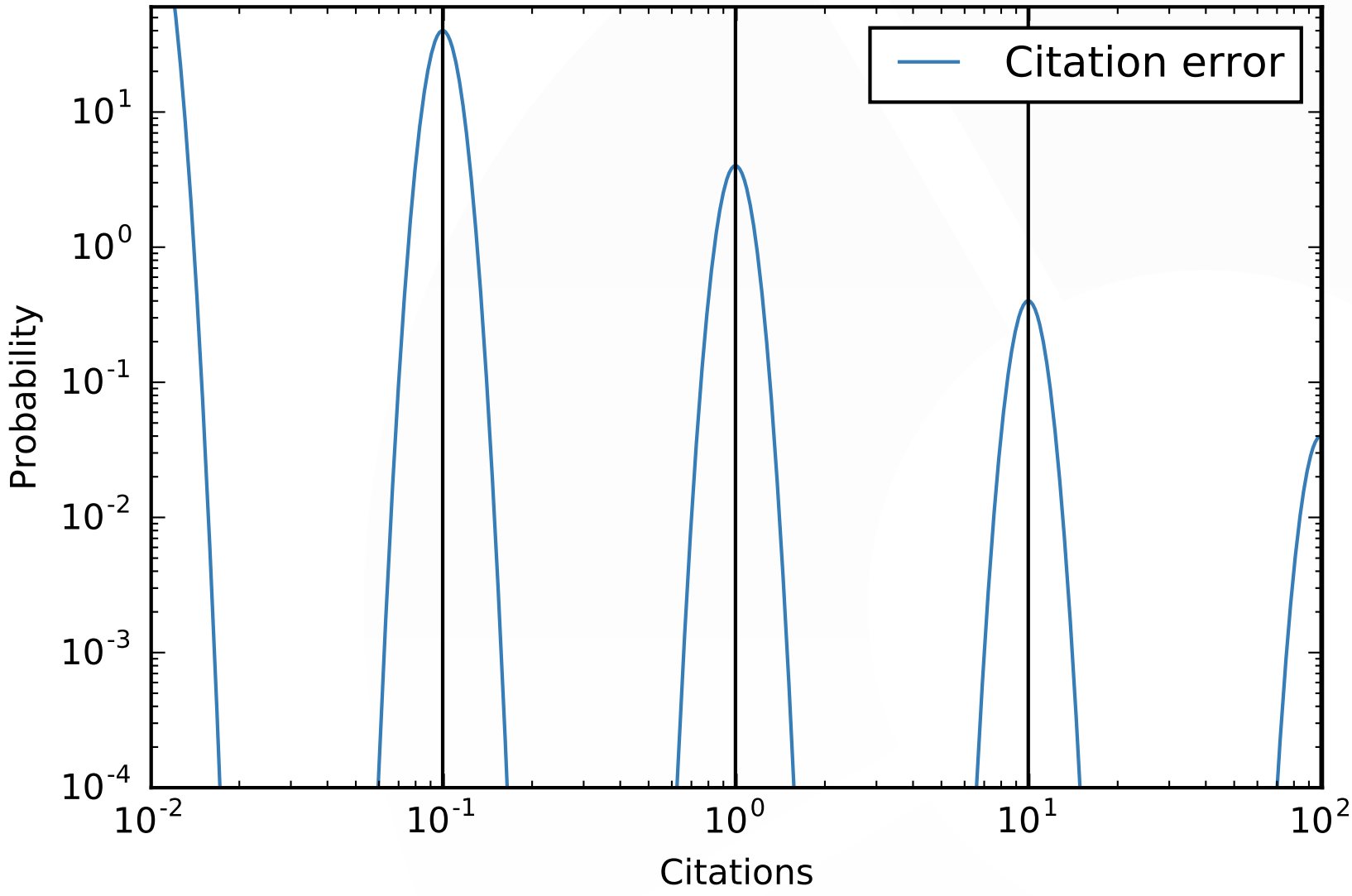
Scenario 1 (Citations accurate) illustration



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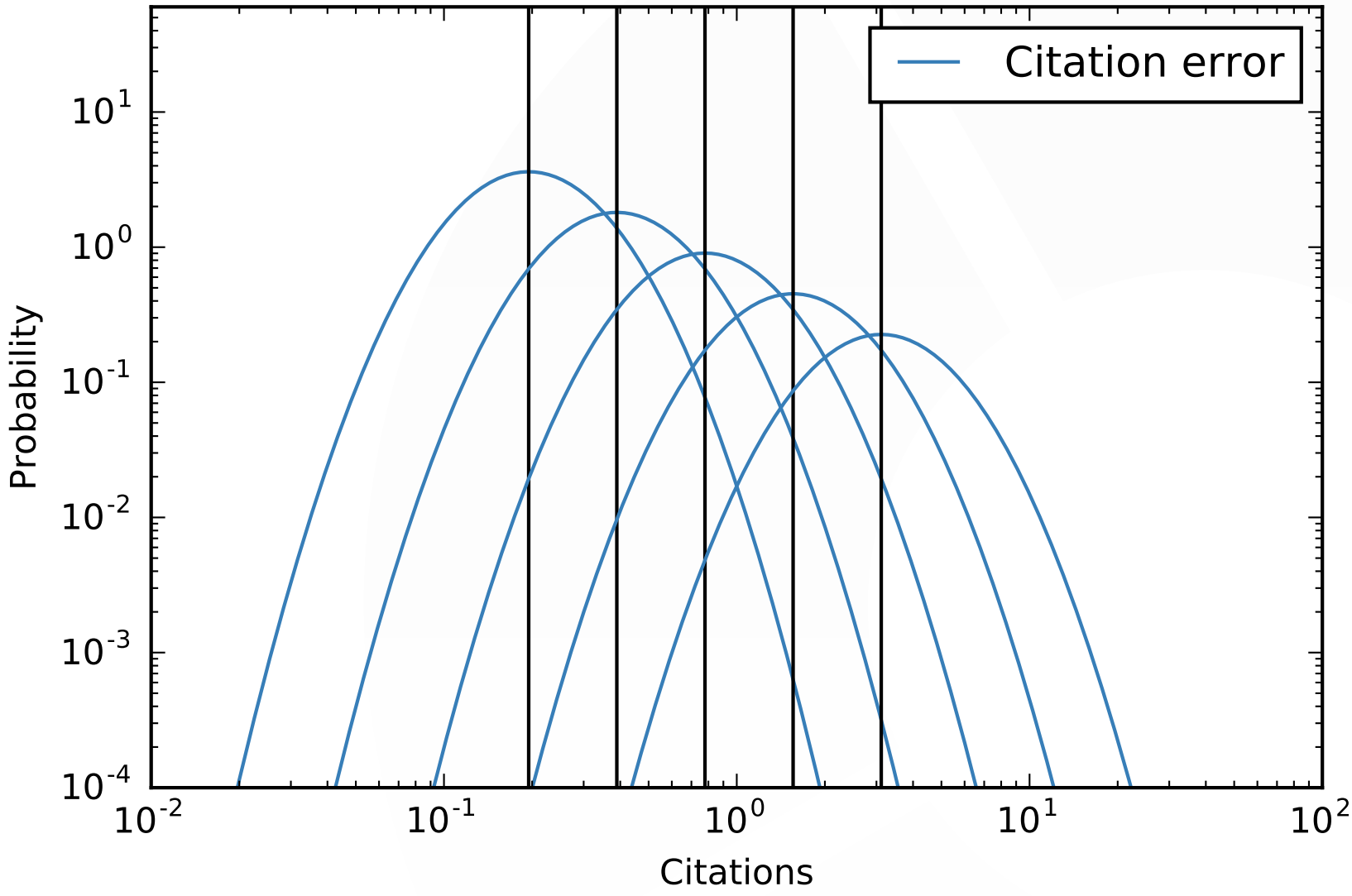
Scenario 2 (Citations noisy) illustration



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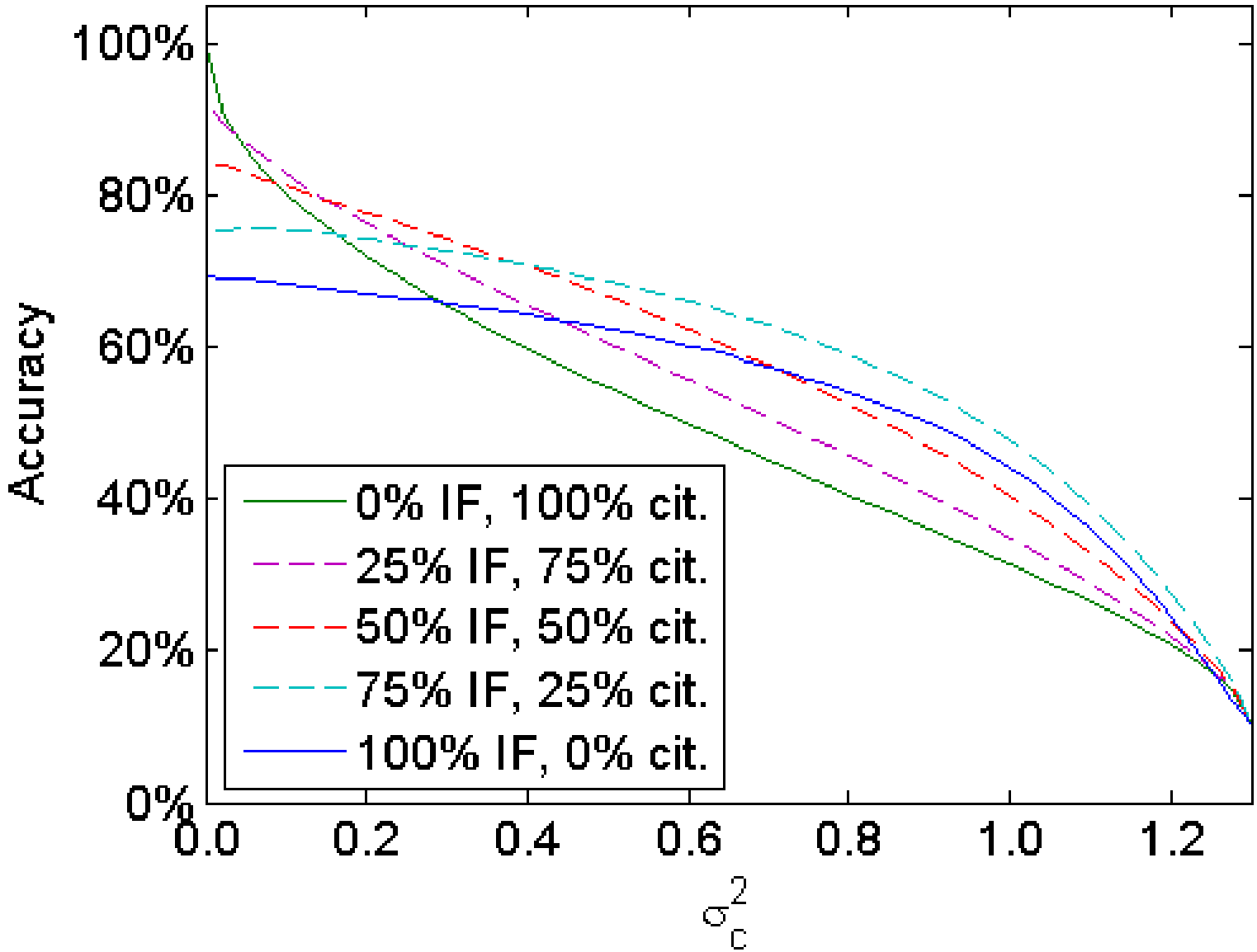
Results hybrid case



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