Does Project Performance Stability Exist?  
A Re-examination of CPI and  
Examination of SPI(t) Stability  

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Kym Henderson  
Vice President Research and Standards  
PMI College of Performance Management  
Kym.Henderson@froggy.com.au  

* The contents of this presentation are the presenter’s personal views and conclusions which do not reflect an endorsed position of the PMI-CPM.
Summary of Research Post A-12 Cancellation

- Research by Dr. David Christensen and associates
  - CPI cum (CPI) stabilises by 20% of project completion
  - Stability usually defined to mean CPI at completion does not change by more than +/- .10 from CPI 20%
    - Subsequent research used program data from US DoD DAES database (Christensen & Heise: 1993)
- CPI stability findings since generalised as being universally applicable “to all projects using Earned Value”
  - Fleming and Koppelmann
Earned Schedule Brief Summary
Concept developed by Lipke in 2003

- **Time** based schedule performance metrics using EVM data
  - $SV(t)$ and $SPI(t)$ behaviour analogous to the EVM cost metrics
- **ES** metrics do not fail – work for early and late finish projects
  - Revert to zero/unity at completion only if on time schedule performance ACTUALLY achieved
The Research Project

- **Aim:**
  - Re-examine CPI stability and
  - Compare the stability behavior of SPI(t) with CPI to ascertain whether SPI(t) exhibited similar stability characteristics to those extensively reported for CPI

- **The Data:**
  - 3 disparate commercial sector EVM data samples utilized

<table>
<thead>
<tr>
<th>Source</th>
<th>CPI Sample</th>
<th>SPI(t) Sample</th>
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<tbody>
<tr>
<td>UK Construction</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Israeli Hi Tech</td>
<td>12</td>
<td>12</td>
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<td>Australian IT</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Composite</td>
<td>26</td>
<td>37</td>
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- The data was “scrubbed” – Re-baselined projects were excluded
The Results

- Formal hypothesis testing
  - Sign Test at 0.05 level of significance
    “none of the null hypotheses can be rejected, for any of the three samples as well as the composite of all samples. This means that stability was not achieved for either CPI or the SPI(t) by the time the project was 20 percent complete.”

Summary of Raw Data
The (Lack of) CPI Stability Corroboration

NAVAAIR research by Michael Popp, mid 1990s
  - Data from same source used by Christensen
    - Known thanks to correction to paper by Mr. Wayne Abba
  - Popp sought to determine
    - “Given a program has a CPI of X and a percent complete of Y, what is the most likely finishing CPI”?

Popp did not focus on CPI stability
  - But plotted relationships between CPI $\text{cum Final}$ and CPI $\text{cum Current}$ in each 10 percentile band

Popp report now in public domain (with permission)
  - PMI Sydney Chapter website
The Correlation Plot: CPI Final and CPI 10-20%

The enclosed area bounds where the “CPI Stability rule” applies

Plots outside bound area conflict with the CPI Stability rule
Additional Analysis

- Commercial sector data
  - Within each 10% complete percentile band projects were categorized as follows:

- Cost at completion:
  - Under or On Budget (UOB)
  - Over Budget (OvB).

- Schedule at completion:
  - Early or On Time finish (EOT)
  - Late Finish (LF).

- Purpose:
  - To determine whether achieving earlier stability correlated to improved cost and schedule outcomes at completion
The Results

- “… achievement of earlier stability is not correlated with improved final cost and/or schedule outcomes”
- For UOB and EOT projects where cost and schedule stability was achieved late … achieving earlier stability would have been disadvantageous … to the final outcome(s) … because project performance progressively improved over the life of those projects.
The Conclusions

- The widely reported CPI stability rule cannot be generalized to “all projects using Earned Value”
  - Claiming the rule had unqualified universal applicability to “all projects using Earned Value” an unfortunate overstatement
- CPI stability rule cannot be generalized even within US DoD
- Based on commercial sector EVM data analysis
  - Achieving early stability is not necessarily “good”
  - Achieving late stability is not necessarily “bad”
- Where projects have not exhibited “CPI stability”
  - EVM practitioners can now know that this is neither unique,
  - Nor is it necessarily an adverse reflection on … those projects
- The consistent behavior to CPI demonstrated by SPI(t) provides further support for the validity of SPI(t) metric and ES method
The Consequences

Thanks Kym,

“I think it is traditional to burn heretics at the stake and then accept their findings as true after an appropriate delay of several years or decades – there were a few notable exceptions, Galileo spring to mind, he merely was placed under house arrest ….. I look forward to seeing how you go.
The paper certainly makes sense and is a great piece of research.”

E-mail dated 6 May 08 from Patrick Weaver, Director
Mosaic Project Services Pty Ltd, Melbourne Australia
The Way Forward

- Those interested should read the paper, supporting materials and make up their own minds
- More research is needed to determine whether there are project performance characteristics:
  - Which result in early CPI stability (i.e. the rule applies)
  - Where early CPI stability was not achieved due to progressively improving CPI performance
- Academic research aimed at establishing a theoretical rationale for project performance instability
- Researchers repeating the current research using different data samples
  - Lipke’s Stability Point Calculator is in the public domain
- Test for xPI stability on your own completed projects
What About Earned Schedule?

- Paper demonstrates that using Earned Schedule, research opportunities are equally applicable to project schedule performance
- Opinion on Earned Schedule varies:
  - Particularly amongst EVM “thought leadership”
- Website metrics
  - > 30,000 hits each month from Feb to Apr 2008
  - > 20 GB data downloaded from site since Feb 2006

Conclusion

**Earned Schedule has momentum and achieved its place in the project management domain**
Information Sources

- Earned Schedule Website
  http://www.earnschedule.com
- PMI Sydney Chapter Website
  Click “Education,” then “Presentations and Papers” for .pdf copies
- Crosstalk (online version of paper)
  http://www.stsc.hill.af.mil/crosstalk/2008/04/

Calculators and Analysis Tools
http://www.earnschedule.com/Calculator.shtml

- Please respect copyright ©
- Feedback requested
  - Improvement / Enhancement suggestions
  - Your assessment of value to Project Managers
  - Disclosure of application and results
    - (with organization permission and/or anonymously)
  - Application assistance if needed (upon email request)
## Contact Information

<table>
<thead>
<tr>
<th></th>
<th>Kym Henderson</th>
<th>Dr. Ofer Zwikael</th>
<th>Walt Lipke</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Email</strong></td>
<td><a href="mailto:kym.henderson@froggy.com.au">kym.henderson@froggy.com.au</a></td>
<td><a href="mailto:ofer.zwikael@vuw.ac.nz">ofer.zwikael@vuw.ac.nz</a></td>
<td><a href="mailto:waltlipke@cox.net">waltlipke@cox.net</a></td>
</tr>
<tr>
<td><strong>Phone</strong></td>
<td>+61 414 428 537</td>
<td>+64 4 463 5143</td>
<td>+1 (405) 364-1594</td>
</tr>
</tbody>
</table>