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EARNED VALUE

A Practical Approach



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CONTENT

Introduction to Earned Value

Applying Earned Value Management

Experiences

Special topic: Earned Schedule

What about Time Forecasting?

PMI Practice Standard for Earned Value Management, 2005

VARIANCE ANALYSIS	Schedule Variance = $SV = EV - PV$ Schedule Performance Index = $SPI = EV / PV$	$< 0 = \text{delay}$ $< 1 = \text{delay}$	$> 0 = \text{ahead}$ $> 1 = \text{ahead}$
FORECAST	Time Estimate at Completion = $EACt = PD / SPI$ PD = Planned Duration		

PMBOK Guide, Fourth Edition

VARIANCE ANALYSIS	Schedule Variance = $SV = EV - PV$ Schedule Performance Index = $SPI = EV / PV$ Applied onto the critical path	$< 0 = \text{delay}$ $< 1 = \text{delay}$	$> 0 = \text{ahead}$ $> 1 = \text{ahead}$
FORECAST	???		

SV – SPI Revisited

Schedule Variance

$$SV = EV - PV$$

< 0 delay

= 0 on time

> 0 ahead

By definition at end of project :

EV = total PV (BAC)

Thus $SV = EV - PV = 0$

Shows perfect performance!!!

What if we are late?

SV is expressed in Euros

Difficult to understand

Schedule Performance Index

$$SPI = EV / PV$$

< 1 delay

= 1 on time

> 1 ahead

By definition at end of project :

EV = total PV (BAC)

Thus $SPI = EV / PV = 1$

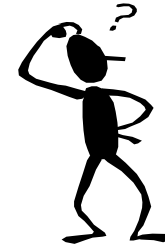
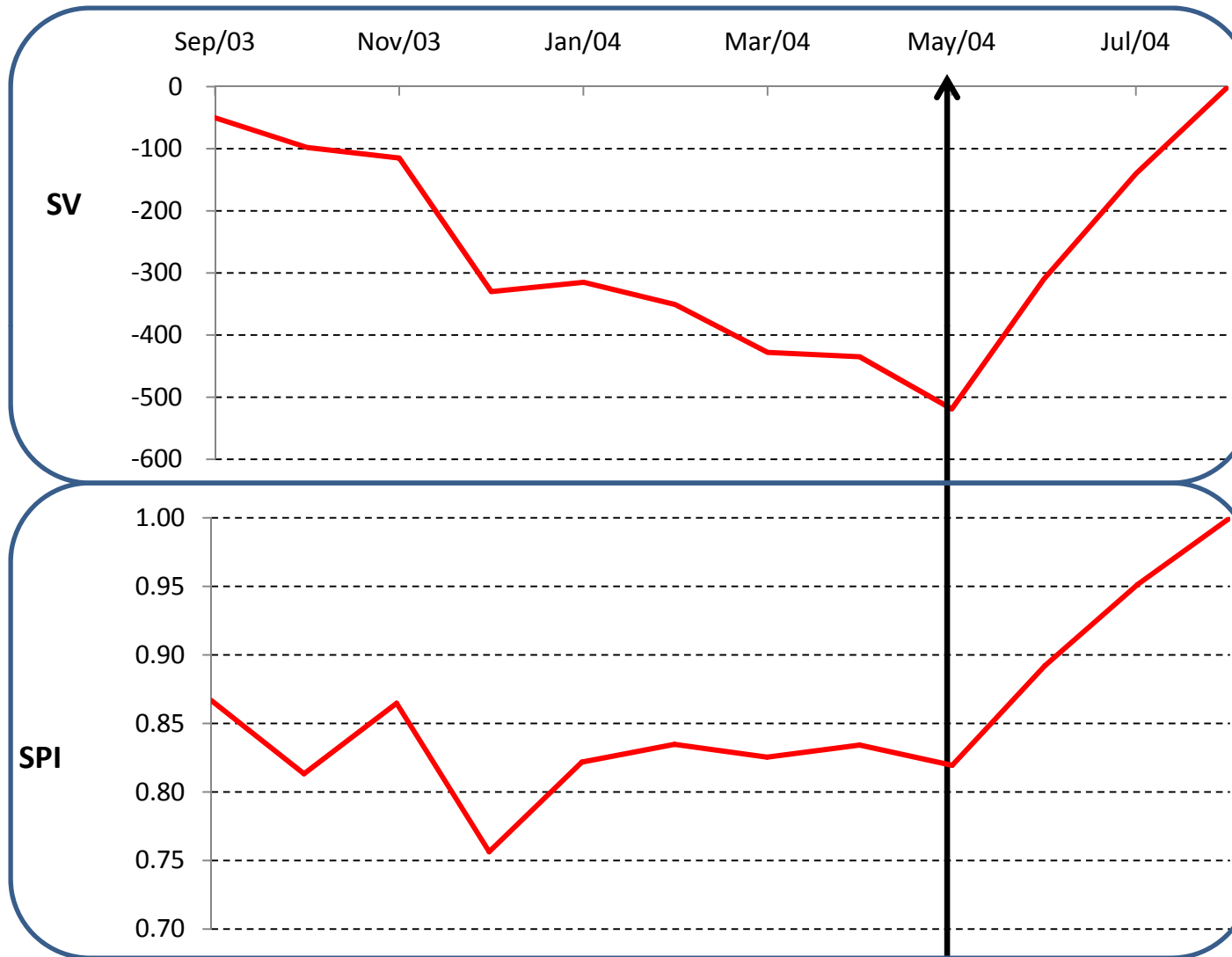
Shows perfect performance!!!

What if we are late?

SPI is dimensionless

Easier to understand

Real Life Late Project



Starting Mei/04:

positive trend
for SV & SPI

... but we are
slipping further

Something is
wrong



Another Method

PMI Practice Standard for Earned Value Management

Box 3-1: Time-Based Schedule Measures -- An Emerging EVM Practice

In the current practice of EVM, schedule variance and schedule performance are both measures of work scope, not time. The work is represented by its budgeted cost as recorded in the performance measurement baseline. The EVM schedule variance is the difference between work performed and work scheduled, and the schedule performance index is the ratio of work performed to work scheduled. For Project EZ, these measures indicate that work is not being accomplished as quickly or as efficiently as planned:

$$SV = EV - PV = 32 - 40 = -8$$
$$SPI = EV / PV = 32 / 40 = 0.8$$

If the work were to continue at this rate, then all of the work of Project EZ would take 16 months to accomplish instead of the 12 months planned ($12 / 0.8 = 15$).

These SV and SPI measures are useful indicators and predictors of performance and results. But, because they are based on work and not time, they can behave in ways that are not normally expected of schedule indicators and predictors. The problem can be illustrated with Project EZ: Whether all of the work is completed as planned at 12 months or at 16 months as predicted by the four-month SPI of 0.8, it will be completed eventually and at that time the work-based schedule variance and performance index will indicate perfect performance. For when the work is completed: $EV = PV$, and so $SV = 0$ and $SPI = 1.0$. This is fine if the work is being accomplished according to plan, but problematic if it is not. If Project EZ does take 16 months, SV will nonetheless equal 0 and SPI equal 1.0, when it's clear that Project EZ is 4 months late and averaged only 80% efficiency.

There is an emerging practice in EVM, which uses time-based measures of schedule variance and schedule performance as an alternative or supplement to the traditional work-based measures. This new method avoids the problems of the work-based method illustrated above. Whereas the traditional work-based method compares work performed and work scheduled at or to a point in time, the time-based method compares the actual time with the planned time for the work performed. In the case of Project EZ, the work performed after four months ($AT = 4$) had a planned time of three months ($PT = 3$) (refer to Figures 2-6 and 2-7). In a manner that parallels the use of AC and EV in traditional EVM, practitioners are beginning to use actual time (AT) and planned time (PT) to compute SV and SPI:

$$SV(t) = PT - AT = 3 - 4 = -1 \text{ month}$$
$$SPI(t) = PT / AT = 3 / 4 = 0.75$$

While the work- and time-based methods provide comparable results at the four-month point in Project EZ, look at the difference at project completion after 16 months:

$$SV(16) = PT - AT = 12 - 16 = -4 \text{ months}$$
$$SPI(16) = PT / AT = 12 / 16 = 0.75$$
$$SV(16) = EV - PV = 160 - 160 = 0$$
$$SPI(16) = EV / PV = 160 / 160 = 1.0$$

Box 3-1:

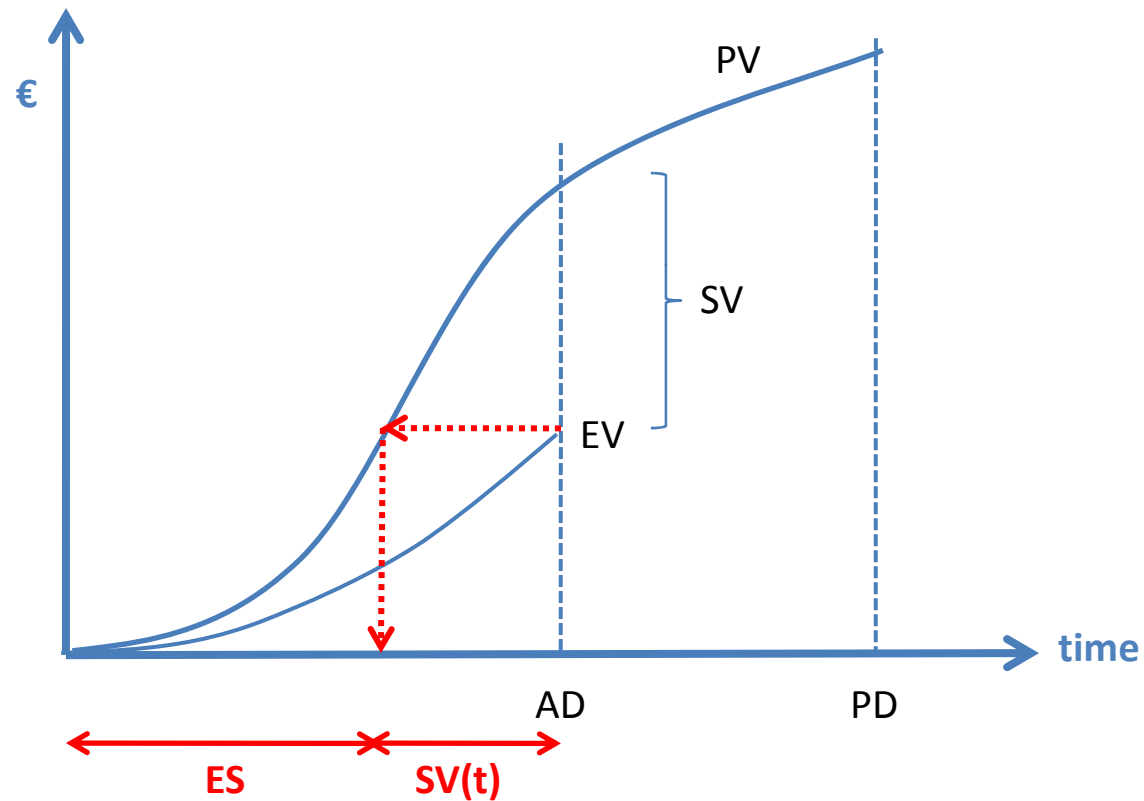
Time-Based Schedule Measures... An Emerging EVM Practice

Describes basic principles of a new method called “Earned Schedule”

Provides foundation for further development of and research intended to result in Earned Schedule acceptance as a valid extension to EV

Earned Schedule

Created by Walt Lipke, Schedule is Different, The Measurable News, Summer 2003



Earned Schedule (ES) = the time when the EV was to be achieved

Earned Schedule

VARIANCE ANALYSIS

Schedule Variance Time = $SV(t) = ES - AD$

AD = actual duration

< 0 = delay 0 = on time > 0 = ahead

Expressed in time units

Schedule Performance Index Time = $SPI(t) = ES / AD$

< 1 = delay 1 = on time > 1 = ahead

FORECAST

Time Estimate at Completion = $EACt = PD / SPI(t)$

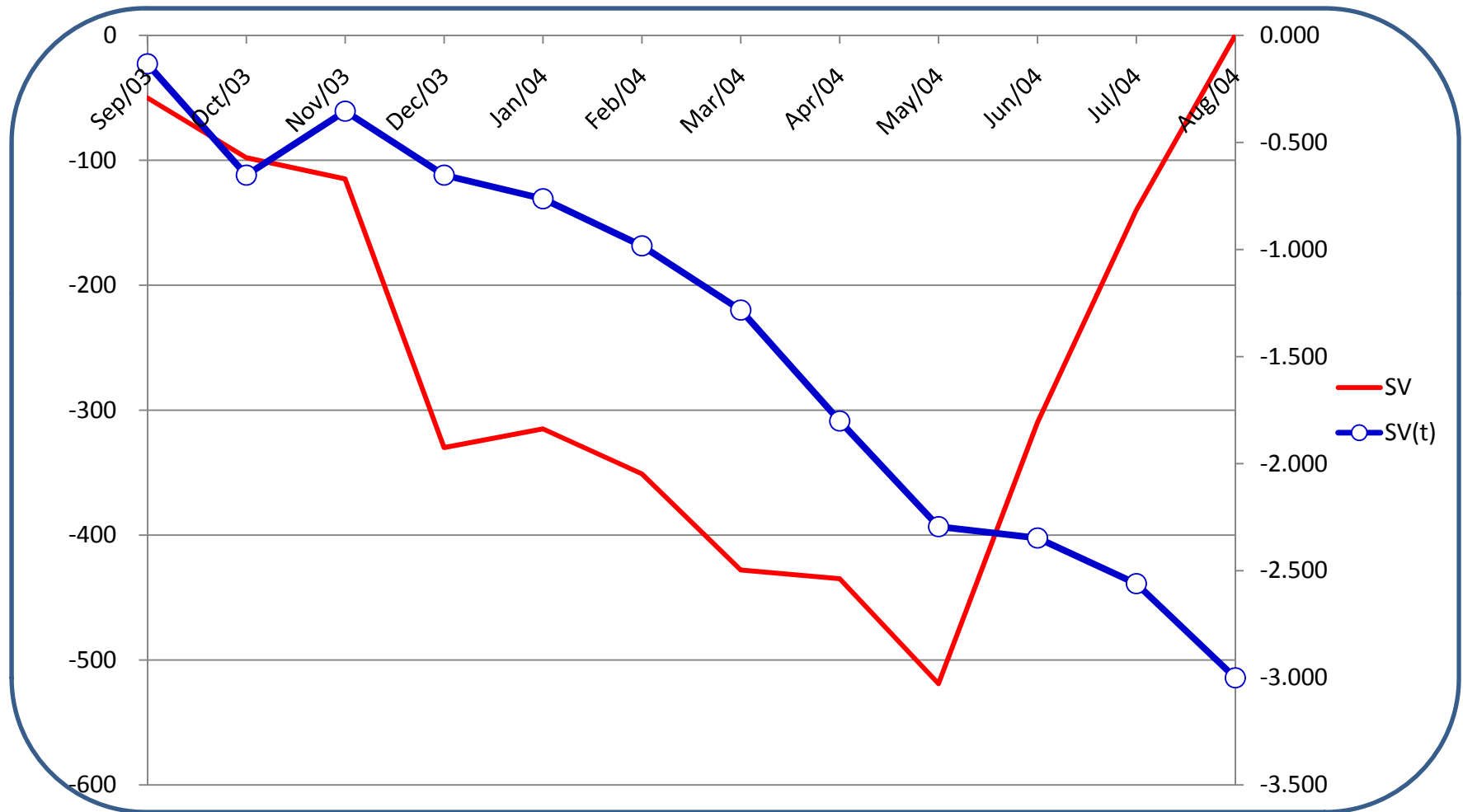
ASSESS REALISM

To Complete Performance Index Time

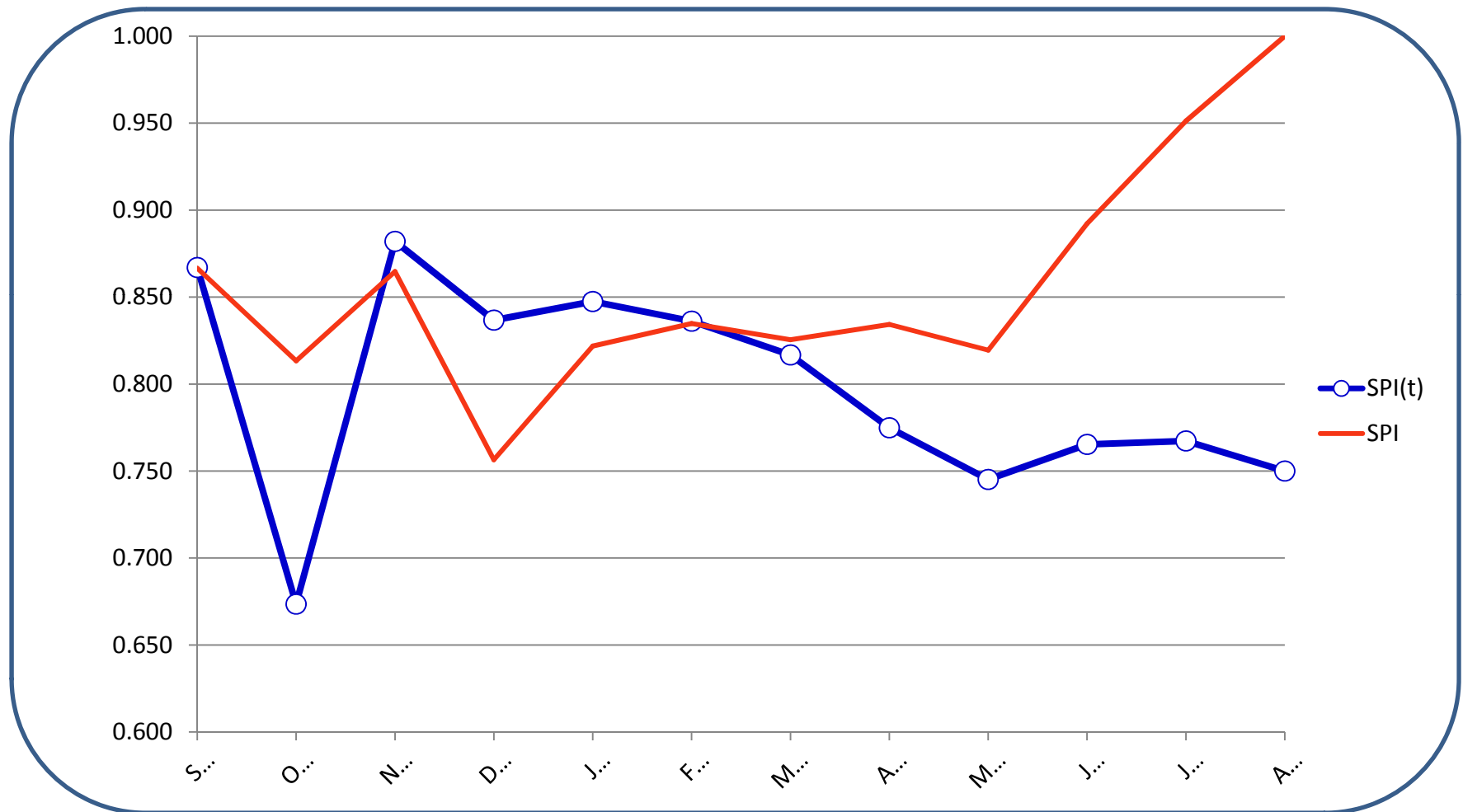
$TSPI(t) = (PD - ES) / (PD - AD)$ if target = PD

$TSPI(t) = (PD - ES) / (LRD - AD)$ if target is Latest Revised Duration

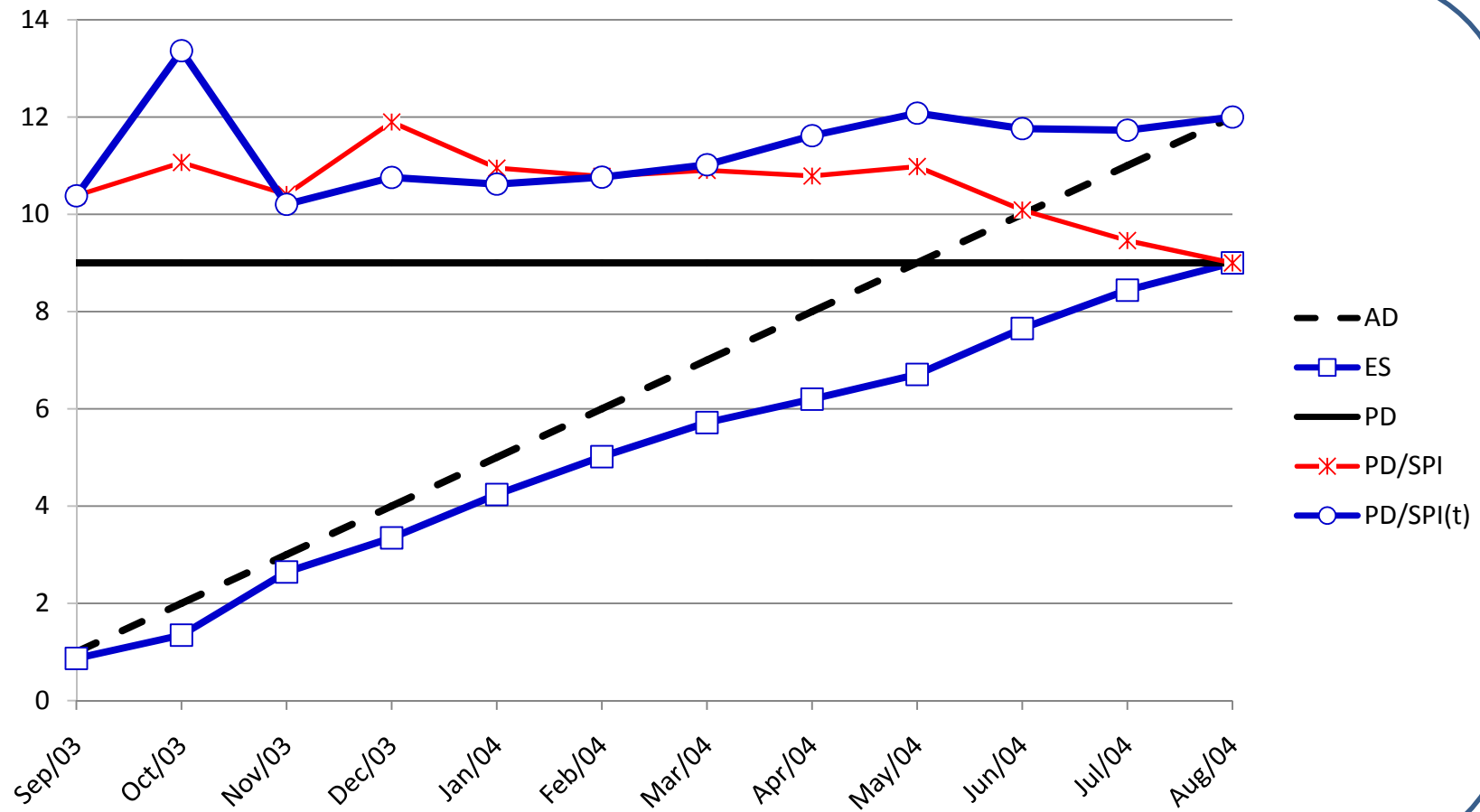
Real Life Late Project



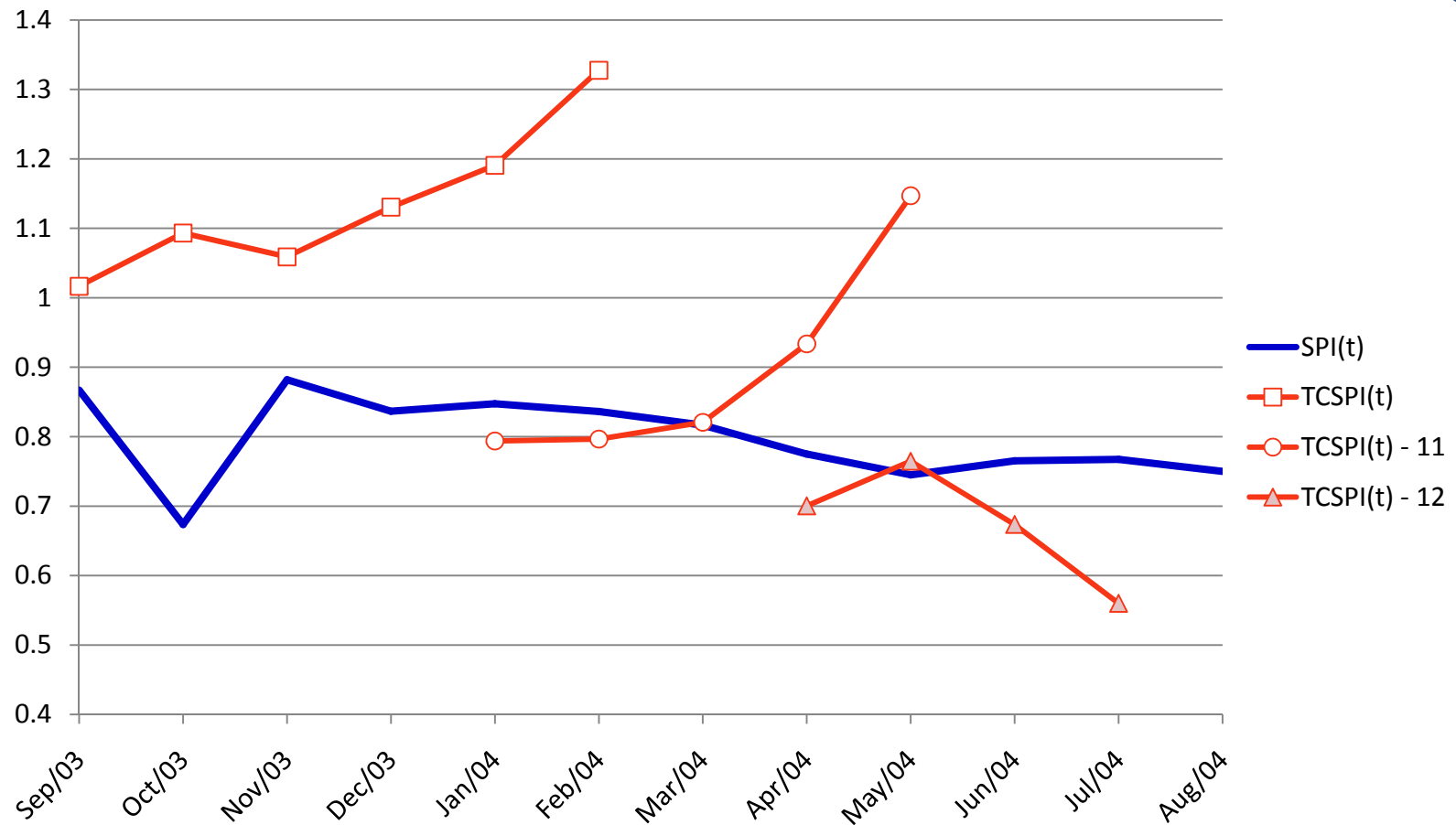
Real Life Late Project



Real Life Late Project



Real Life Late Project



ES Research

Emperical evidence:

Vandevoorde St., Vanhoucke M.,
International Journal of Project Management, May 2006
*“A Comparison of different project duration forecasting methods using
earned value metrics”*

State of the Art Report on Forecasting Duration Methods

Earned Schedule provide schedule metrics which behave correctly during the
whole project life

Earned Schedule forecasting is more reliable, and usefull to sanity check
schedule expectations

ES Research

Academical Research:

Funded by PMI Belgium & FWO, Vlaanderen



Vanhoucke M., Vandevoorde St.,

Journal of the Operational Research Society, October 2007

“A simulation and evaluation of earned value metrics to forecast the project duration”

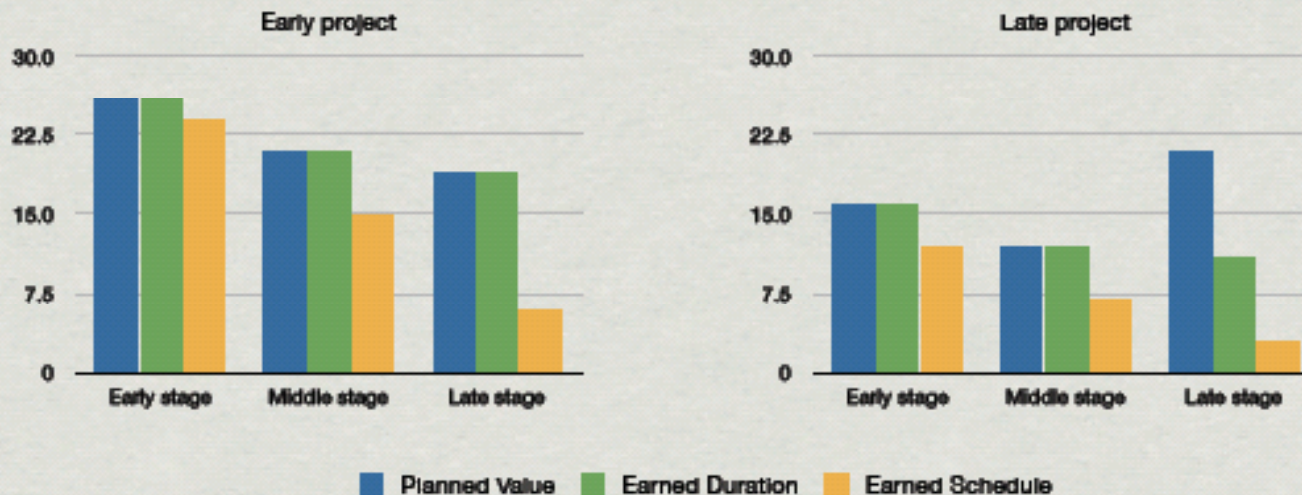
IPMA Research Award 22nd World Congress Rome

Earned Schedule is the better performer for forecasting

ES Research

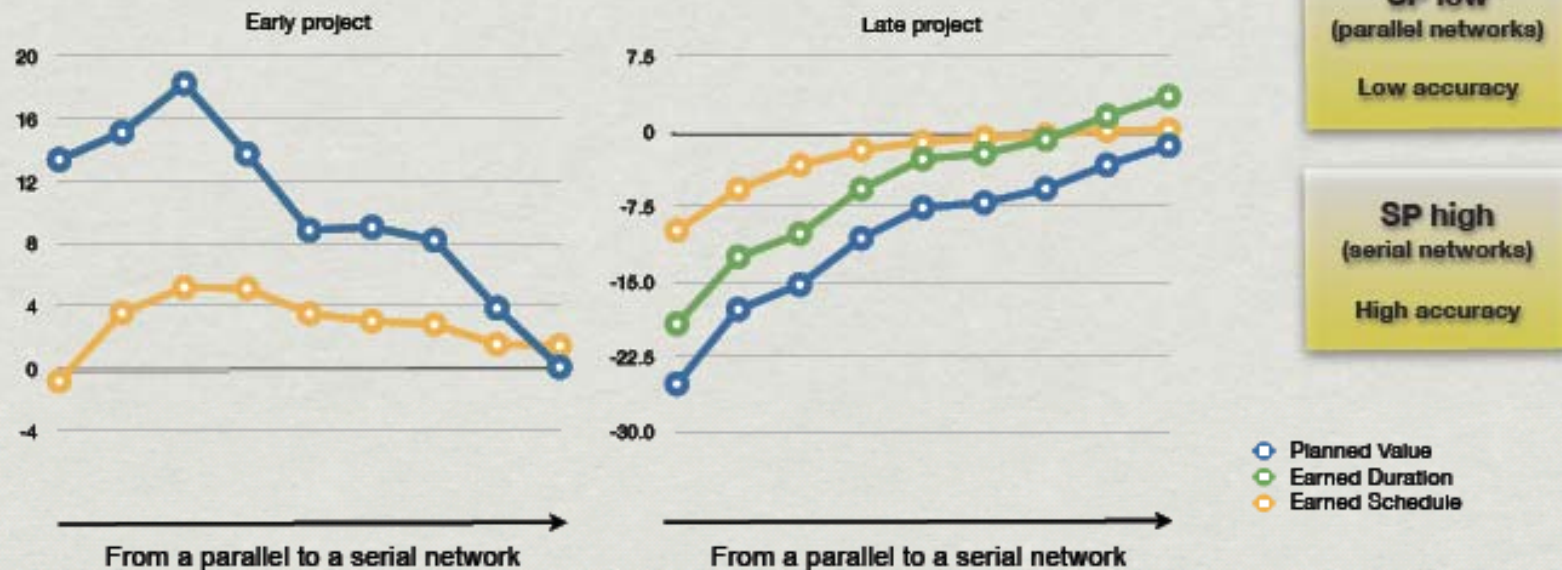
Accuracy along the completion stage (beginning, middle or late)

- All forecasting methods have a relatively low accuracy at the project start. So what?
- The earned schedule method outperforms the other methods from the beginning of the project
- All other methods make the quirky mistake from the 50% to 60% percentage completed

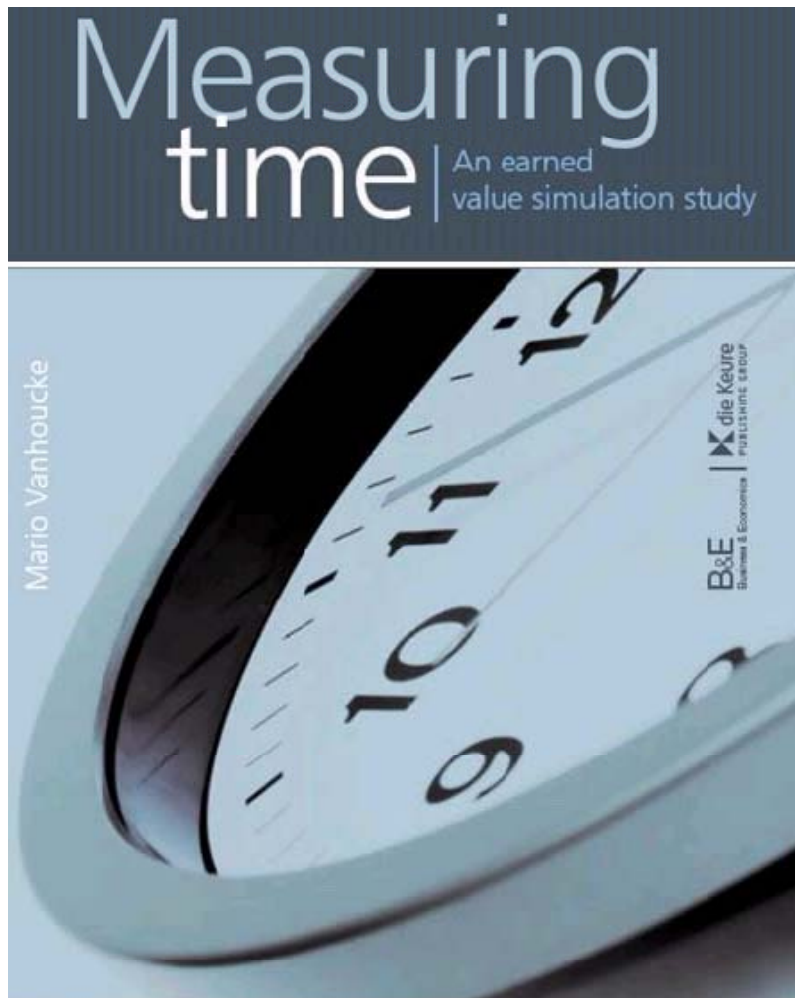


ES Research

The network structure has a clear influence on the forecast accuracy



Information

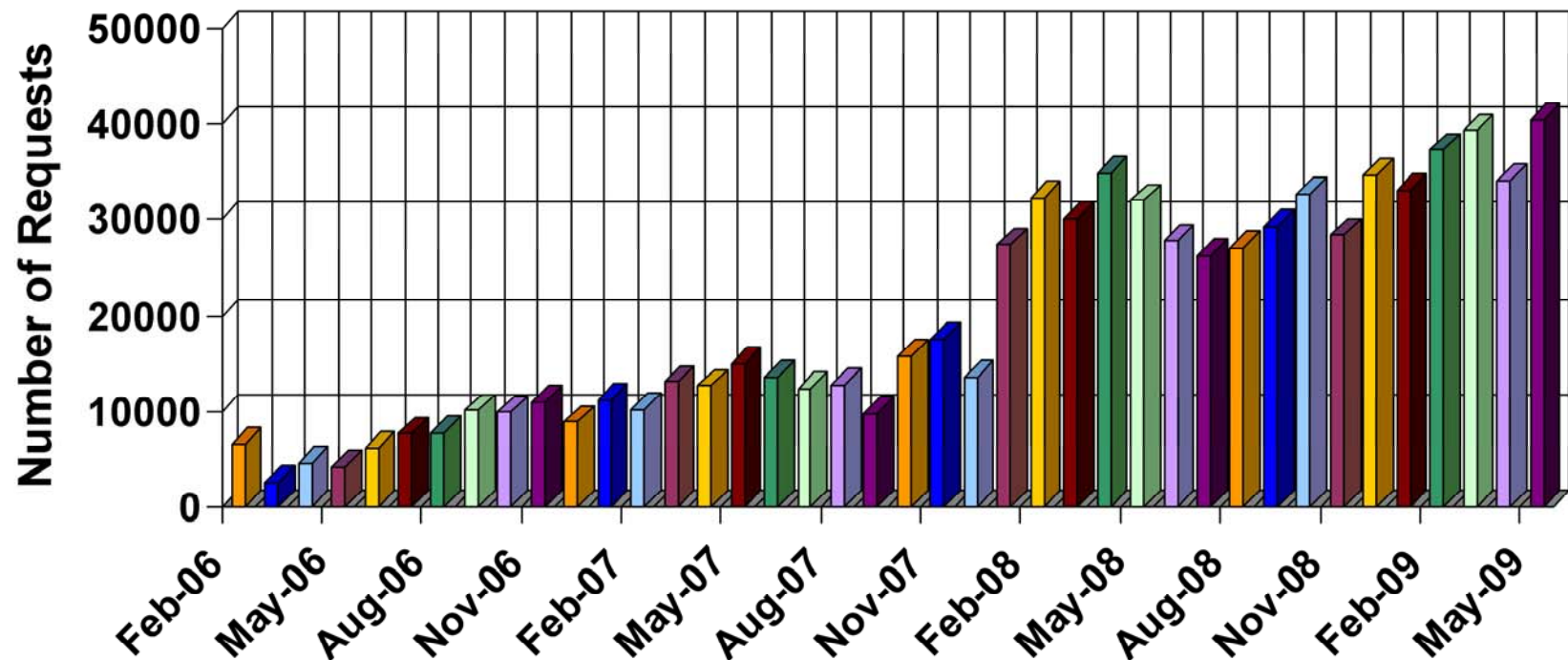


A Belgian Research Effort

Book coming out soon
EV/ES software package

www.protrack.be

ES Website Activity



Free Info, downloads, templates: www.earnedschedule.com
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