

PCT FORECAST

PCT Functional Support Unit
World Intellectual Property Organization

PCT Forecast - WIPO/OECD Workshop on the Use of Patent Statistics

PART I : FORECASTING PCT FILINGS

Main Features

- No external factors are taken into account
- Auto regressive integrated moving average method is used
- Filing trends are consistent
- Seasonal filing patterns are consistent

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Time Series: Monthly Number of PCT Applications Filed Worldwide

- Monthly filing data is less volatile
- Last few months' data may be incomplete

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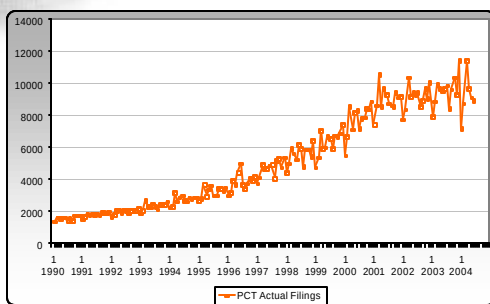
PCT Filing Trend

We use the *Centered Moving Average* to represent the filing trend:

$$T(x) = \frac{\sum_{i=-n}^n F(x+i)}{(2n+1)}$$

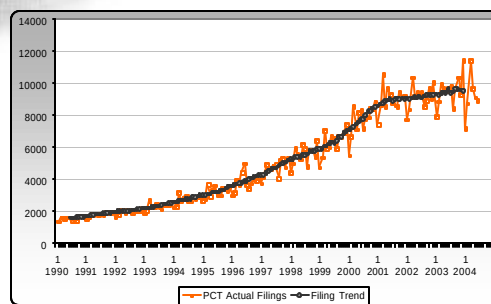
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Monthly PCT Filing Statistics

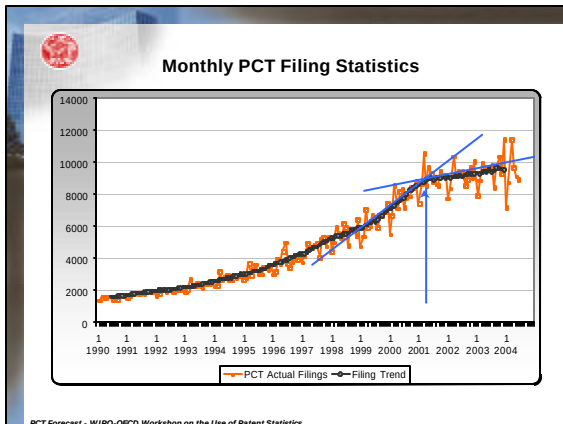


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Monthly PCT Filing Statistics



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Analysis by Country of Origin

The country of origin is defined as the residence of the first named applicant, regardless with which receiving Office the PCT application is filed.

It's assumed that the applicants of different country of origin will follow the similar filing strategy, due to similar economic conditions in that country.

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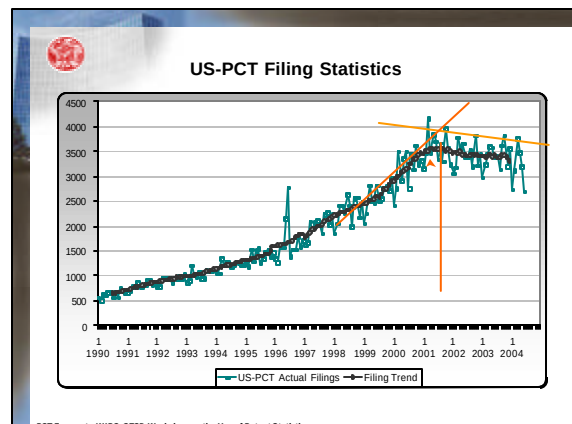
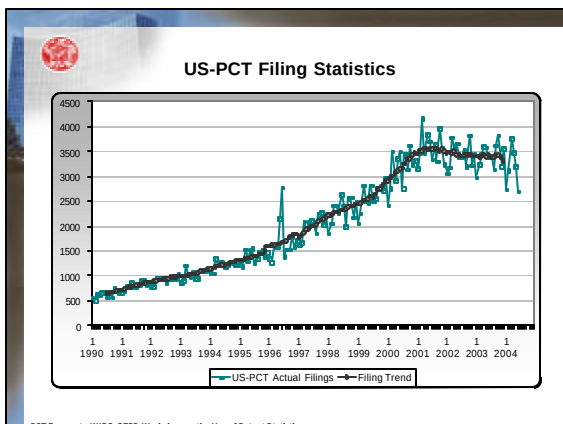
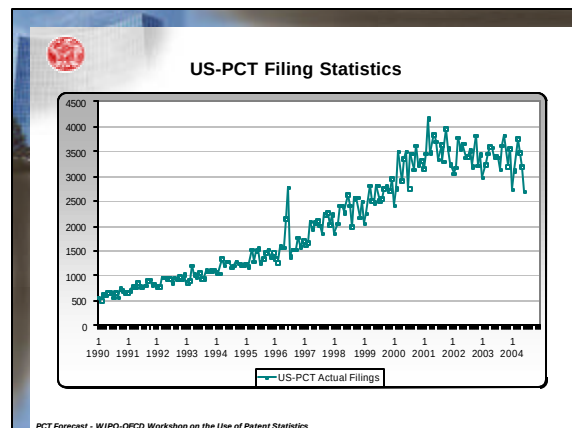
Analysis by Country of Origin

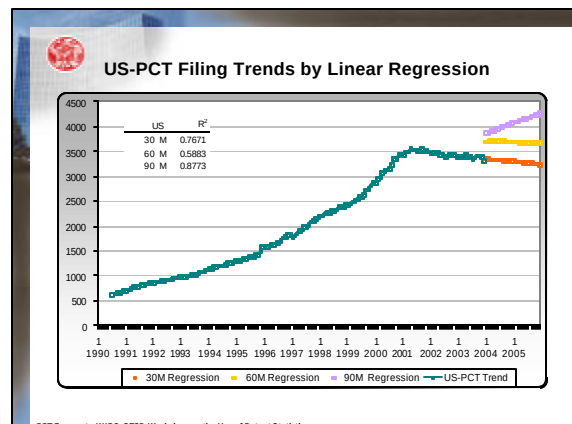
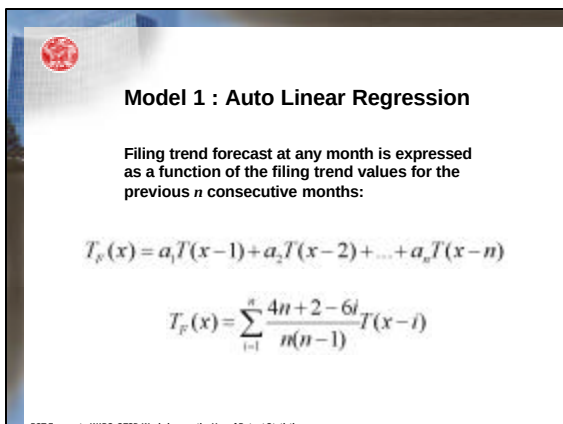
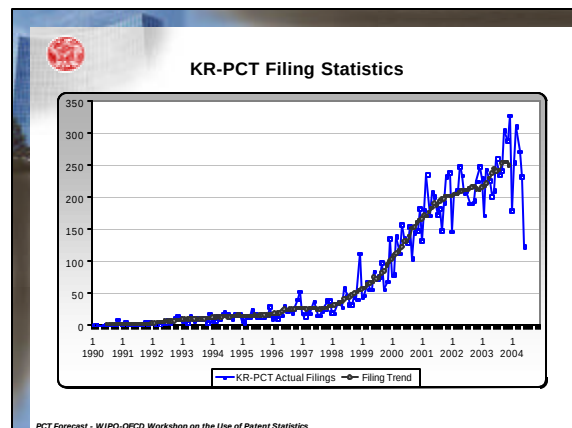
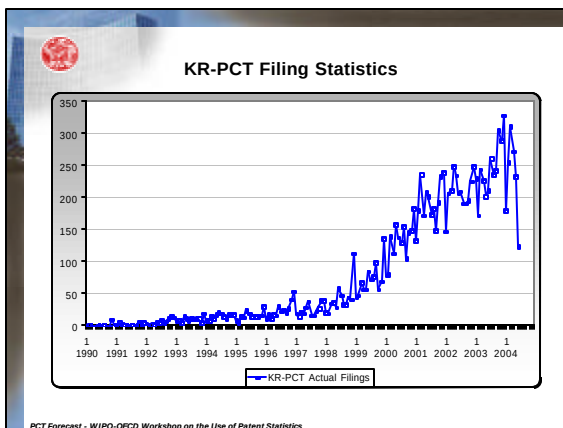
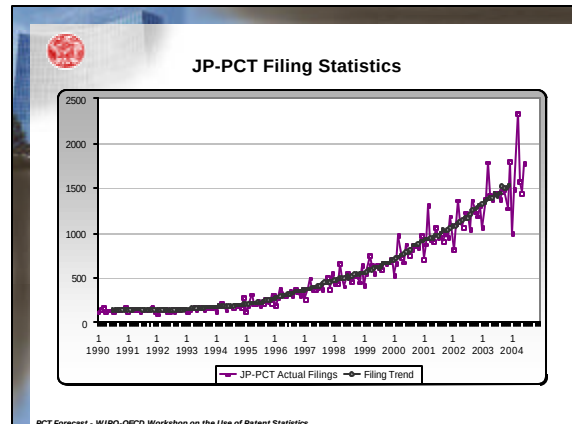
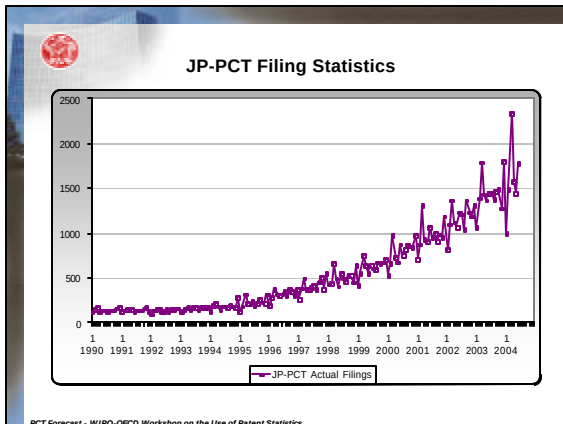
Main PCT Filing Countries (1996 - 2003):

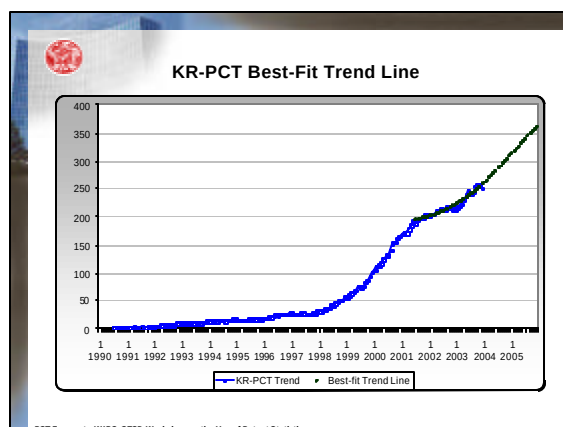
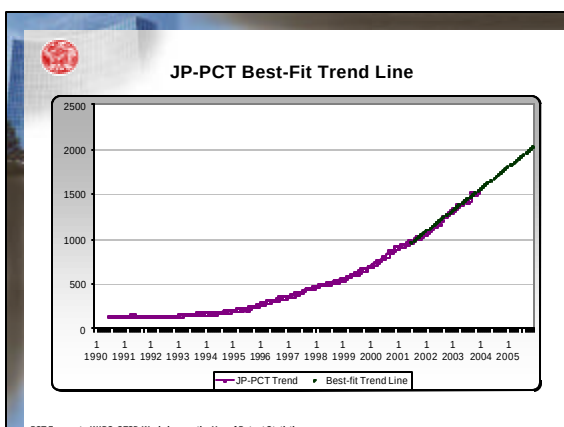
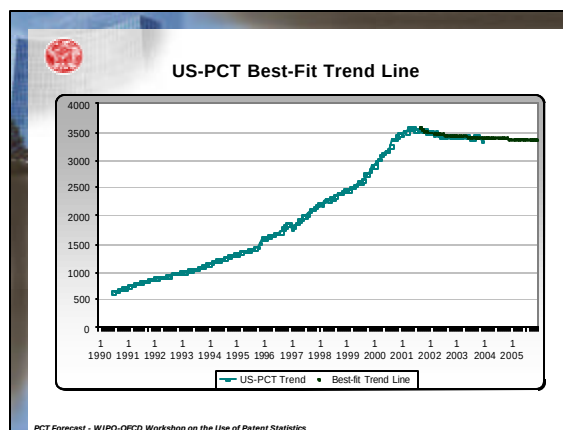
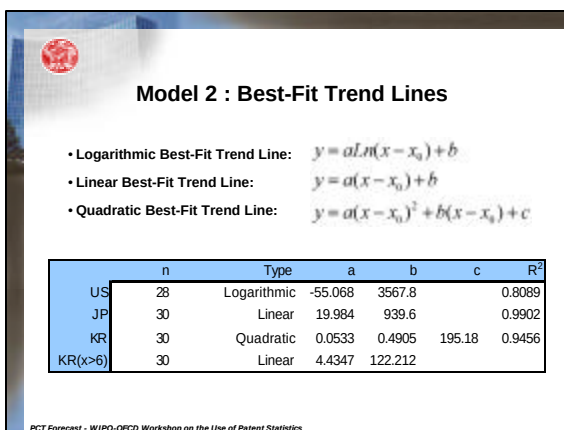
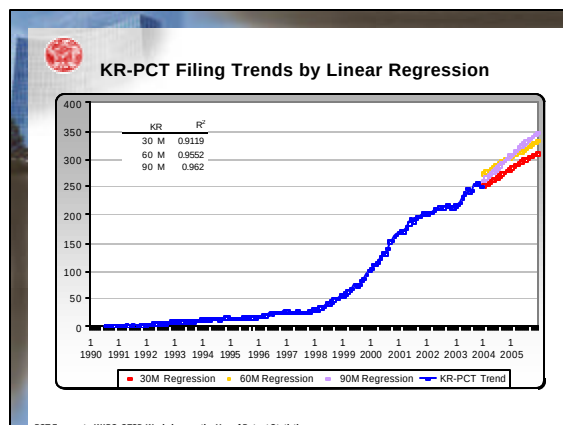
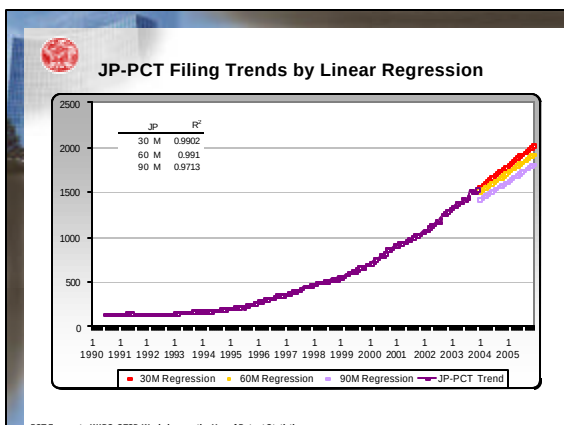
US	39.06%	G1 (Industrialized Countries)	8.16%
DE	13.25%	G2 (Developing Countries)	2.33%
JP	11.65%	G3 (All Other Countries)	0.49%
GB	5.04%		
FR	4.54%		
NL	3.37%		
SE	3.06%		
CH	2.30%		
CA	1.99%		
KR	1.89%		
IT	1.62%		
CN+IN	1.28%		

• Examples: US, JP and KR

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Can we model the trend lines ?

PCT filing trend could be determined by domestic filings, PCT filings and percentage of PCT filings:

2003 Domestic and PCT filings				
	Domestic	PCT	% PCT	Trend
US	287000	41000	14.29%	Logarithmic
JP	365000	17000	4.66%	Linear
KR	130000	3000	2.31%	Quadratic + Linear

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Seasonal Filing Pattern

Seasonal filing pattern is the average of percentage between the actual filing number $F(x)$ and the filing trend $T(x)$ established by moving average:

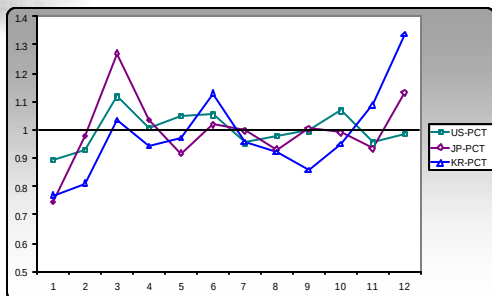
$$S(x) = \frac{\sum_{i=n_1}^{n_2} F(x+12i)/T(x+12i)}{n_2 - n_1 + 1}$$

$$n_1 = \lfloor x/12 \rfloor$$

$$n_2 = \lfloor (n-x)/12 \rfloor$$

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Seasonal Filing Patterns



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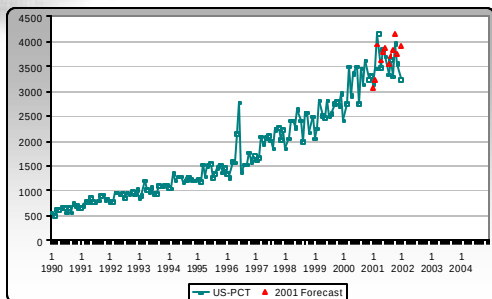
PCT Filing Forecast

Filing forecast is the forecasted filing trend $T_F(x)$ multiplied by the seasonal filing pattern $S(x)$:

$$F_F(x) = T_F(x)S(x)$$

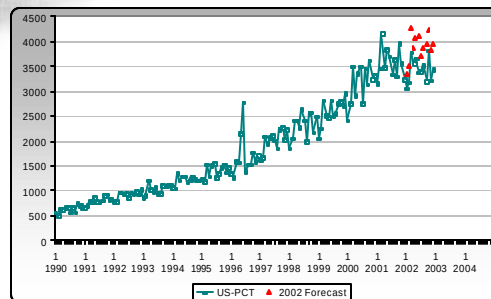
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US-PCT Filing Forecast

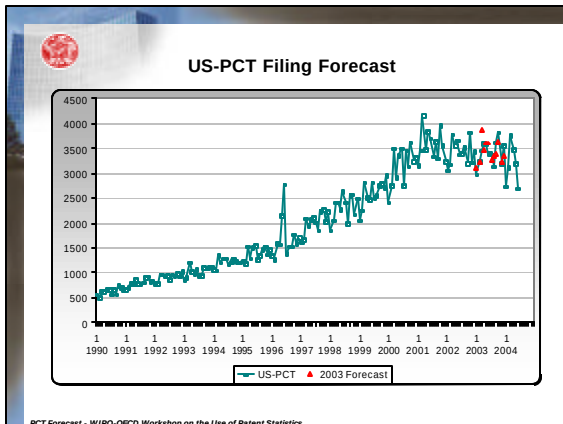


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US-PCT Filing Forecast



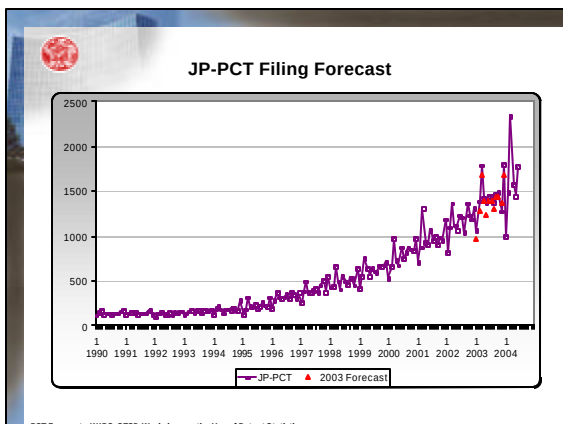
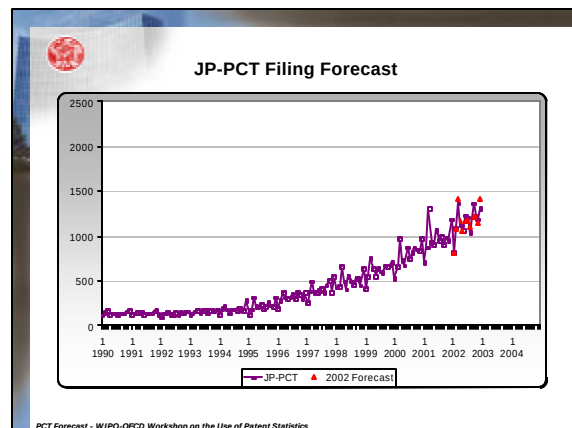
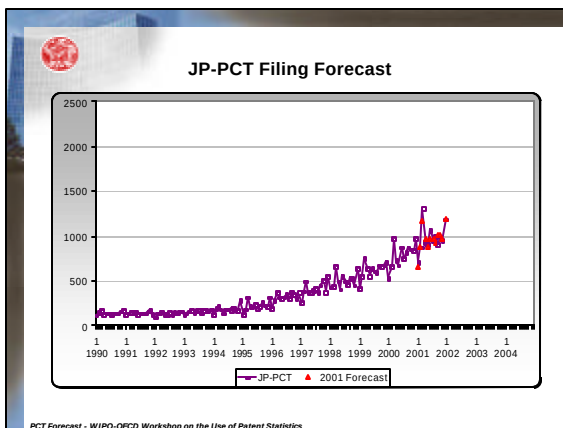
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Evaluation of US-PCT Forecast

US	Actual	Forecast	Error	% Error
2001	42892	44428	1536	3.58%
2002	41297	46757	5460	13.22%
2003	41065	41161	96	0.23%

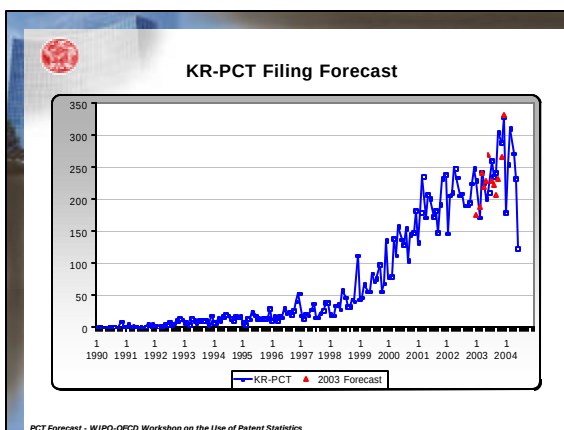
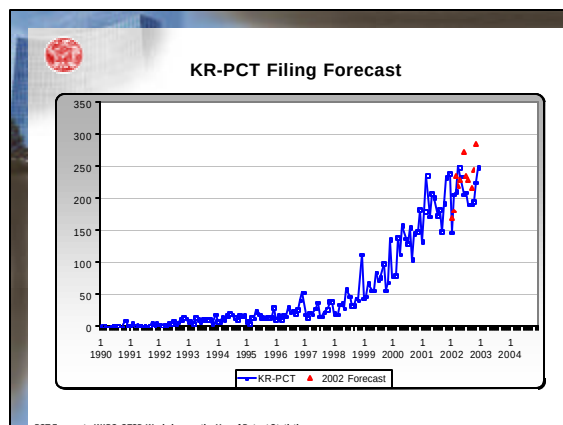
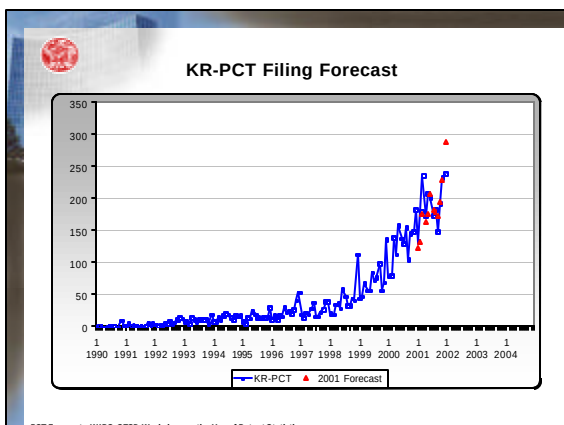
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Evaluation of JP-PCT Forecast

JP	Actual	Forecast	Error	% Error
2001	11757	11602	-155	-1.31%
2002	14062	13946	-116	-0.82%
2003	17360	16552	-808	-4.65%

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Evaluation of KR-PCT Forecast

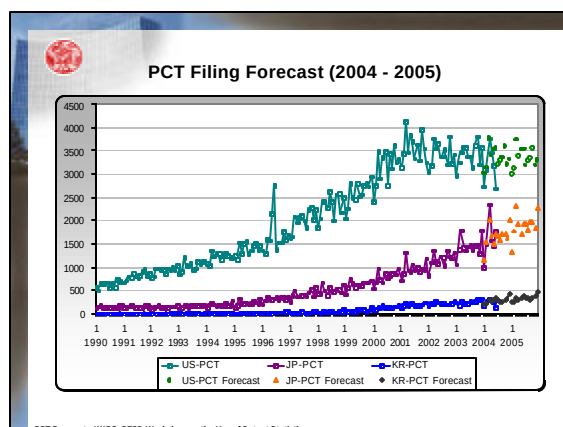
KR	Actual	Forecast	Error	% Error
2001	2306	2230	-76	-3.29%
2002	2522	2875	353	13.98%
2003	2953	2821	-132	-4.46%

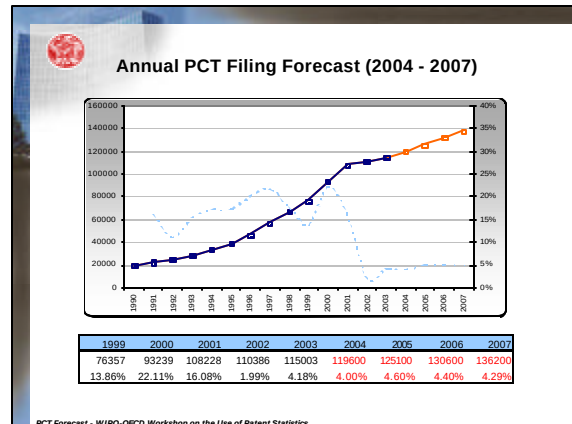
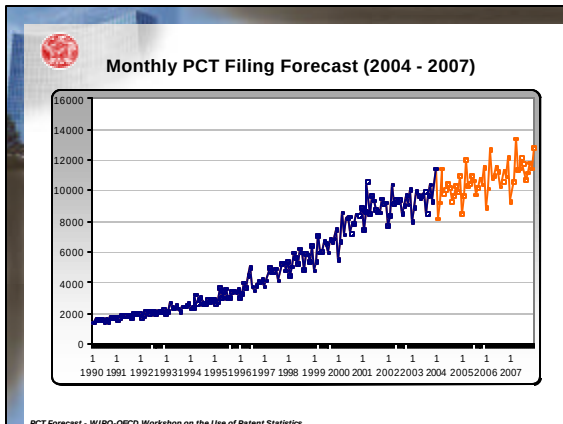
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Forecast Results for All Countries (Groups)

	2003	2004	2005	2006	2007
CA	2269	2304	2328	2340	2345
CH	2819	2929	3008	3056	3073
CN+IN	2051	2500	3024	3550	4100
DE	14652	14833	15037	15232	15405
FR	5164	5248	5305	5332	5344
G1	8903	9053	9173	9246	9285
G2	2659	2787	2956	3140	3330
G3	547	597	628	658	693
GB	5218	5211	5208	5206	5205
IT	2165	2434	2697	2952	3211
JP	17360	20344	23386	26427	29472
KR	2953	3319	3900	4640	5500
NL	4430	4965	5473	5940	6330
SE	2620	2592	2575	2564	2559
US	41065	40488	40444	40354	40324

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Conclusions

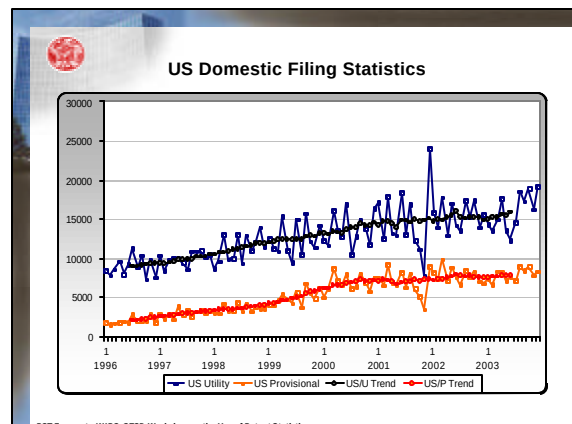
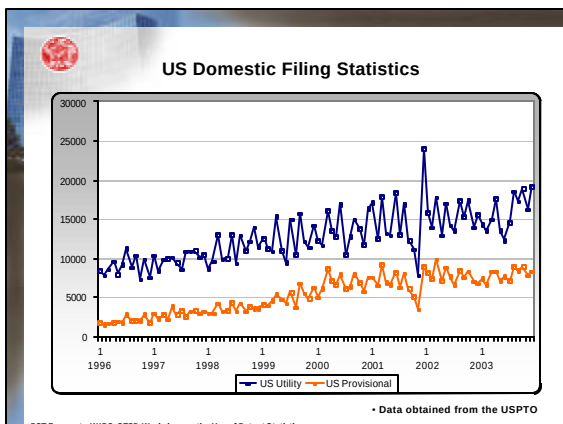
- PCT filings will grow at the annual growth rate of about 4%
- Auto regression method cannot predict sudden change of PCT filing pattern, due to economic or policy reasons
- Shorter period monthly data used for regression may produce better results
- More analysis needed for modeling the best fit trend lines

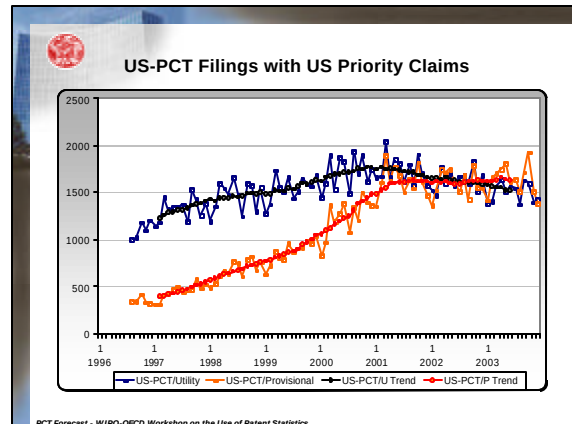
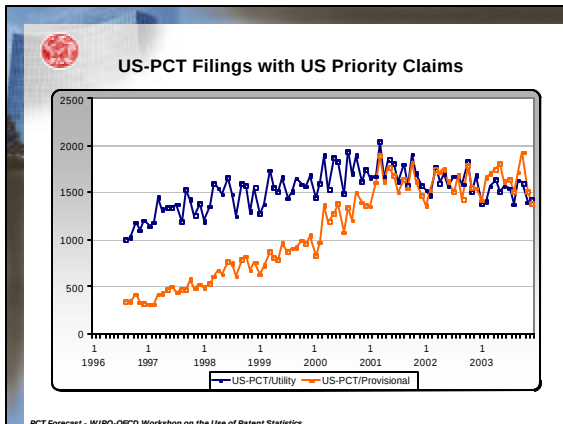
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PART II : US-PCT CASE STUDY

- US domestic filings: Provisional + Utility
- US domestic filings may be predictive for the PCT applications filed one year later

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Model 1 : Regression of "Conversion Rates" (CR)

- US-PCT Applications are considered as "Converted" from US Domestic applications
- The delay is fixed at 12 months
- "Conversion Rate" is affected by the desire of US applicants to file abroad, and usefulness of the PCT system

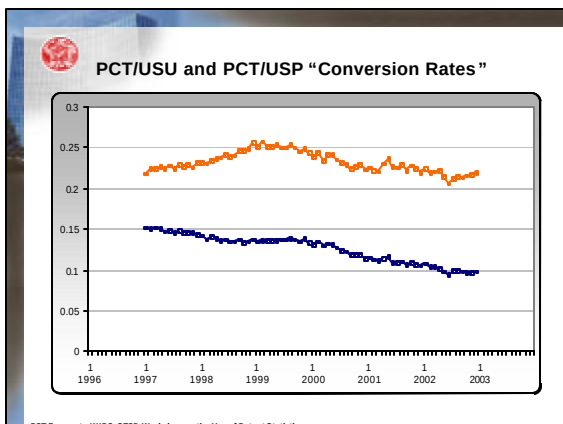
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"Conversion Rates"

PCT Conversion Rate is the percentage between the US-PCT filing trend value 12 months later and the current US domestic filing trend value:

$$C(x) = \frac{T_{PCT}(x+12)}{T_{USD}(x)}$$

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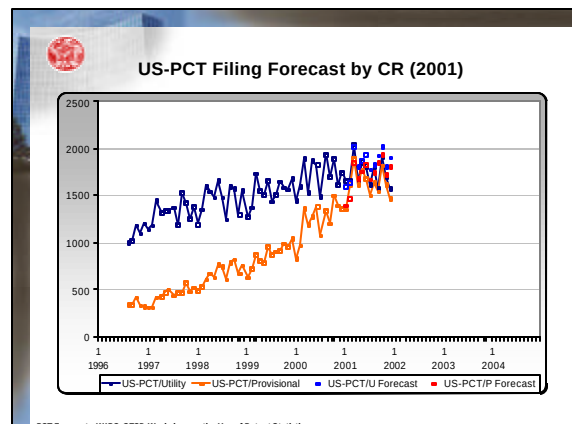
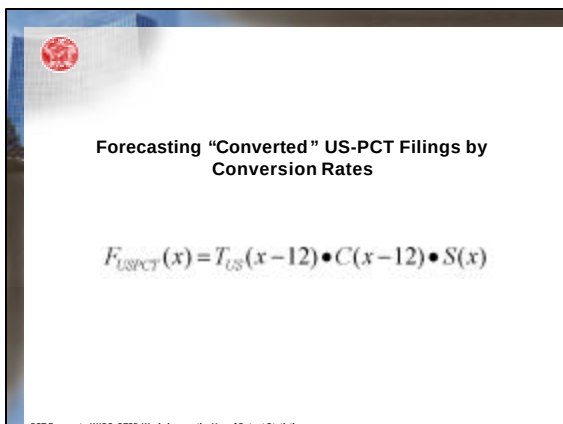
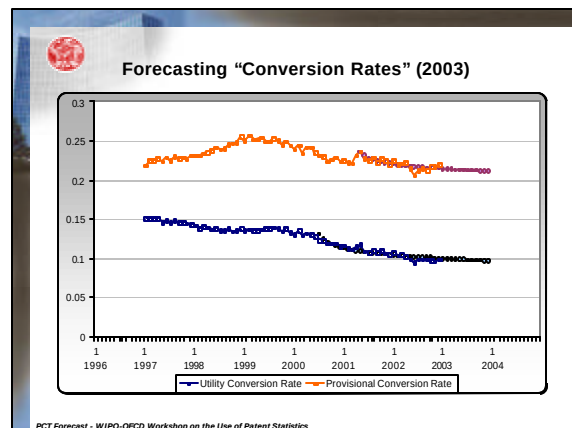
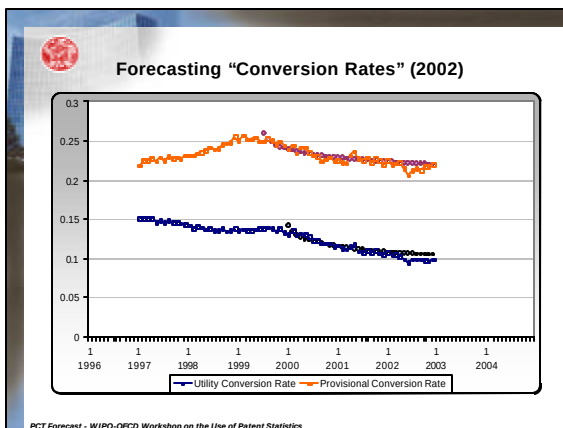
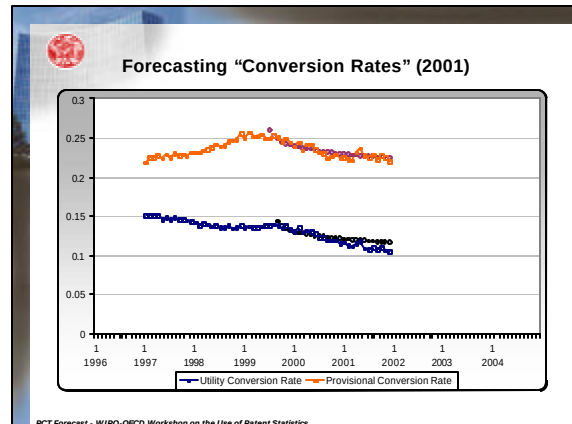
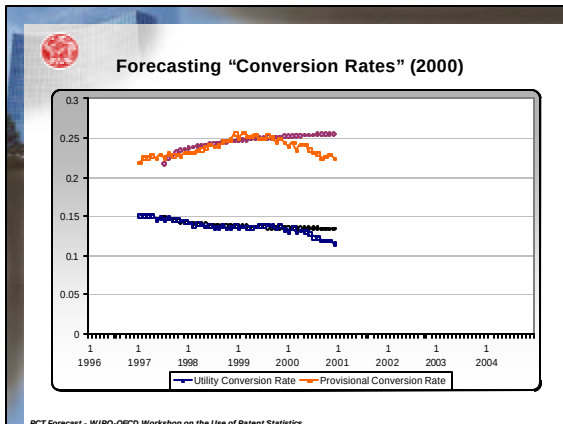
Trend of "Conversion Rates"

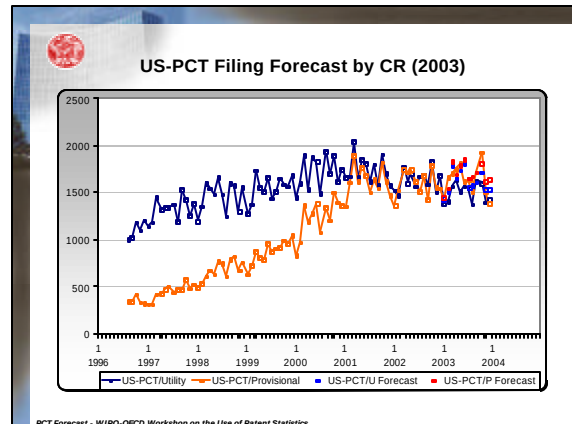
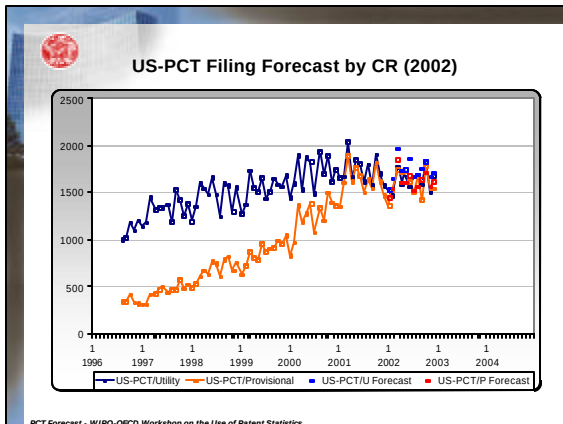
Best-fit logarithmic trend lines based on n-months' data are used:

$$C_p(x) = a \ln(x - x_0) + b$$

		n	a	b	R-Square
USU Conv	2000	30	-0.0041	0.149	0.7144
	2001	16	-0.0081	0.1436	0.7164
	2002	24	-0.0102	0.1414	0.8544
	2003	30	-0.0091	0.1308	0.8422
USP Conv	2000	30	0.0101	0.217	0.7558
	2001	18	-0.0103	0.2596	0.75
	2002	30	-0.0104	0.2595	0.7831
	2003	20	-0.0071	0.2359	0.6812

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Evaluation of Forecast by CR

US-PCT/Utility Priority				
	Actual	Forecast	Error	% Error
2001	20923	22213	1290	6.17%
2002	19615	20876	1261	6.43%
2003	18081	19484	1403	7.76%
2004		18445		

US-PCT/Provisional Priority				
	Actual	Forecast	Error	% Error
2001	19558	20773	1215	6.21%
2002	19266	19399	133	0.69%
2003	19715	20287	572	2.90%
2004		19878		

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- ### Model 2 : Multiple Regression (ANOVA)
- Independent variables:
 - US domestic utility filings
 - US domestic provisional filings
 - Dependant variables:
 - US-PCT filings with US utility priority
 - US-PCT filings with US provisional priority
 - The lag is 12 months
 - Regression applied on filing trend
 - Seasonal pattern then applied on filing trend
 - The tool used is "S-Plus"
- PCT Forecast - WIPO-OECD Workshop on the Use of Patent Statistics

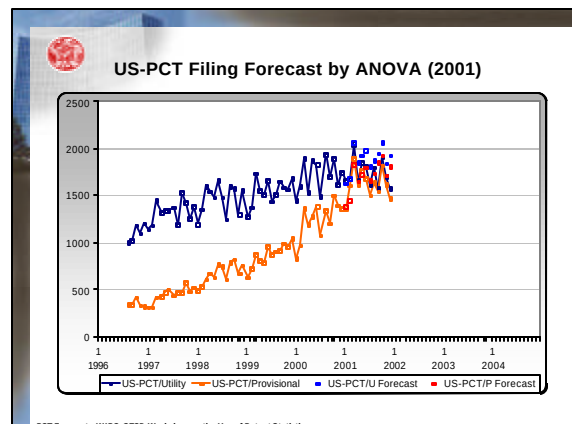
ANOVA Results

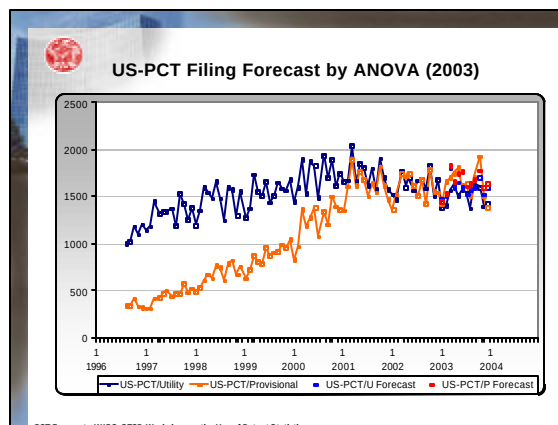
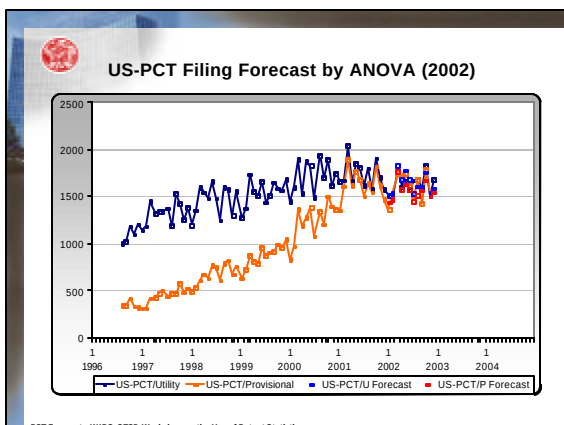
$$y = y_0 + v_1x_1 + v_2x_2$$

ANOVA Output, US-PCT - Utility Priority				
	2001	2002	2003	2004
R ²	0.965	0.634	0.844	0.761
y ₀ Intercept	537.16	2876.84	2901.60	2636.87
v ₁	0.076	-0.137	-0.115	0.014
v ₂	0.045	0.108	0.059	-0.171

ANOVA Output, US-PCT - Provisional Priority				
	2001	2002	2003	2004
R ²	0.994	0.995	0.811	0.632
y ₀ Intercept	-638.00	1494.00	1032.36	1305.48
v ₁	0.067	-0.131	-0.033	-0.017
v ₂	0.209	0.279	0.148	0.078

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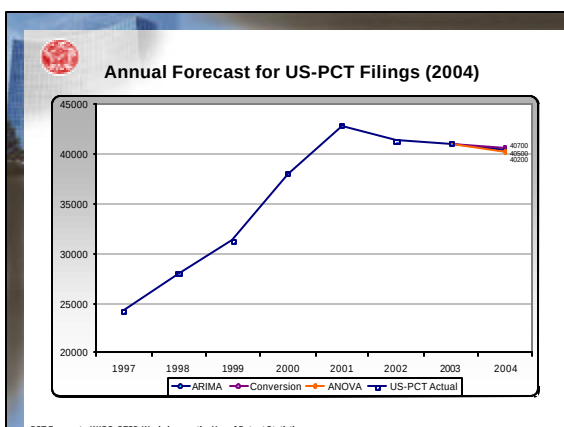
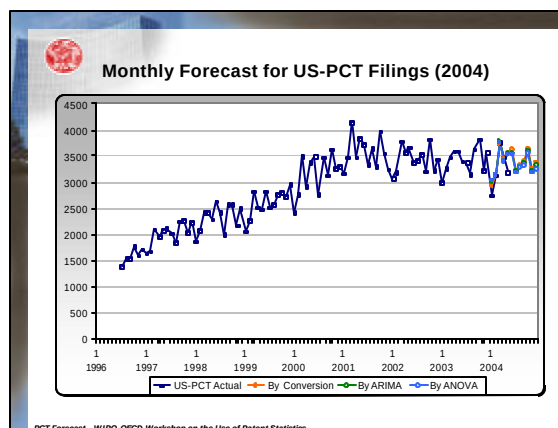


Evaluation of Forecast by ANOVA

US-PCT/Utility Priority				
	Actual	Forecast	Error	% Error
2001	20923	22621	1698	8.11%
2002	19615	19691	76	0.39%
2003	18081	19182	1101	6.09%
2004		17996		

US-PCT/Provisional Priority				
	Actual	Forecast	Error	% Error
2001	19558	20594	1036	5.30%
2002	19266	18731	-535	-2.78%
2003	19715	19968	253	1.28%
2004		19866		

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Comparing ARIMA, CR and ANOVA

US-PCT Total					
		Actual	Forecast	Error	% Error
ARIMA	2001	42892	44428	1536	3.58%
	2002	41297	46757	5460	13.22%
	2003	41065	41161	96	0.23%
CR	2001	42892	45526	2634	6.14%
	2002	41297	42792	1495	3.62%
	2003	41065	42242	1177	2.87%
ANOVA	2001	42892	45769	2877	6.71%
	2002	41297	40822	-475	-1.15%
	2003	41065	41583	518	1.26%

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Conclusions

- No method is particularly better
- ARIMA can not predict sudden change in filing trend, otherwise is quite accurate for consistent trends
- ANOVA and CR could, on the other hand, pick up the changed filing trend
- ANOVA and CR could only predict short term results due to 1 year lag
- ANOVA and CR depend on availability of national filing statistics
- Combination of the above methods may produce better forecasting results

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QUESTIONS & COMMENTS ?

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THANK YOU!

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