Financial Analytics & Data Visualization

Expanding our Knowledge with Open Source Software



Introduction



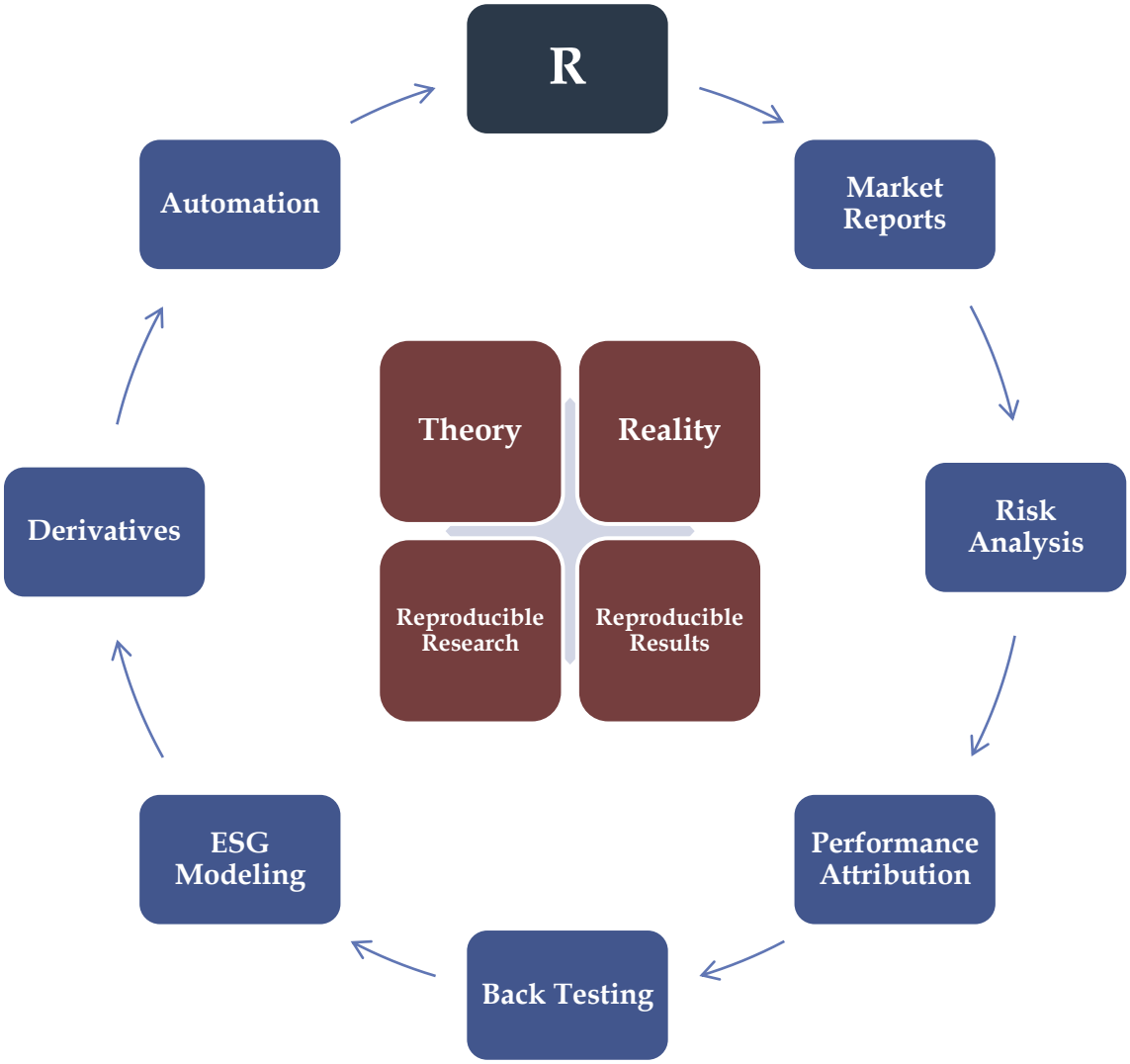
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Introduction

- **Life Insurance Sector**
  - **Current Challenges:**
    - Low interest rate environment, with increased probability that rates will remain low
    - Complex regulatory environment (Solvency II)
    - More stringent capital regulations (Solvency II, RBC 2 etc)
    - Less accessible derivatives markets (partially due to regulations) for hedging out risk
  - **Areas of Focus:**
    - ORSA
    - ERM
    - ALM & Capital Management
  - **Tools:**
    - Economic Scenario Generators (B&H, ORTEC, Conning AM …)
    - Risk measurement (Barra, UBS, Credit Suisse, RiskMetrics …)
    - Policy Pricing & Management (Prophet, MoSes or Axis)
    - Market Information (Bloomberg, Reuters, MorningStar, Lipper)

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Agenda



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- **The benefits of using Open Source Software R**
  - **No license Fee.** Accessible to anyone interested.
  - Used by a large community worldwide, including various large financial institutions. →Actively being developed & Easy to find documentation on R.
  - Easy to integrate with other systems, such as Bloomberg, Excel, C++, Python, Perl, SAS, etc
  - Powerful Financial Analytics engine & Very strong Data Visualization tool (with many add-on packages)
  - Great platform for reproducible research
- **Disadvantages**
  - Steep learning curve – despite all the documentation
  - Not the fastest programming language!
  - Challenging with large datasets (although commercial packages are available to solve this)
  - Not all add-on packages are of equal quality

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- **Possibilities within R**
  - ARCH, GARCH, MARCH modeling
  - ARIMA modeling
  - Performance Analytics (Information Ratio, Sharpe Ratio, Calmar Ratio etc)
  - Risk Analysis (VaR, CVaR, Expected Shortfall)
  - Factor Analysis
  - Efficient Frontier, Backtesting based on the Efficient Frontier
  - Black-Litterman Model
  - Option Analysis, tools for Option pricing (including Swaps)
  - Dependency modeling (Copulas)
  - ESG Engine

  - 5-6 Actuarial Packages

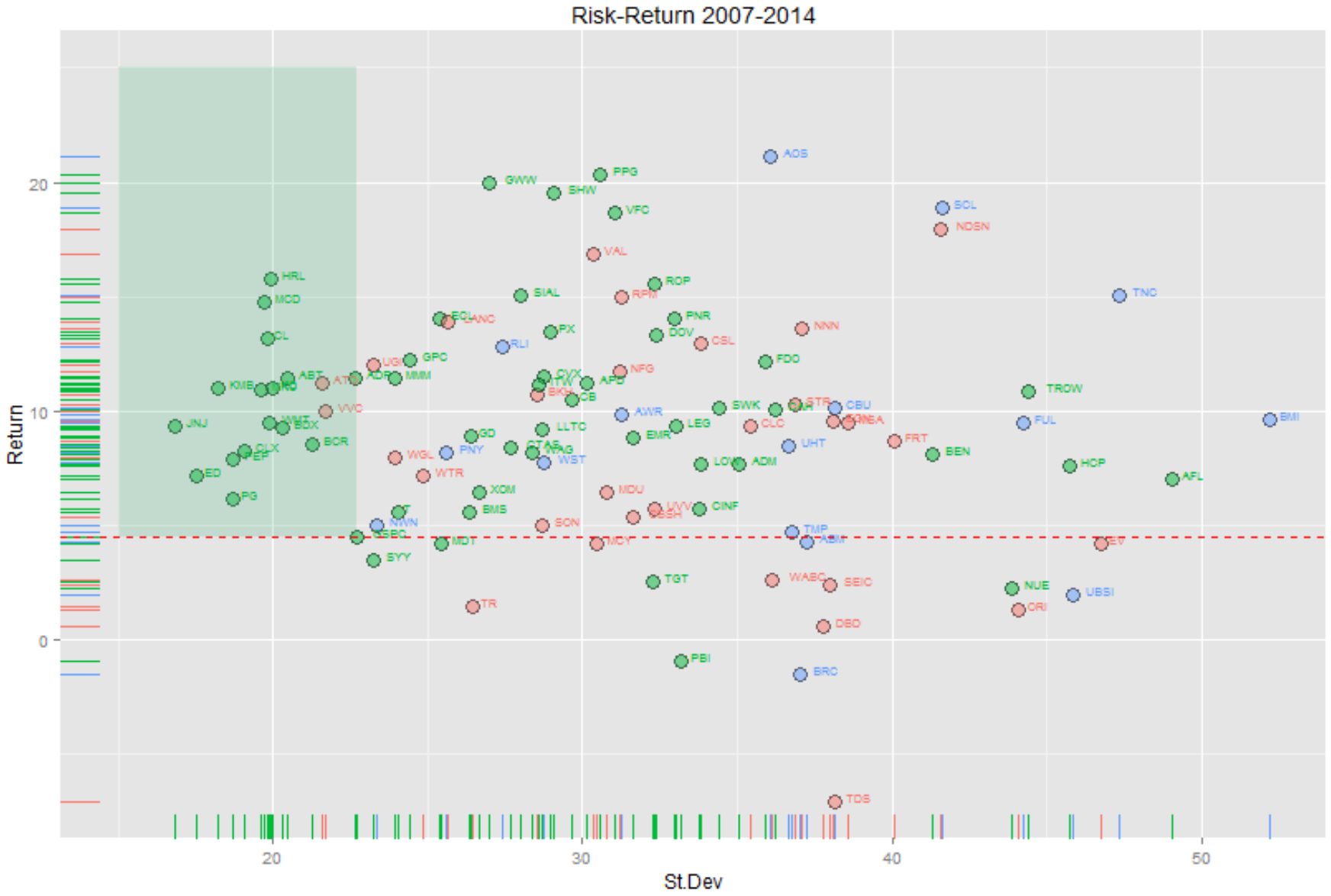
  - **Full automated Market Reports & DashBoards**

  - **Interactive webs apps**

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Market Reports

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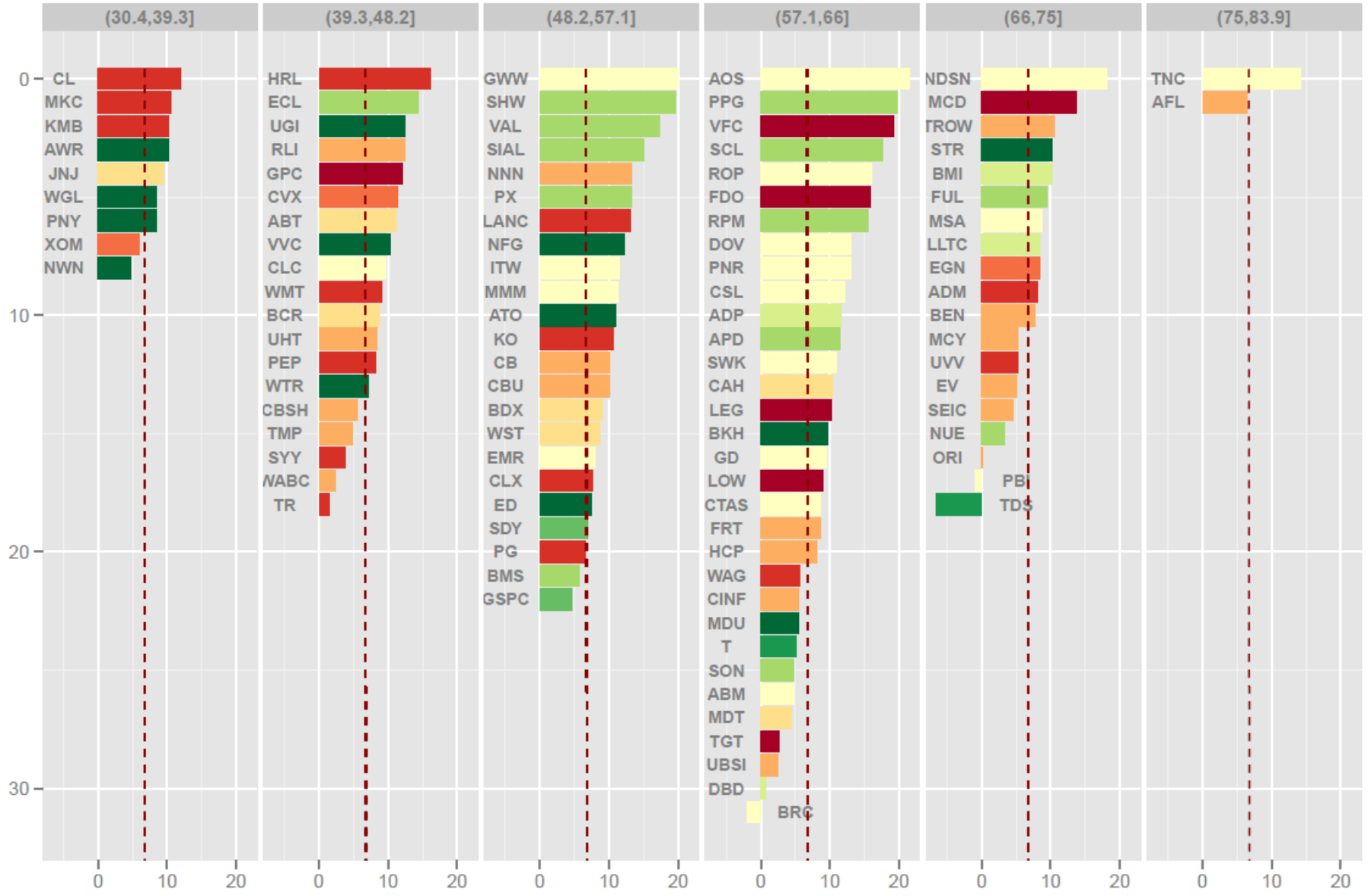
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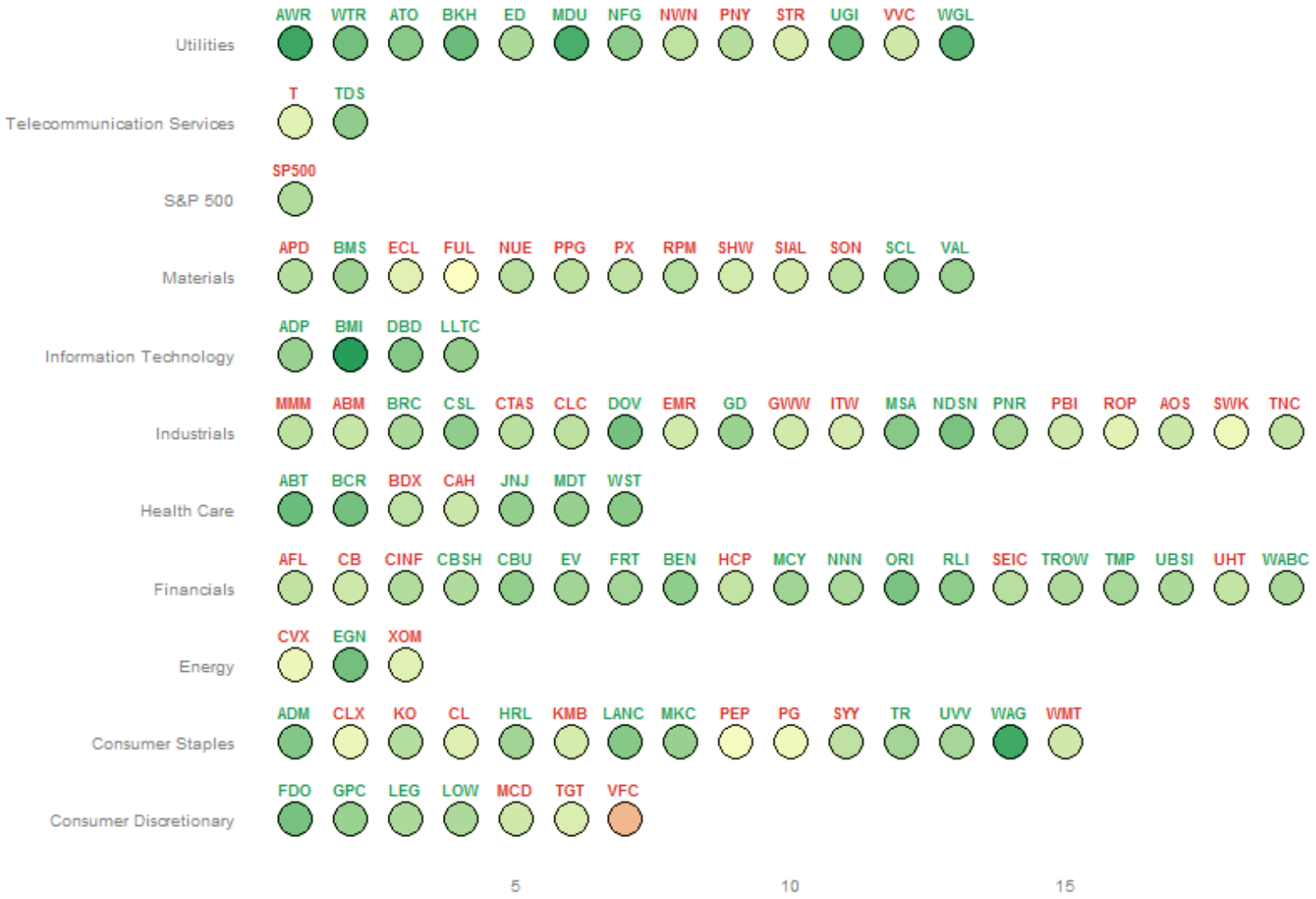
Ranking by Performance, Split by 2007 – 14 Drawdown, Color by Sector



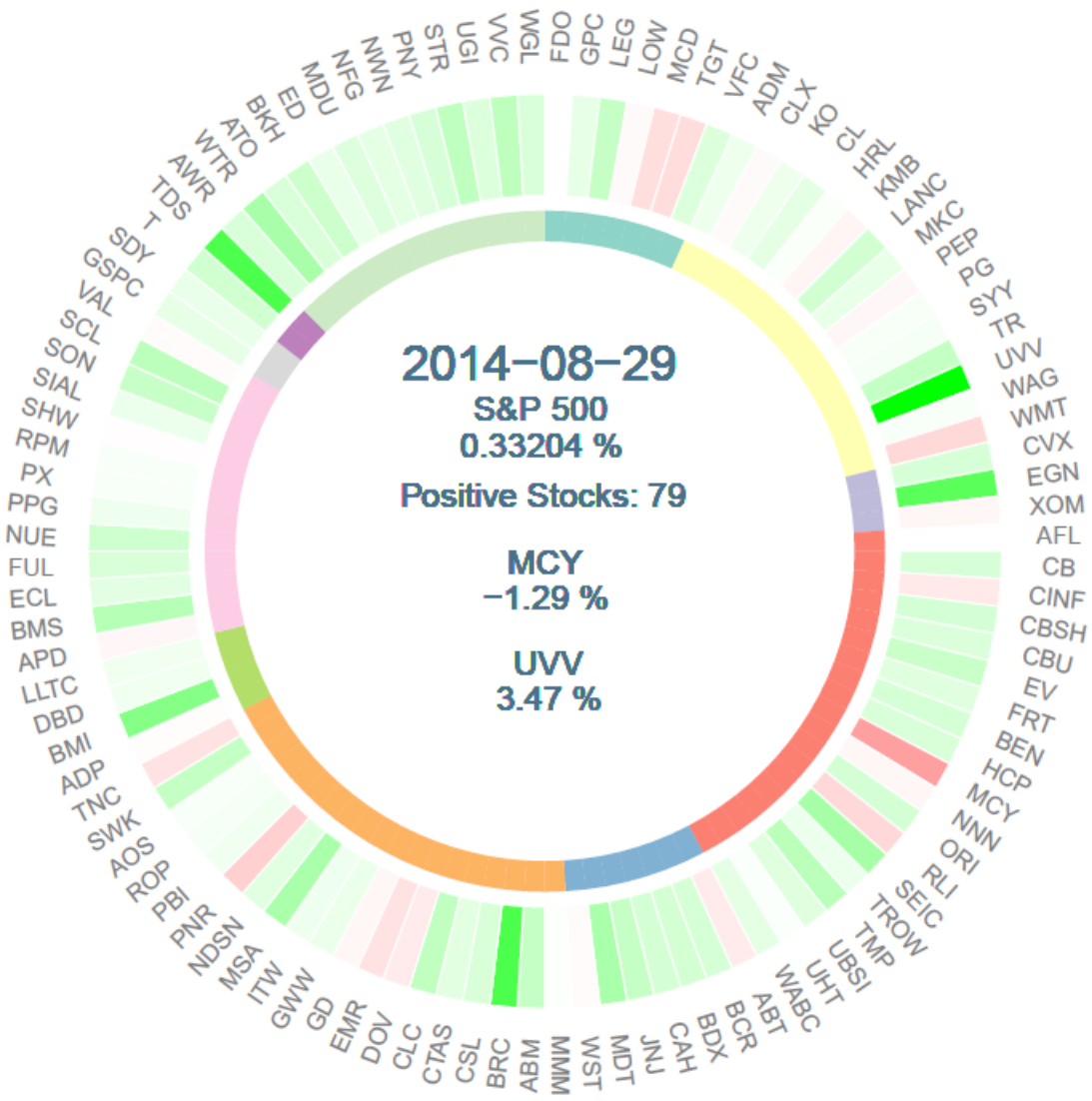
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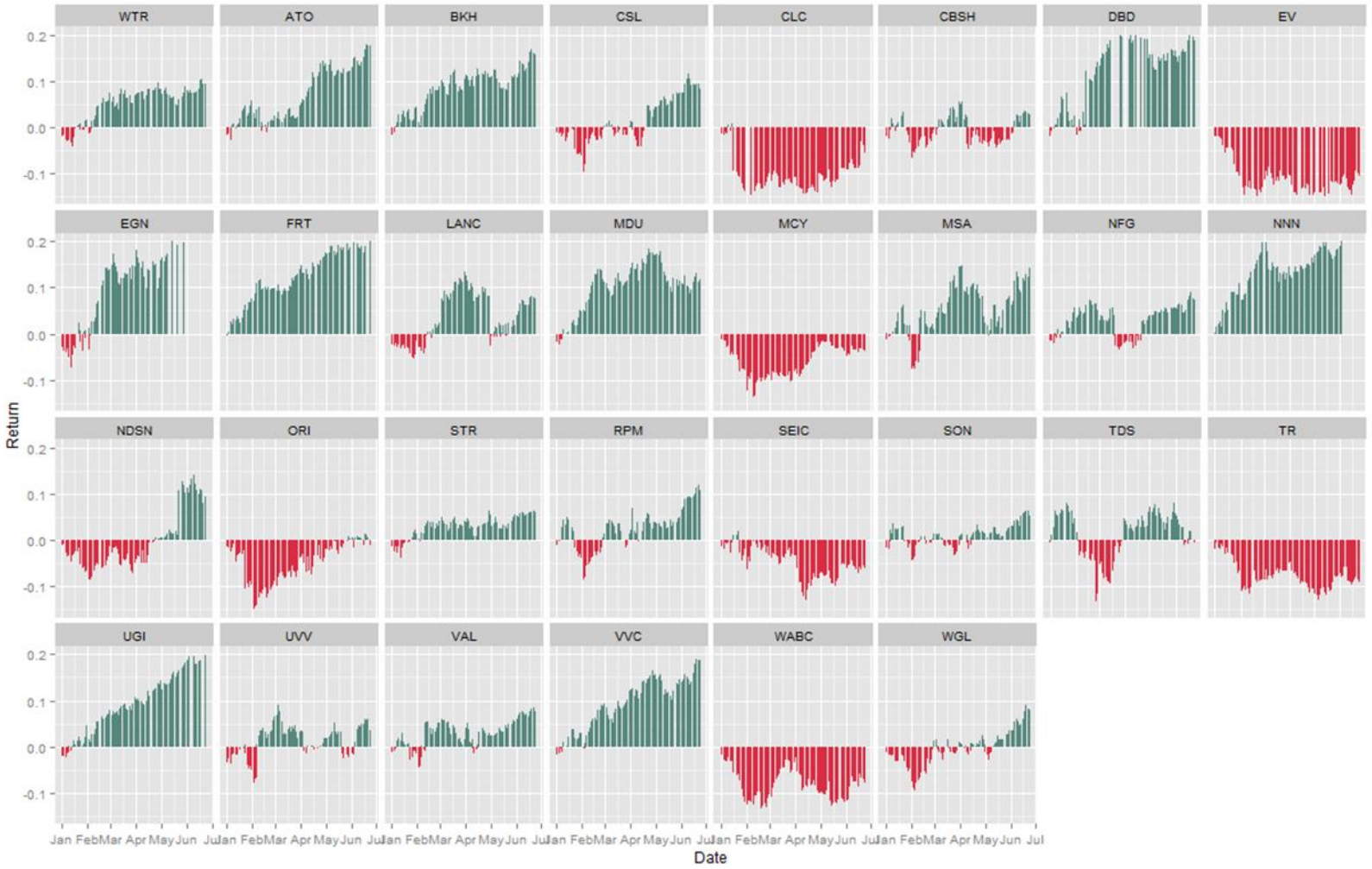
Stock Point Plot ~ Yesterday



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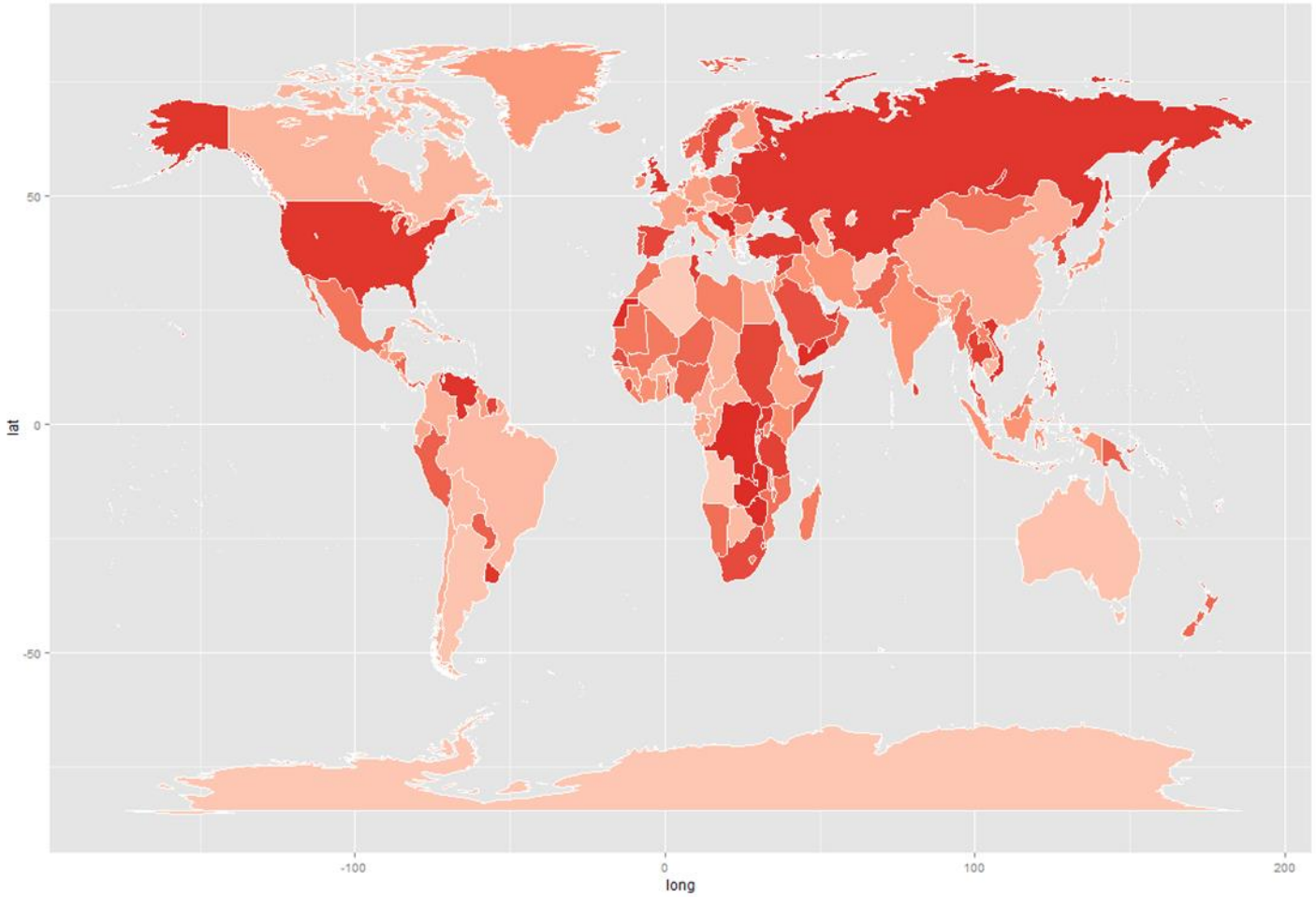


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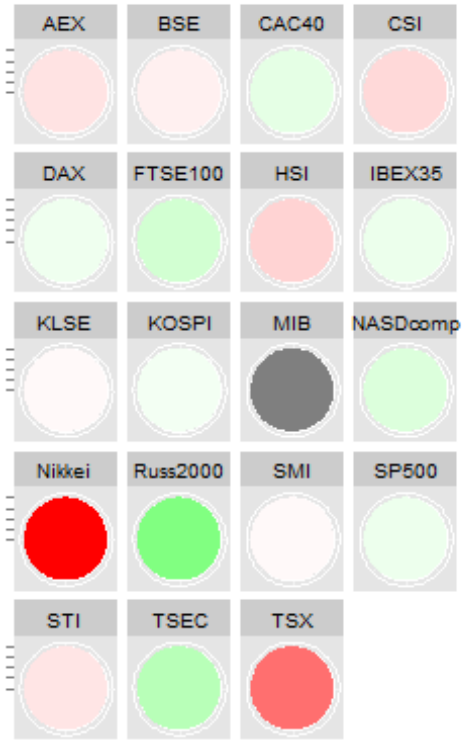
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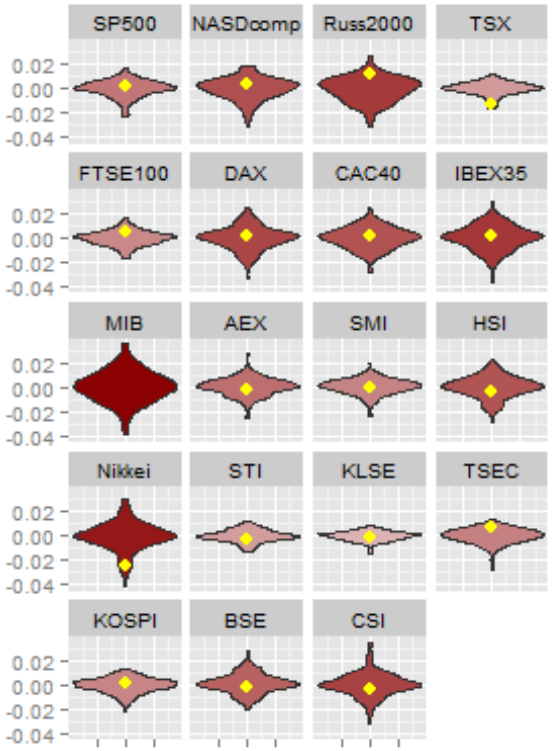
Map Graph

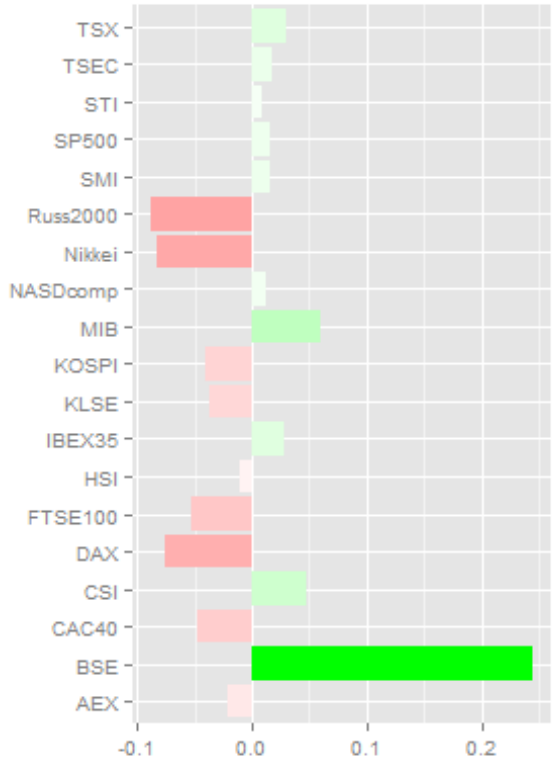


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Risk Analysis

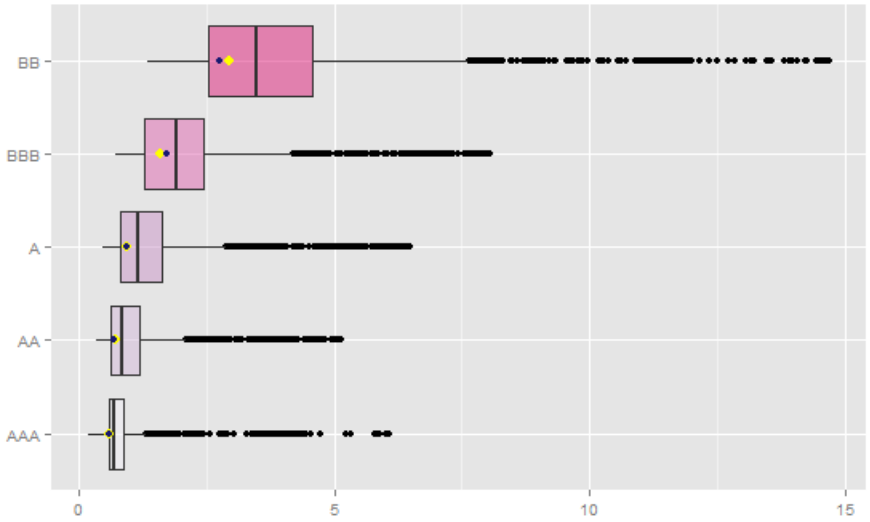


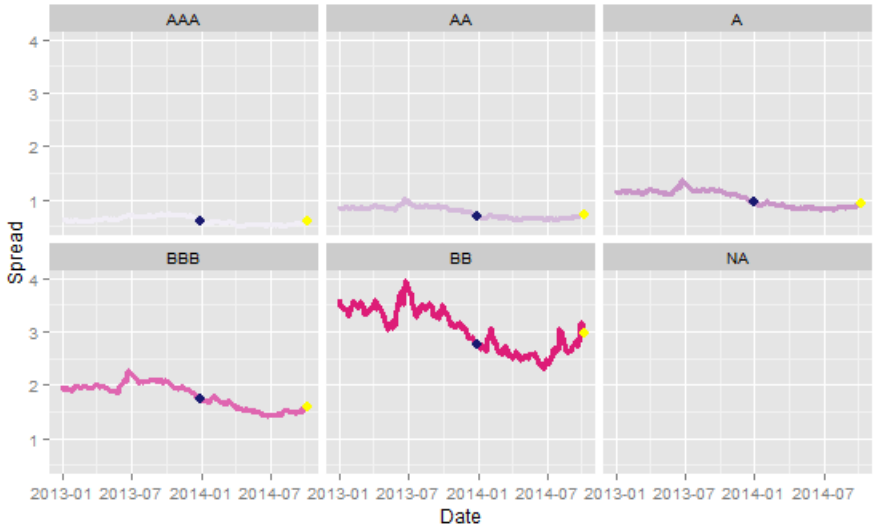


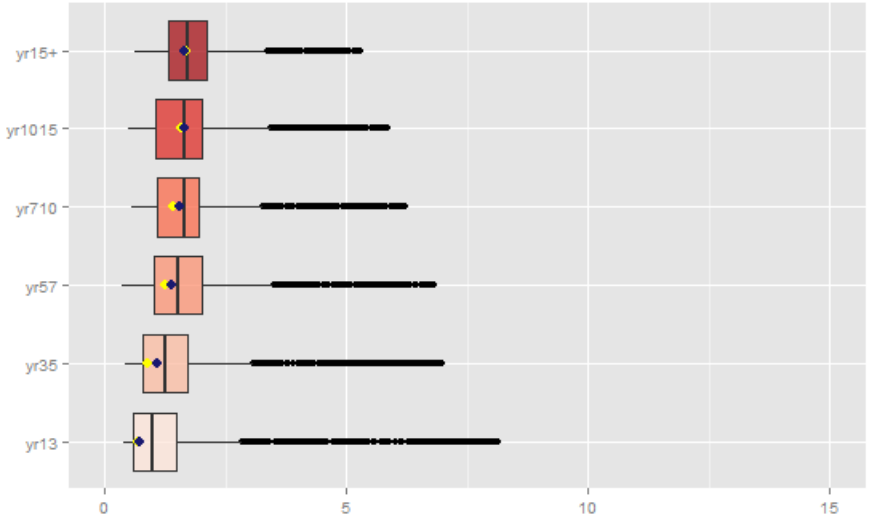


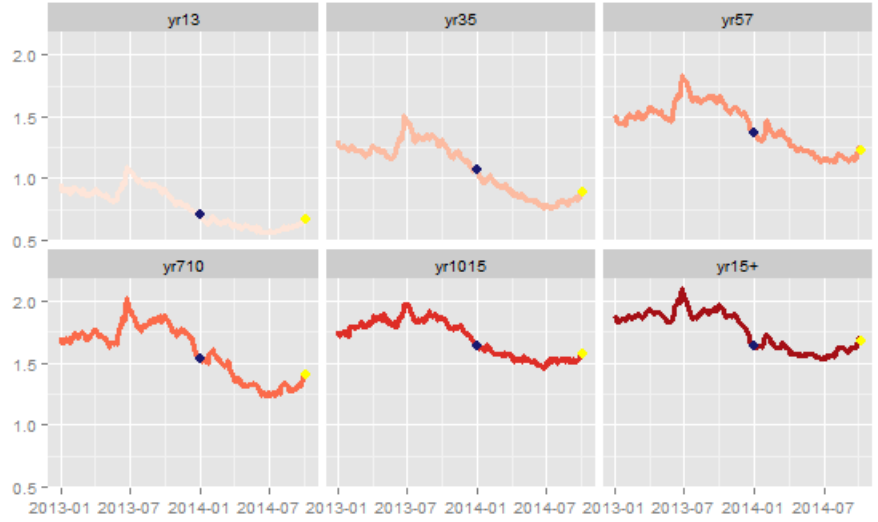
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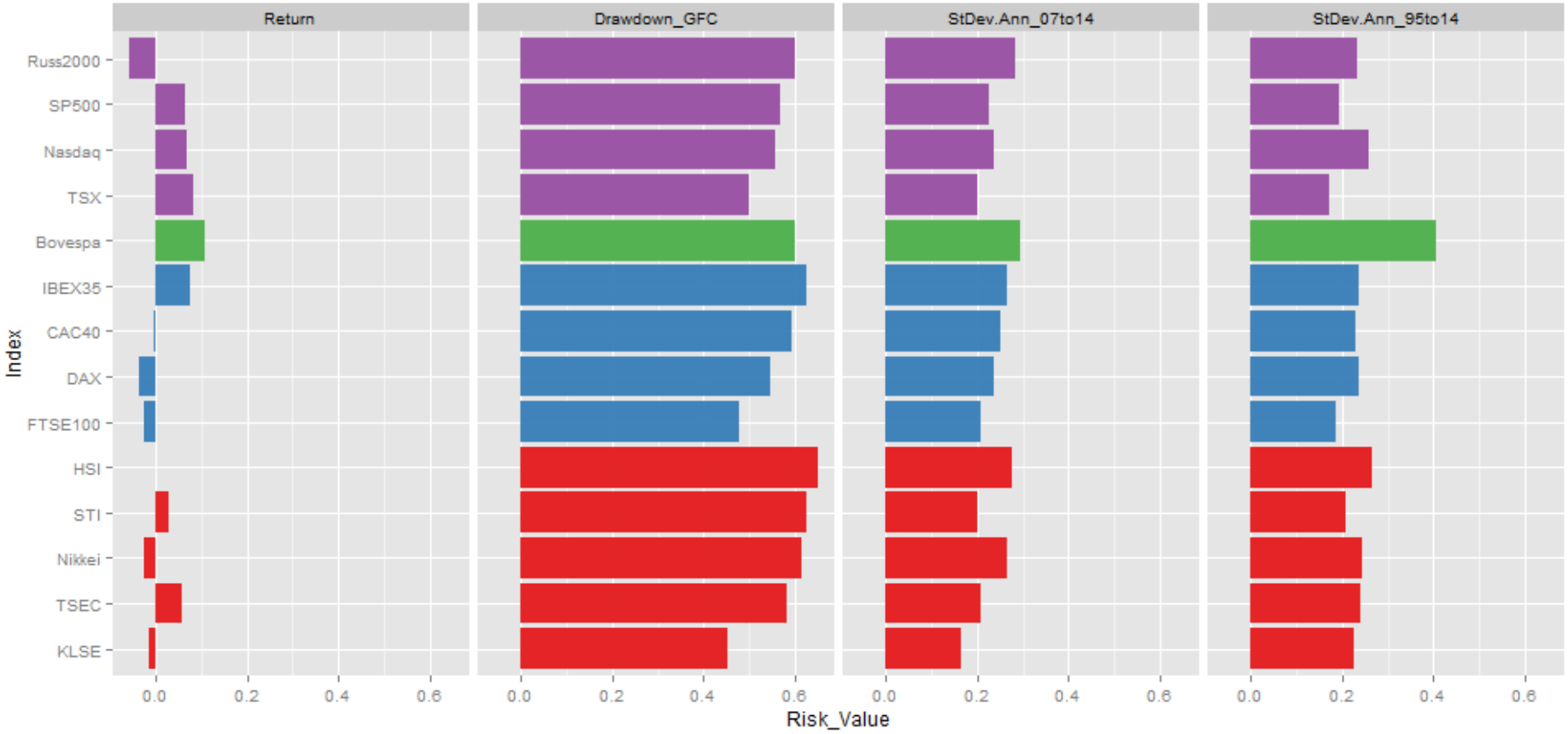






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Risk Analysis



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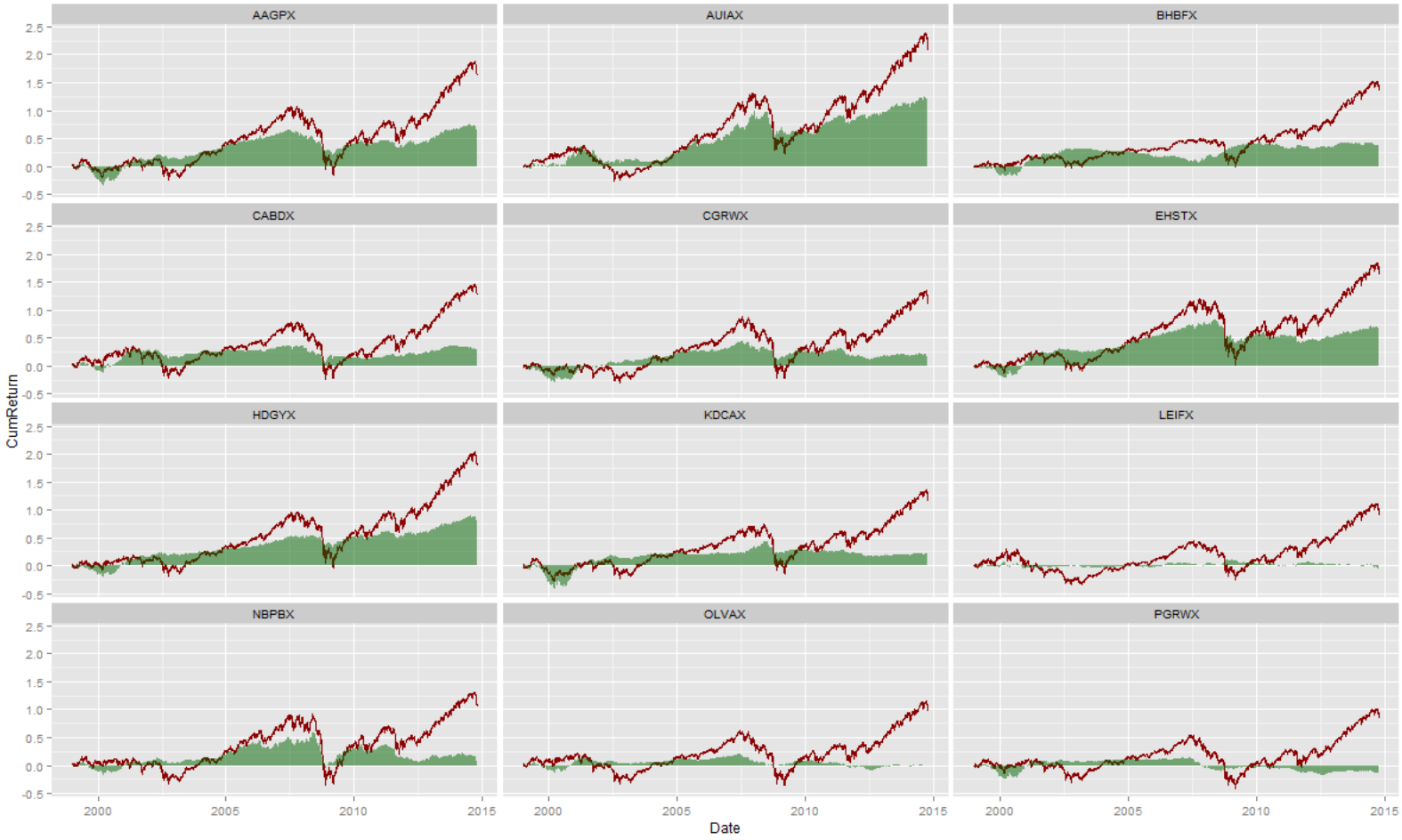
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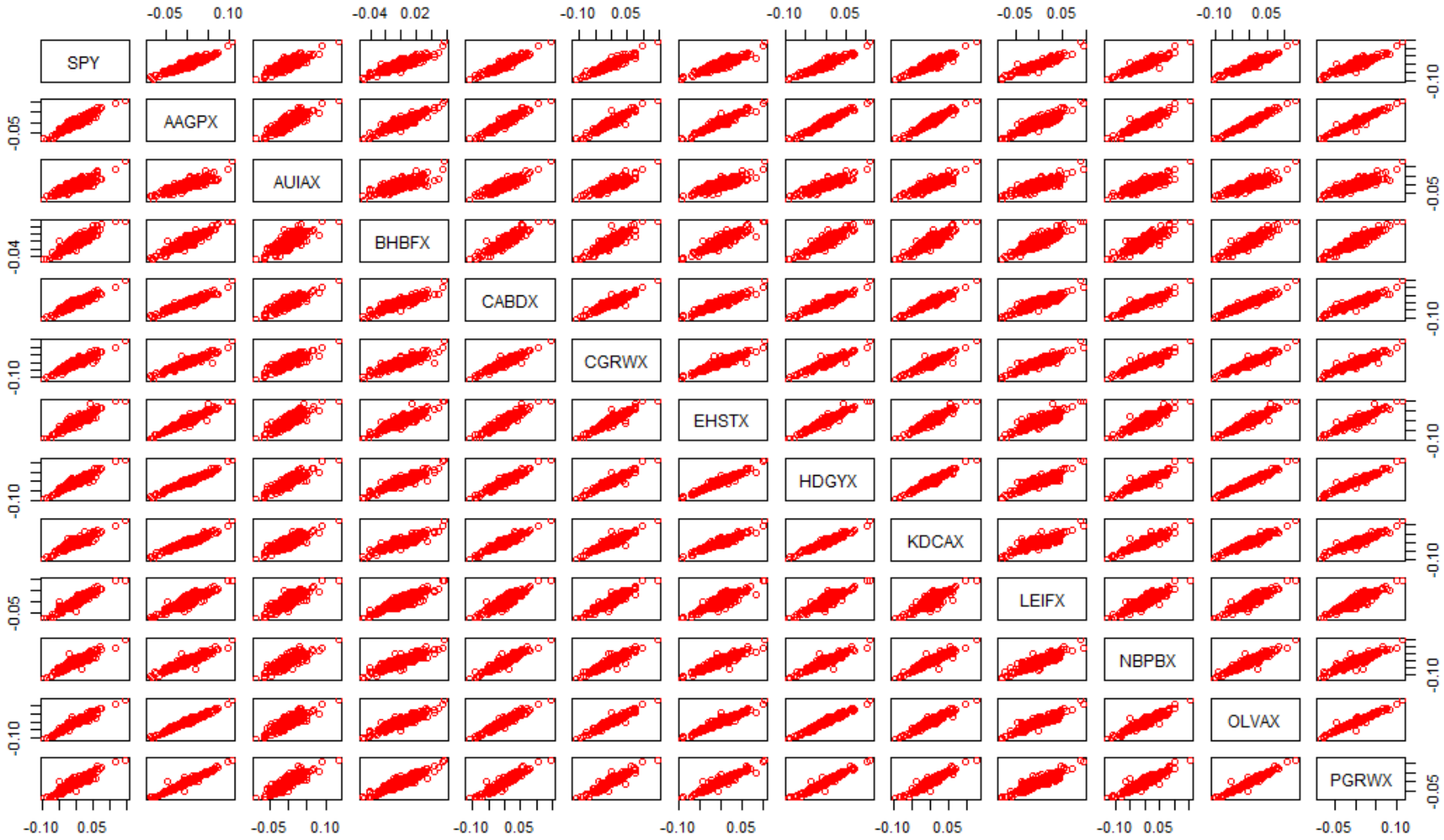
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Performance Measures

Period 1999-2014

Annual Returns

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SPY	20.38	-9.74	-11.94	-21.58	28.18	10.69	4.83	15.91	5.16	-36.68	26.34	15.05	1.9	16.13	32.31	2.98
AAGPX	-4.88	11.27	1.93	-17.83	35.31	19.15	9.71	18.76	3.05	-39.52	27.21	14.11	-2.68	18.84	34.48	0.09
AUIAX	18.02	14.57	-19.62	-19.65	19.35	23.54	16.13	23.97	22.21	-34.45	16.42	18.32	3.45	13.81	27.7	0.49
BHBFX	3.62	10.8	1.23	-9.08	15.24	8.14	-2.19	12.05	2.23	-19.81	24.82	8.24	1.74	10.99	30.61	-0.57
CABDX	10.78	13.62	-2.09	-26.57	31.9	11.19	3.9	16.95	5.91	-40.79	20.94	13.07	5.63	17.91	34.17	-1.89
CGRWX	-4.79	-1.52	2.99	-12.41	32.19	15.19	6.48	15.9	6.29	-41.51	33.6	14.73	-4.76	13.59	30.29	-1.12
EHSTX	3.35	14.97	1.67	-15.86	23.32	16.23	11.52	18.87	10.02	-34.31	17.03	10.03	-4.47	15.87	29.38	2.57
HDGYX	5.07	10.8	-4.13	-13.71	26.4	12.48	5.87	20.13	8.19	-31.53	24.29	13.7	1.33	13.56	31.44	2.39
KDCAX	-10.85	15.79	1.54	-15.3	32.38	9.32	1.83	15.39	12.3	-35.51	24.84	10.34	-0.33	9.62	30.71	0.87
LEIFX	17.64	-10.96	-11.29	-19.48	24.2	13.05	3.32	23.13	2.12	-29.5	15.66	11.97	7.41	11.35	31.64	-3.43
NBPBX	7.16	0	-3.55	-24.62	35.28	18.75	17.51	12.95	9.62	-51.98	55.54	15.26	-11.56	16.67	31.26	-2.99
OLVAX	11.74	5.65	-13.46	-22.81	29.23	14.83	3.77	20.21	-1.73	-39.07	32.51	12	-4.87	16.41	35.74	1.32
PGRWX	1.22	7.96	-6.53	-18.86	27.2	10.91	5.2	15.96	-6.72	-38.77	29.46	14.4	-4.82	19.02	35.37	0.45

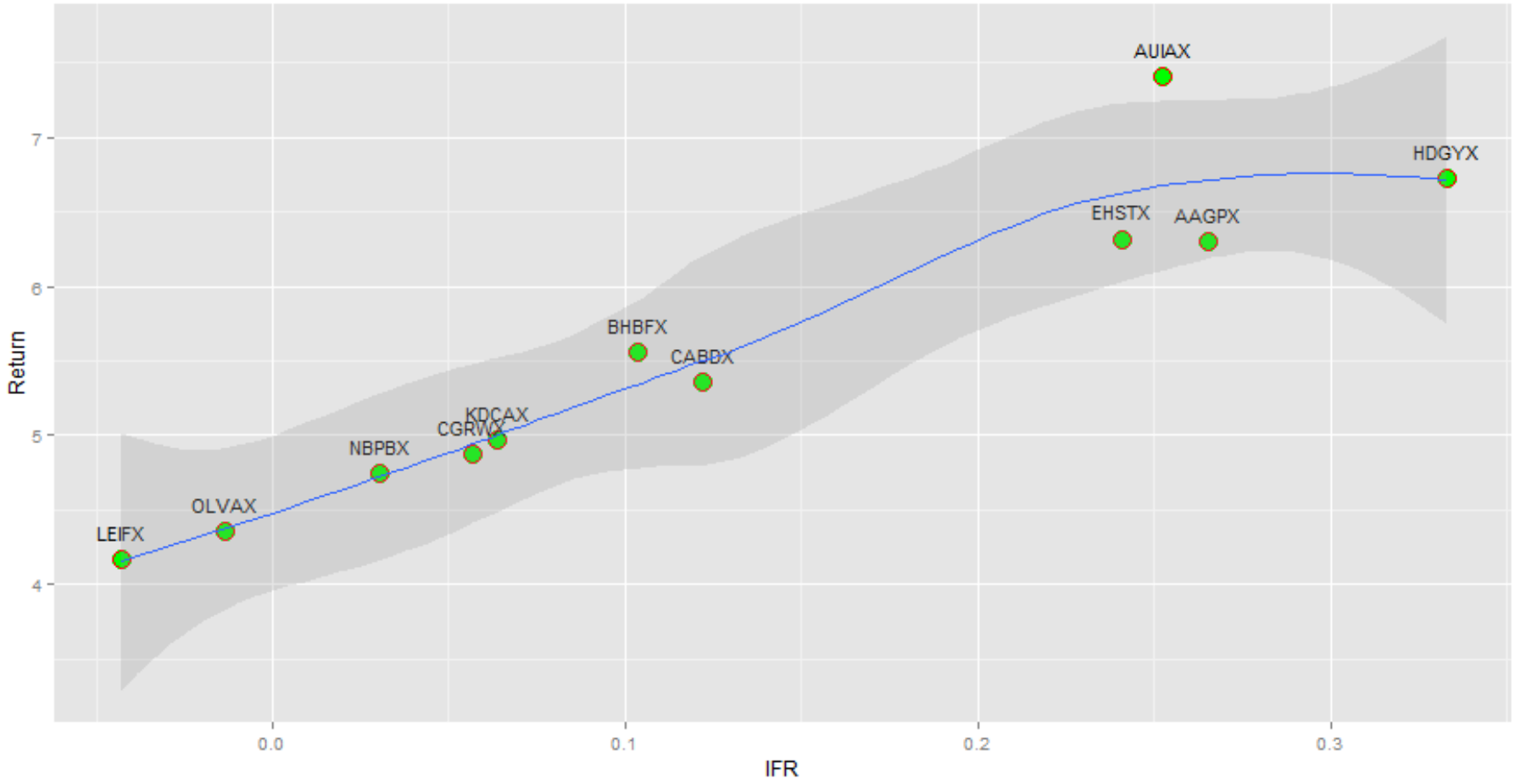
Information Ratio

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
AAGPX	-1.13	0.86	0.58	0.12	0.28	0.41	0.23	0.14	-0.09	-0.06	0.02	-0.04	-0.14	0.12	0.1	-0.14
AUIAX	-0.11	1.11	-0.34	0.07	-0.38	0.64	0.51	0.38	0.66	0.05	-0.36	0.14	0.05	-0.11	-0.22	-0.12
BHBFX	-0.81	0.9	0.62	0.55	-0.58	-0.13	-0.36	-0.21	-0.15	0.57	-0.06	-0.33	-0.01	-0.25	-0.08	-0.18
CABDX	-0.41	0.95	0.38	-0.15	0.14	0.02	-0.04	0.05	0.03	-0.08	-0.17	-0.08	0.12	0.08	0.09	-0.24
CGRWX	-1.14	0.32	0.58	0.3	0.15	0.22	0.08	0	0.05	-0.1	0.21	-0.01	-0.21	-0.12	-0.09	-0.19
EHSTX	-0.77	1.01	0.59	0.2	-0.19	0.27	0.31	0.15	0.19	0.05	-0.27	-0.19	-0.2	-0.01	-0.14	-0.02
HDGYX	-0.71	0.89	0.34	0.27	-0.07	0.09	0.05	0.21	0.12	0.12	-0.06	-0.05	-0.02	-0.12	-0.04	-0.03
KDCAX	-1.39	1	0.57	0.21	0.16	-0.07	-0.14	-0.03	0.29	0.03	-0.05	-0.2	-0.08	-0.31	-0.08	-0.1
LEIFX	-0.12	-0.04	0.02	0.07	-0.16	0.12	-0.07	0.37	-0.13	0.18	-0.36	-0.13	0.19	-0.22	-0.03	-0.3
NBPBX	-0.56	0.37	0.31	-0.09	0.27	0.38	0.53	-0.12	0.16	-0.27	0.66	0.01	-0.38	0.02	-0.05	-0.28
OLVAX	-0.37	0.61	-0.06	-0.04	0.04	0.21	-0.05	0.21	-0.27	-0.05	0.16	-0.11	-0.2	0.01	0.16	-0.08
PGRWX	-0.83	0.73	0.22	0.09	-0.04	0.01	0.02	0	-0.46	-0.05	0.09	-0.03	-0.2	0.13	0.14	-0.12

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Performance Measures

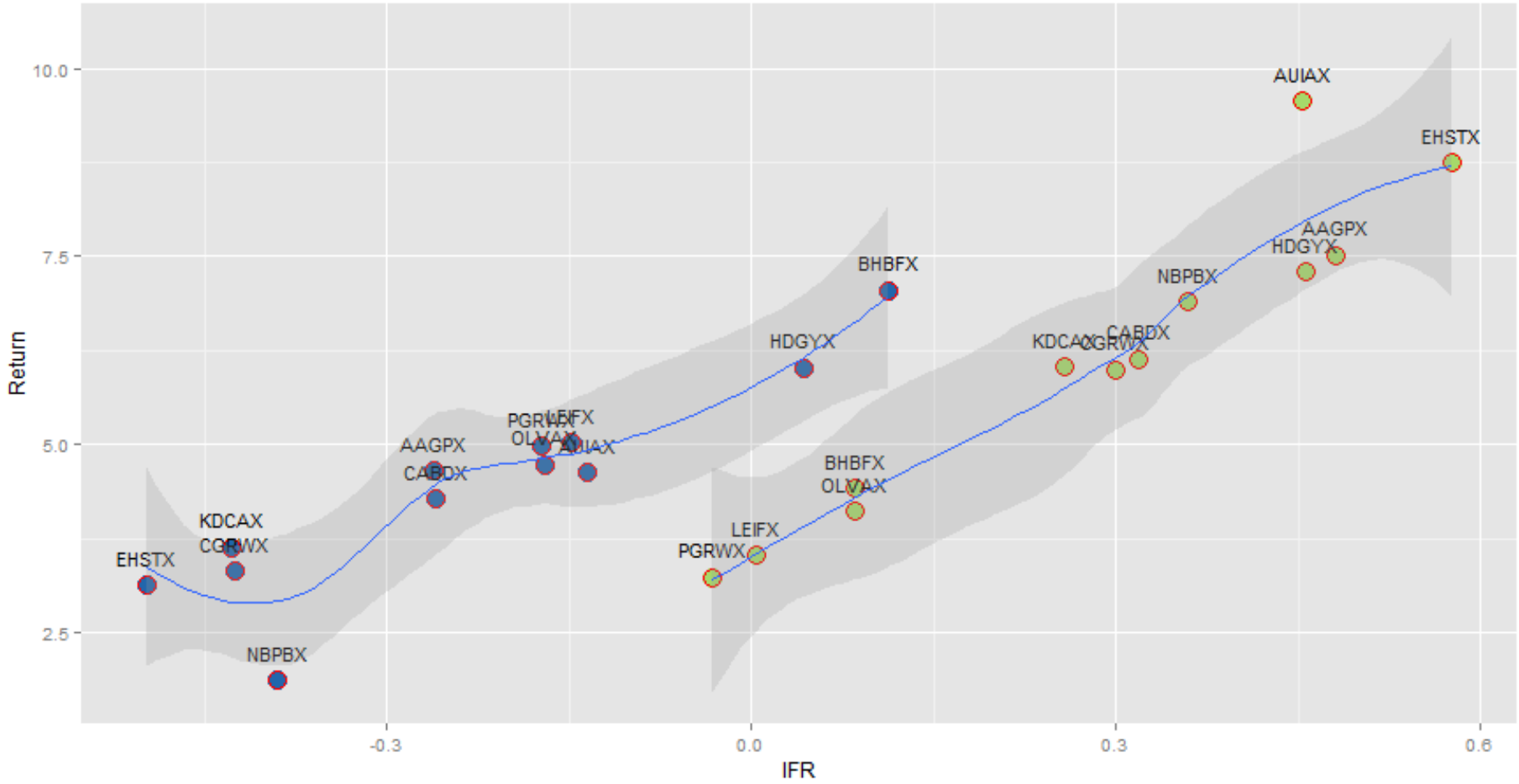
Period 1999 - 2014



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Performance Measures

Periods 1999 – 2007 & 2008 - 2014



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Risk Analysis

Period 2001-2014

Value At Risk Annualized

	SPY	AAGPX	ACTIX	ANDAX	AUIAX	BHBFX	CABDX	EHSTX	HHGAX	KDCAX	LEIFX	OLVAX	PGRWX
Historical 95%	-31.3	-30.34	-30.44	-29.07	-27.13	-17.85	-29.67	-29.68	-29.7	-27.86	-26.98	-33.25	-31.55
Gaussian 95%	-32.98	-32.4	-32.92	-32.09	-28.26	-19.22	-33.46	-31.84	-31.19	-30.24	-28.58	-36.2	-33.76
Modified 95%	-26.85	-29.9	-28.65	-29.69	-22.41	-17.66	-27.99	-28.76	-28	-25.72	-25.94	-31.76	-30.33
Historical 99%	-56.51	-57.29	-55.93	-56.78	-52.16	-33.83	-57.28	-56.2	-55.49	-52.79	-50	-62.91	-56.42
Gaussian 99%	-46.83	-46.06	-46.77	-45.62	-40.18	-27.35	-47.5	-45.25	-44.35	-42.96	-40.59	-51.37	-47.91
Modified 99%	-99.95	-85.21	-97.04	-98.28	-93.62	-45.54	-109.38	-89.92	-86.37	-95.27	-75.6	-105.93	-87.78

DrawDown Ratios

	SPY	AAGPX	ACTIX	ANDAX	AUIAX	BHBFX	CABDX	EHSTX	HHGAX	KDCAX	LEIFX	OLVAX	PGRWX
Sterling ratio	0.0761	0.1044	0.0862	0.1017	0.1155	0.1288	0.0707	0.0998	0.1209	0.0985	0.0839	0.06	0.0602
Calmar ratio	0.0899	0.1219	0.1007	0.1187	0.1402	0.1666	0.083	0.1185	0.1441	0.1179	0.1011	0.07	0.0698
Burke ratio	0.0521	0.0837	0.068	0.0804	0.0812	0.1053	0.0484	0.0729	0.0864	0.0694	0.0604	0.039	0.0431
Pain index	0.1151	0.0998	0.1009	0.0985	0.1364	0.0406	0.1197	0.0862	0.094	0.0769	0.1097	0.1306	0.1291
Ulcer index	0.1762	0.1688	0.1676	0.1678	0.2031	0.0702	0.1876	0.1414	0.1501	0.1328	0.164	0.1977	0.2014
Pain ratio	0.3441	0.6294	0.4943	0.6162	0.4091	1.1515	0.3151	0.6183	0.6904	0.6487	0.3567	0.2461	0.2597
Martin ratio	0.2247	0.3721	0.2974	0.3619	0.2747	0.6665	0.2009	0.3772	0.4323	0.3759	0.2386	0.1625	0.1664

Total Risk

	AAGPX	ACTIX	ANDAX	AUIAX	BHBFX	CABDX	EHSTX	HHGAX	KDCAX	LEIFX	OLVAX	PGRWX
Specific Risk	0.0516	0.0557	0.0697	0.0935	0.0434	0.0621	0.0611	0.0703	0.0524	0.0483	0.0581	0.0563
Systematic Risk	0.1937	0.1954	0.1859	0.1478	0.1111	0.1965	0.187	0.1799	0.1793	0.1695	0.2149	0.1999
Total Risk	0.2004	0.2032	0.1985	0.1749	0.1193	0.206	0.1967	0.1931	0.1868	0.1762	0.2226	0.2077

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Risk Analysis

SPY

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2007-10-10	2009-03-09	2012-08-16	-0.5519	1224	355	869
2	2000-03-27	2002-10-09	2006-10-26	-0.4752	1657	637	1020
3	1999-07-19	1999-10-15	1999-11-17	-0.1169	87	64	23
4	2000-01-20	2000-02-25	2000-03-17	-0.0930	41	26	15
5	2007-07-20	2007-08-15	2007-10-05	-0.0905	55	19	36

AAGPX

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2007-07-16	2009-03-09	2013-02-01	-0.5974	1399	416	983
2	2001-05-22	2002-10-09	2003-12-18	-0.3438	647	346	301
3	1999-05-14	2000-02-25	2001-05-16	-0.2953	507	199	308
4	2014-09-19	2014-10-15	NA	-0.0913	20	19	NA
5	2006-05-10	2006-06-13	2006-09-20	-0.0864	93	24	69

AUIAX

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2001-05-02	2002-07-23	2005-06-01	-0.4701	1025	305	720
2	2007-12-11	2009-03-09	2012-03-13	-0.4687	1072	312	760
3	2005-10-04	2005-10-20	2006-01-19	-0.1078	74	13	61
4	2007-07-20	2007-08-16	2007-09-26	-0.1039	48	20	28
5	2012-04-03	2012-06-04	2012-08-10	-0.0994	91	43	48

BHBFX

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2007-12-11	2009-03-09	2010-01-08	-0.3409	524	312	212
2	2001-05-23	2002-10-09	2003-12-29	-0.1991	652	345	307
3	1999-07-19	2000-03-07	2000-09-08	-0.1413	291	162	129
4	2011-07-25	2011-10-03	2012-01-20	-0.1128	125	50	75
5	2010-04-16	2010-07-02	2010-11-02	-0.0994	140	55	85

CABDX

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2007-10-15	2008-11-20	2013-01-17	-0.5749	1325	280	1045
2	2001-05-22	2002-10-09	2005-03-04	-0.4304	950	346	604
3	1999-07-08	2000-02-25	2000-04-12	-0.1685	195	162	33
4	2001-02-02	2001-03-22	2001-05-16	-0.1234	72	34	38
5	2007-07-16	2007-08-15	2007-10-05	-0.0854	59	23	36

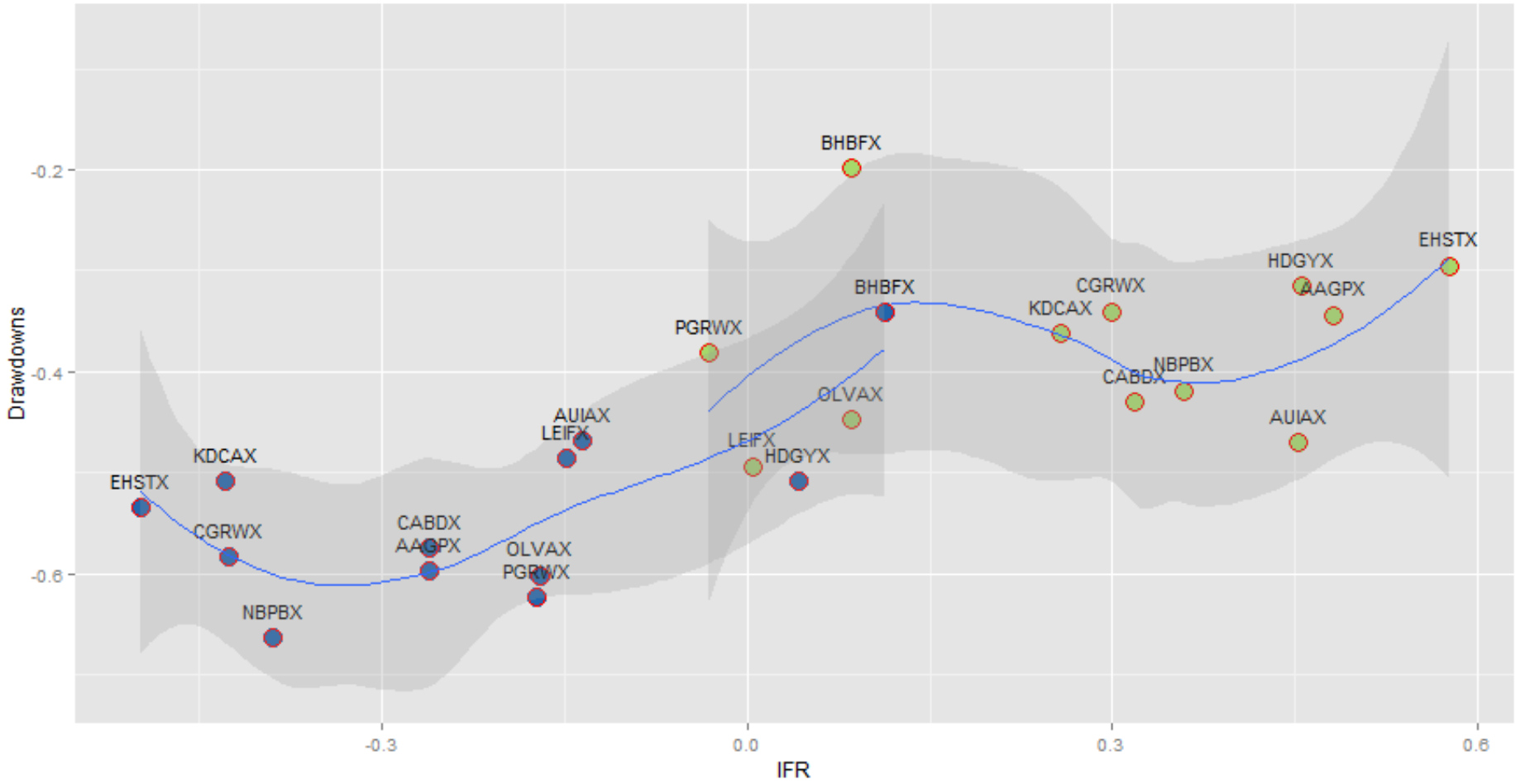
CGRWX

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2007-07-20	2009-03-09	2013-05-14	-0.5828	1465	412	1053
2	1999-05-14	2002-10-09	2003-12-01	-0.3404	1144	856	288
3	2004-03-08	2004-05-17	2004-11-03	-0.0993	168	50	118
4	2014-09-19	2014-10-15	NA	-0.0979	20	19	NA
5	2006-05-08	2006-06-13	2006-09-15	-0.0788	92	26	66

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Risk Analysis

Drawdowns ~ Information Ratio



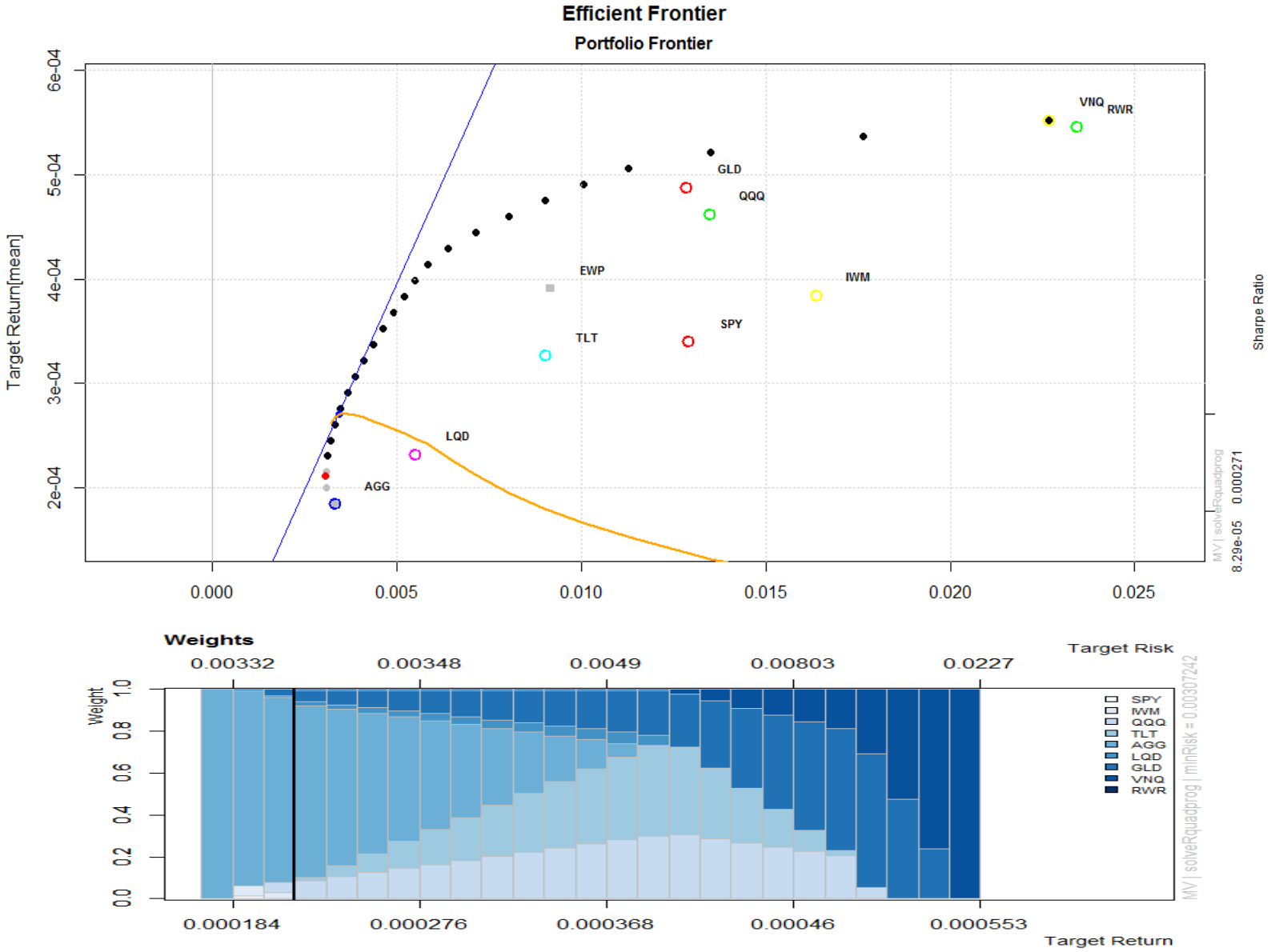
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Back Testing

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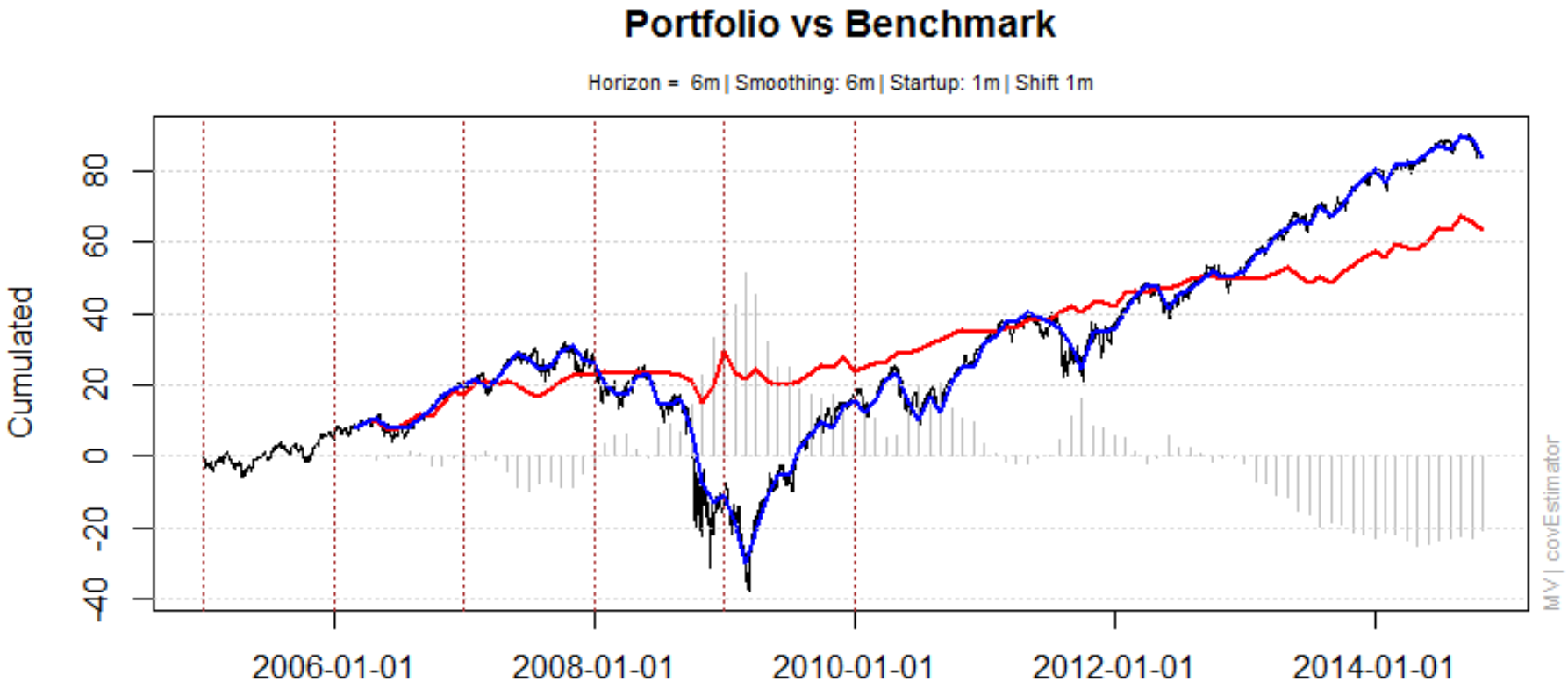
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Base Case



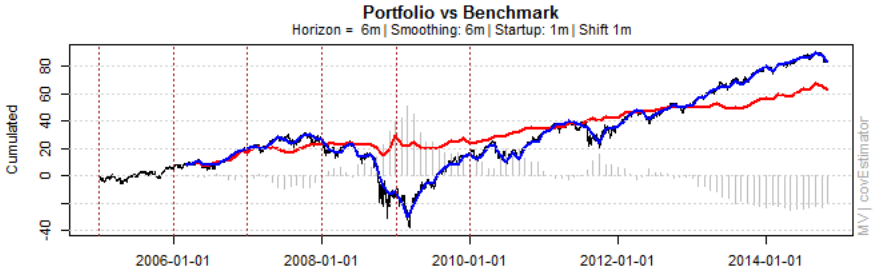
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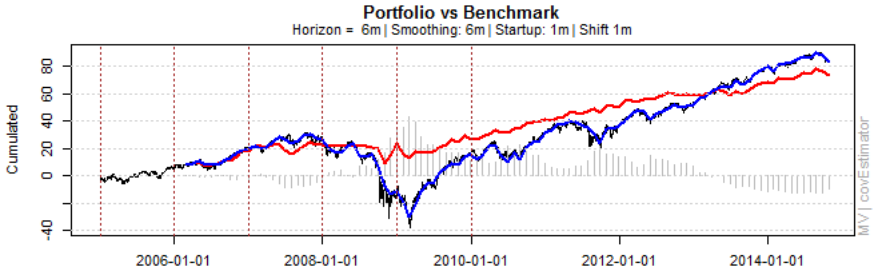
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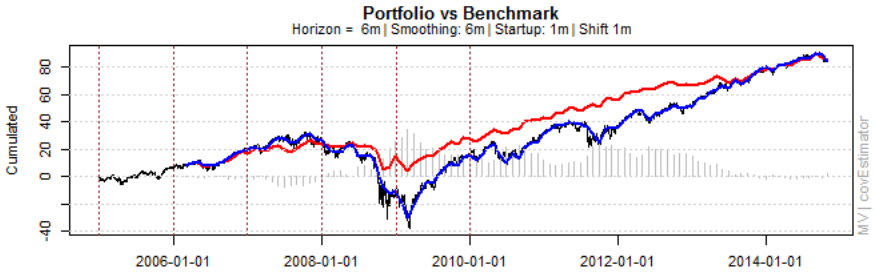


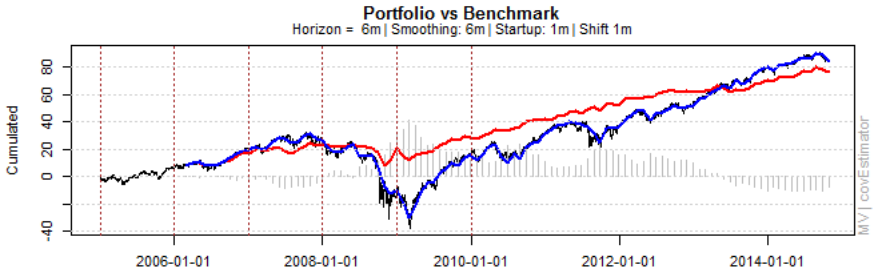
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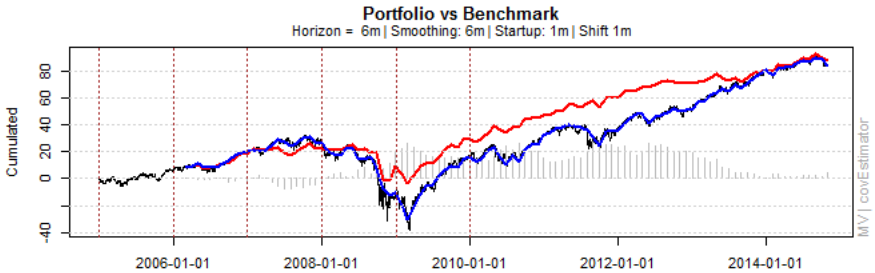
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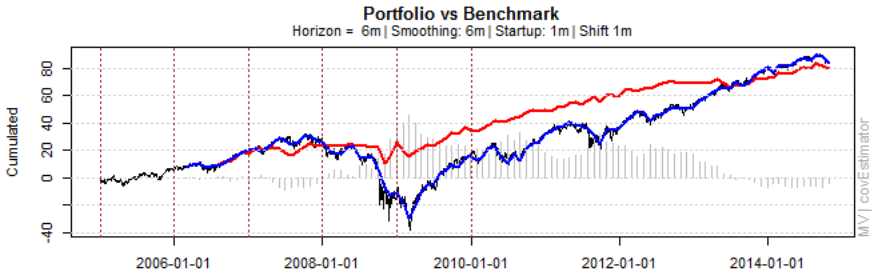






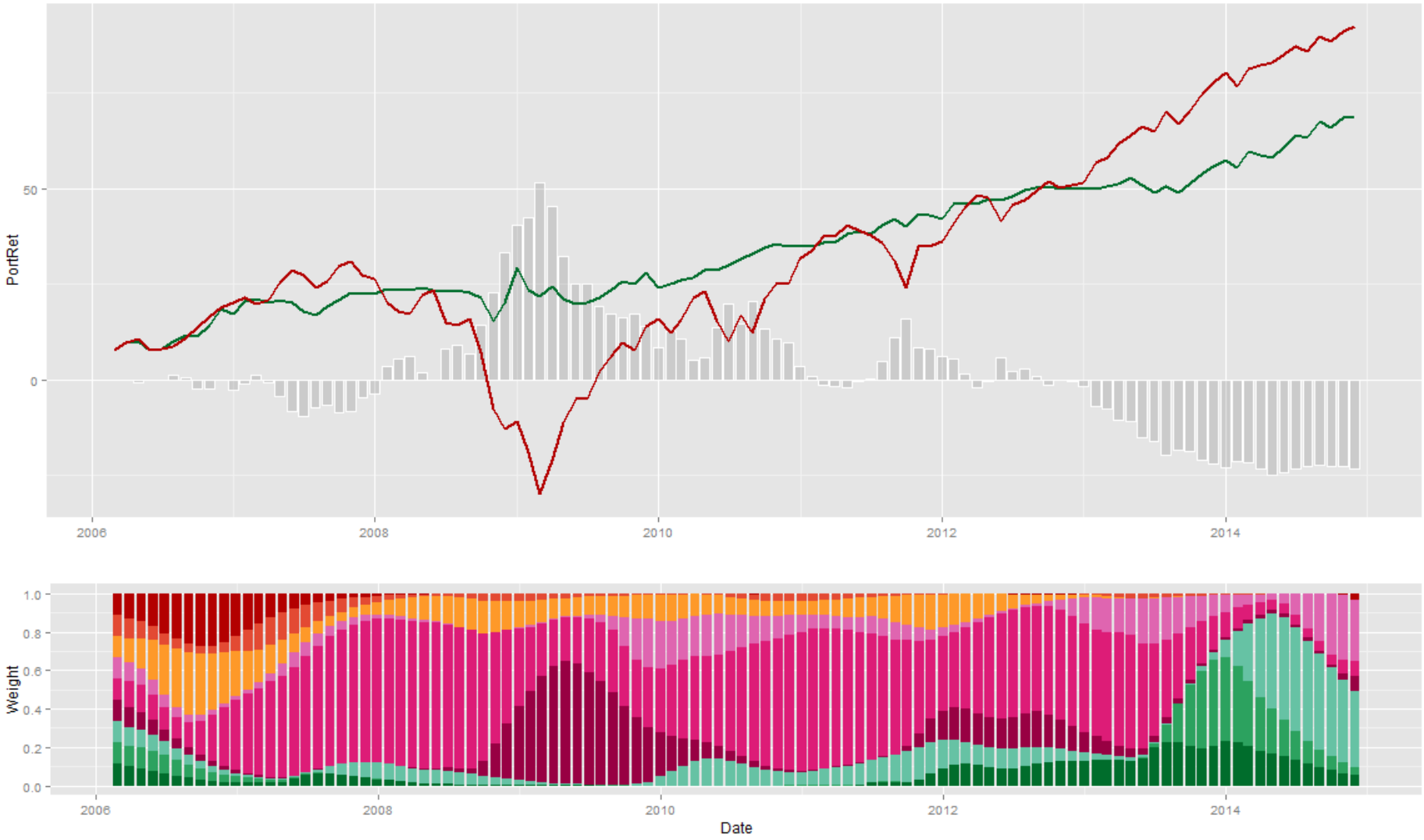






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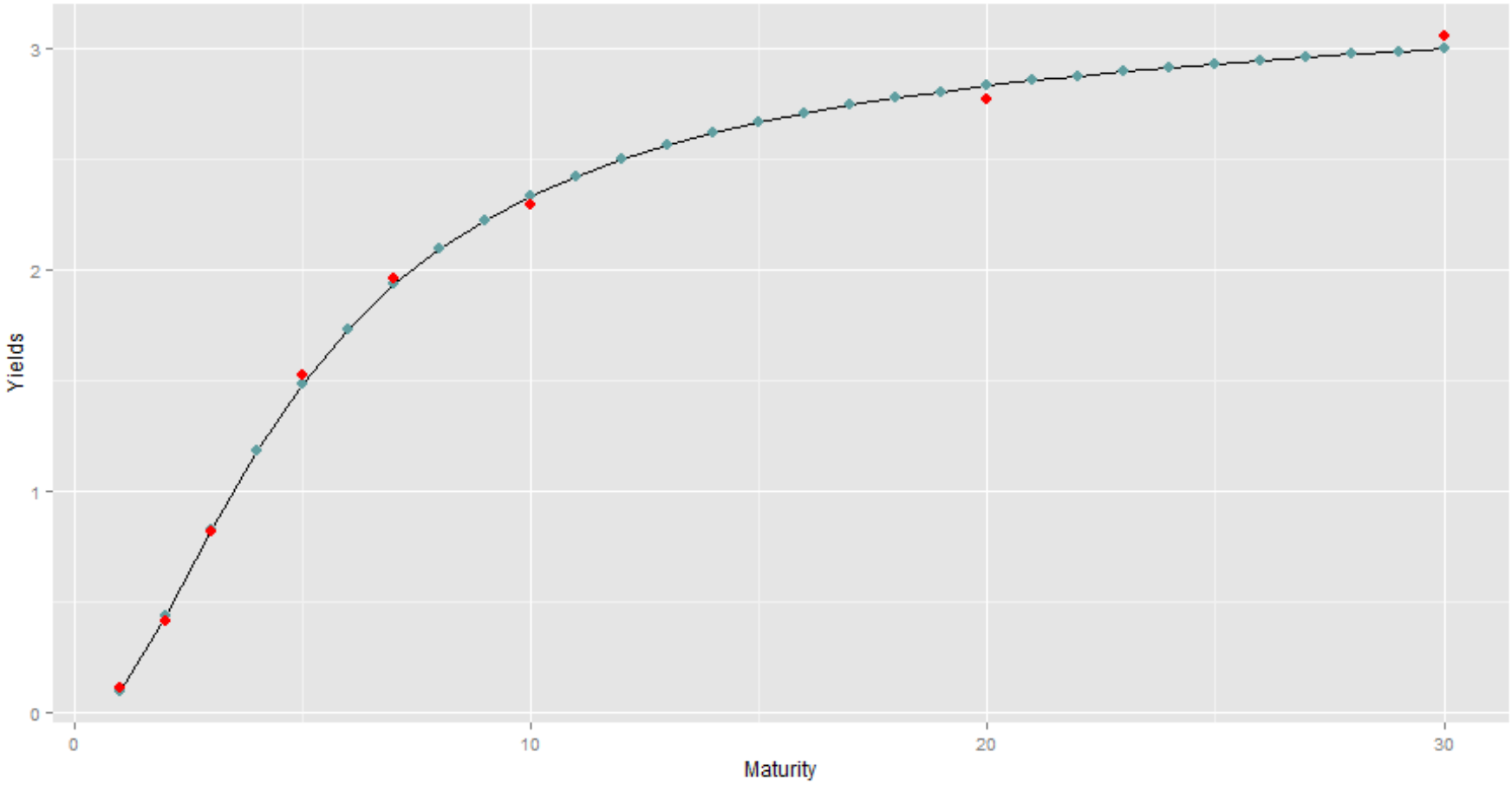
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ESG Engine

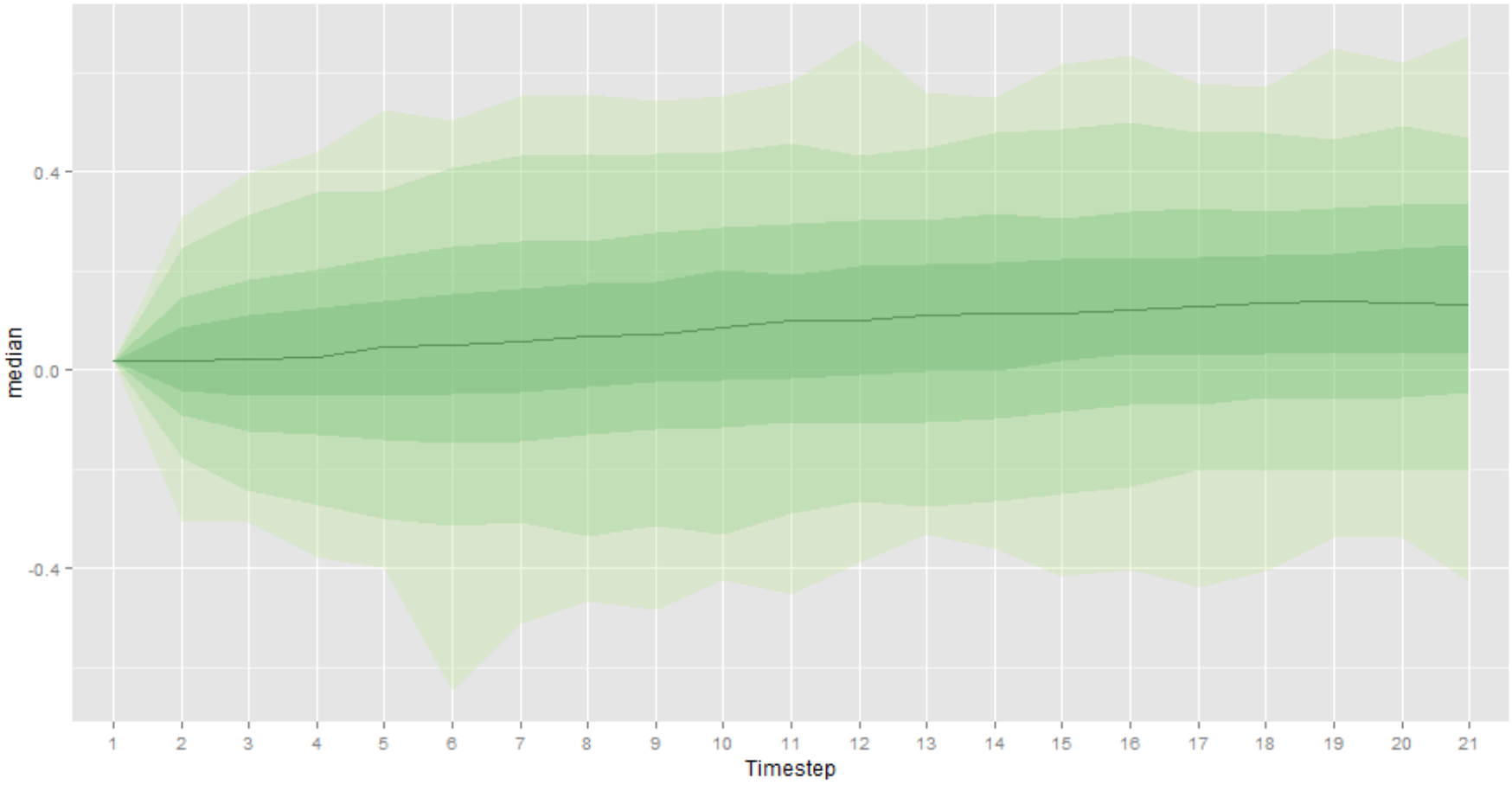
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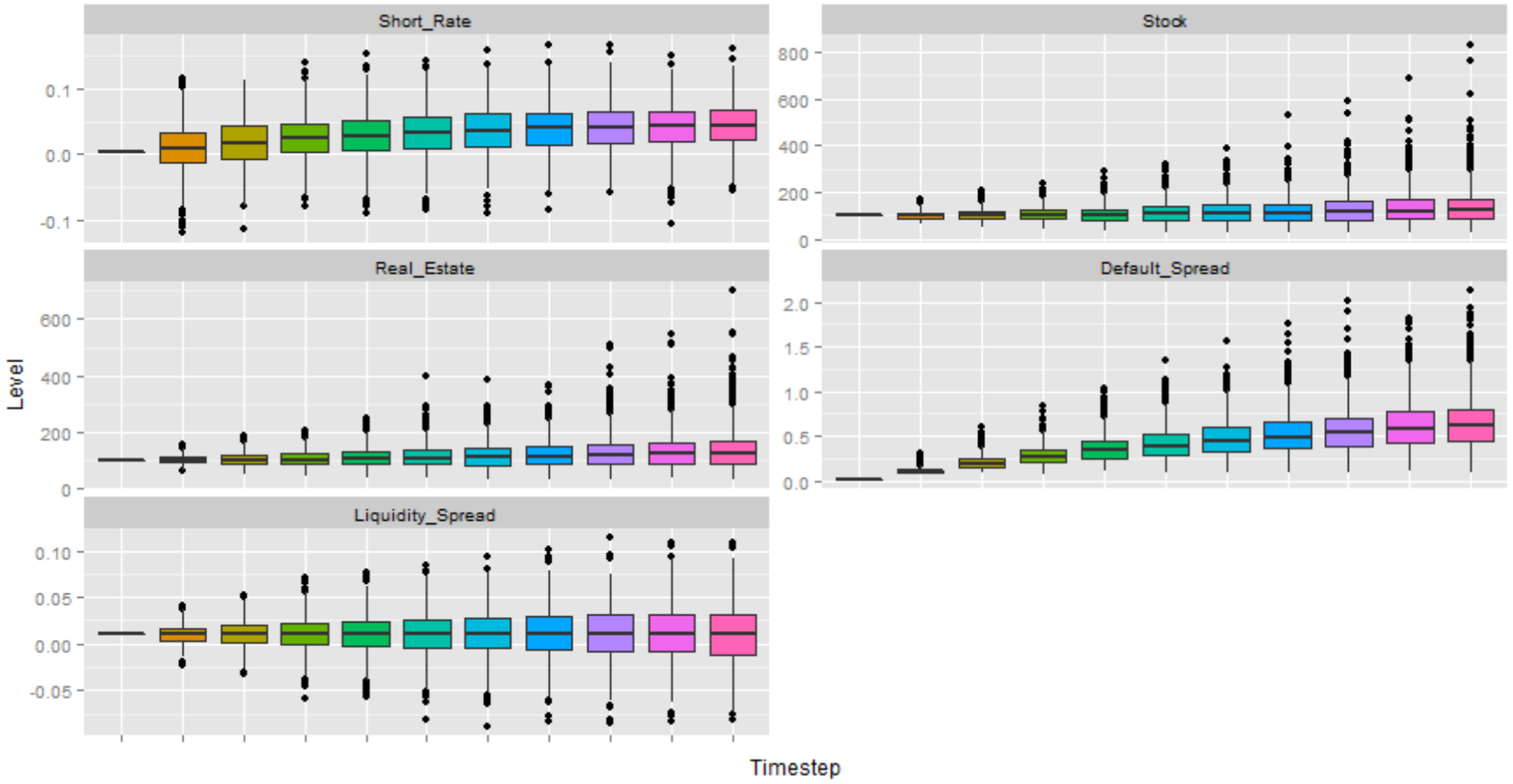
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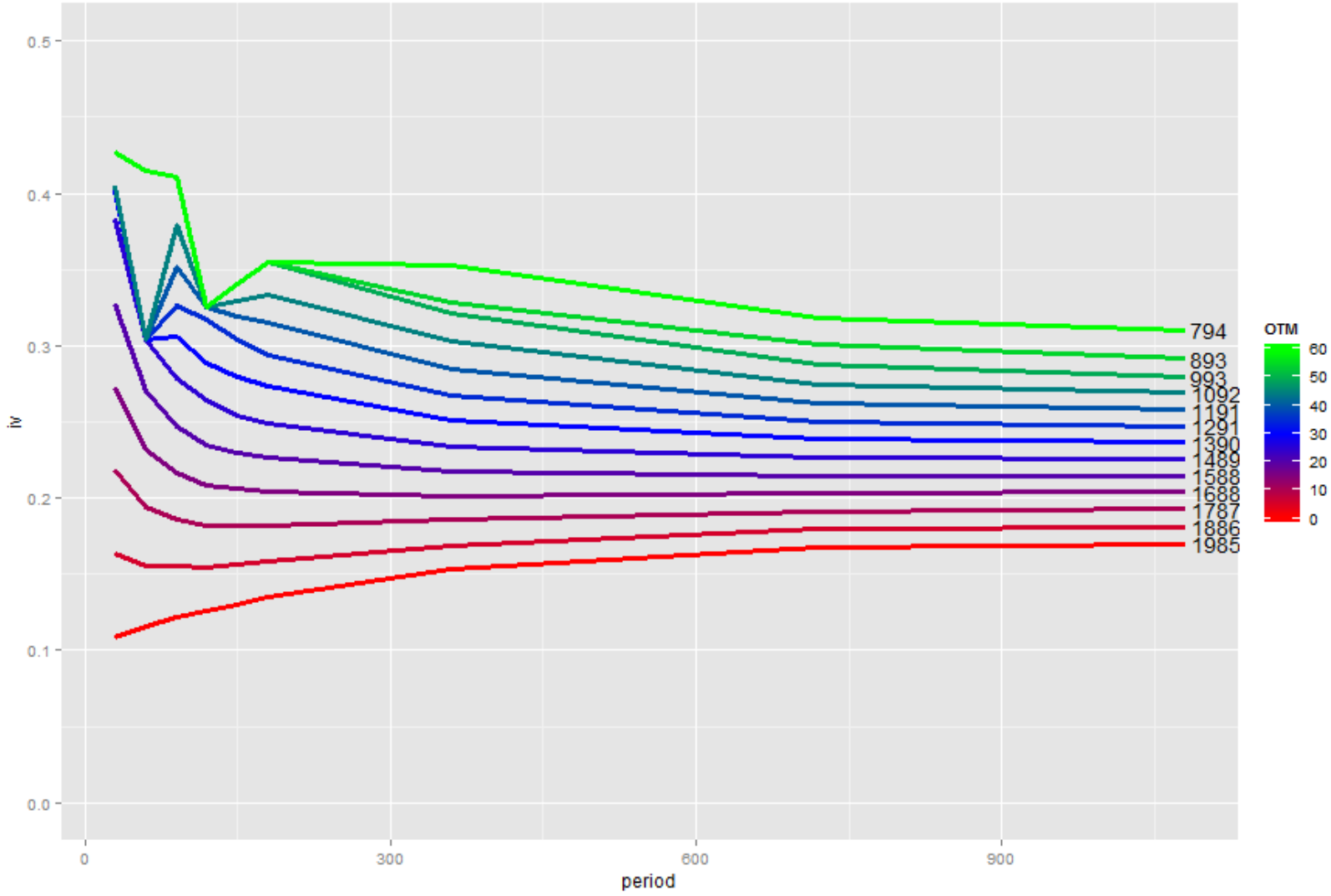


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Derivatives

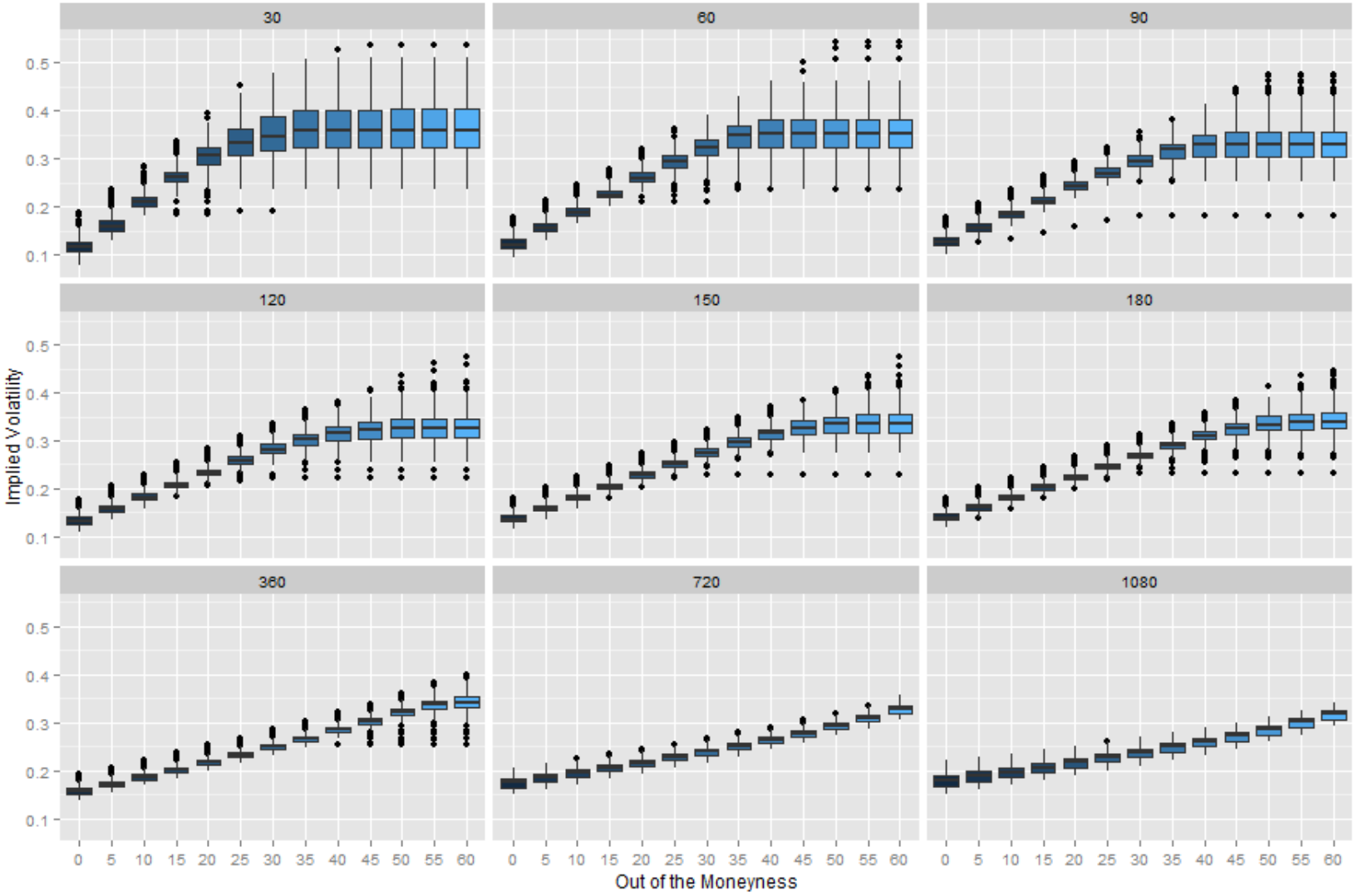
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Volatility Surface 12-Sept-2014



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Historical Implied Volatility Distribution



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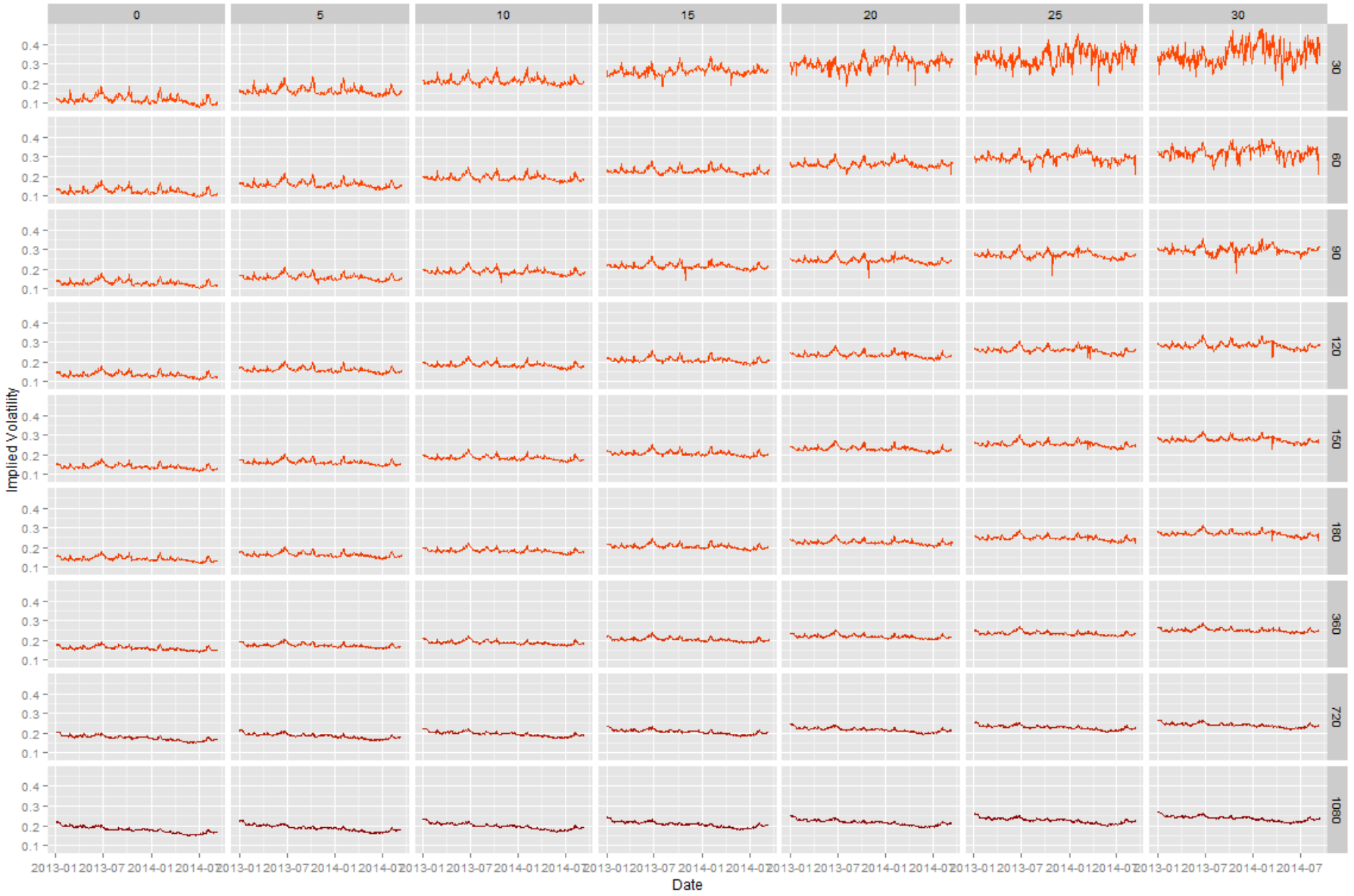
Historical Implied Volatility for 30day Expiry

split by OTM-ness



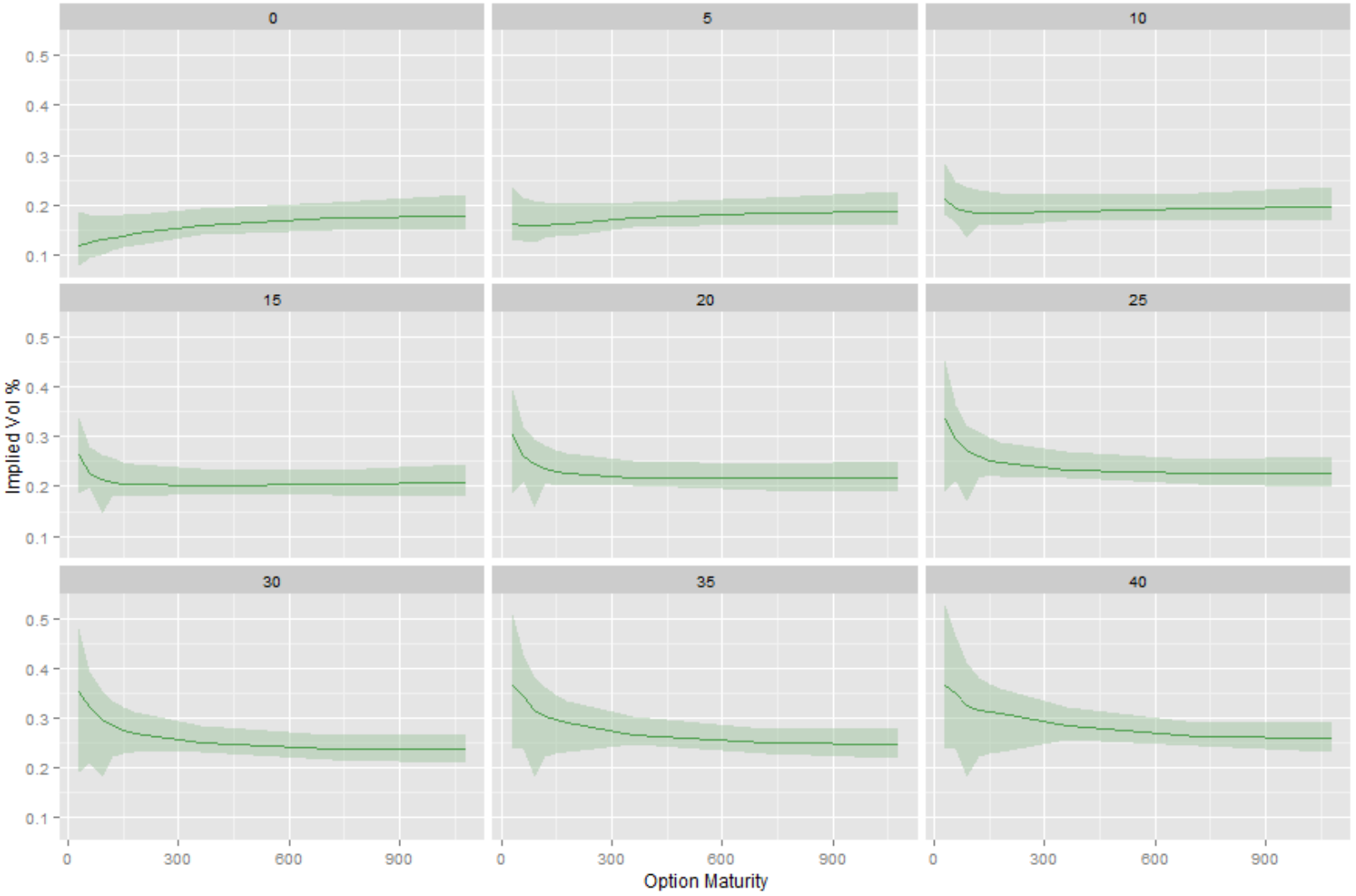
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Historical Implied Volatility for all Expiries & OTM-ness



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Range of Implied Volatilities in 2013/2014



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