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Smoothing Residual Seasonality from Indirectly Adjusted Series

Presented at the first Seasonal Adjustment Practitioners Workshop
November 4, 2016

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Outline

- Statistics Canada's Building Permits Survey
- Challenges for Seasonal Adjustment
- Smoothing Approach
- Conclusions

Statistics Canada's Building Permits Survey

- Administrative Data Program
  - Collects monthly data on the value of permits issued by Canadian municipalities
  - Totals published for domains based on type of building and geographic areas

- Seasonal Adjustment
  - X12ARIMA methodology, implemented in production environment around Fortran executable
  - Upcoming transition to SAS-based Time Series Processing System

  - Need to seasonally adjust 110 individual series:
    - 5 Activity Sectors: (Residential – (Single or Multi) or Non-Residential – (Commercial, Institutional or Industrial)
    - 22 Geographical Areas:
      - 9 Provinces with 2 types of areas (Census Metropolitan Areas (CMA) or Other)
      - 4 Province / Territory totals

  - Total Building Permits is derived by aggregating adjusted components (indirect)

Challenges with Building Permits Data

Identifiable Seasonality Approach

- Adjust those with identifiable seasonality, treat others as summary series
  - Identifiable seasonality based on typical statistics, modelling and graphical analysis

- **Many** series don't have identifiable seasonal patterns
  - Fairly flat due to even distribution of permits (year-round)
  - Spikes in activity in different months, or sectors over different years

    Significant projects (e.g. hospital) introduce volatility

    Not always in the same month – but often in same season

Identifiable Seasonality Approach - Description

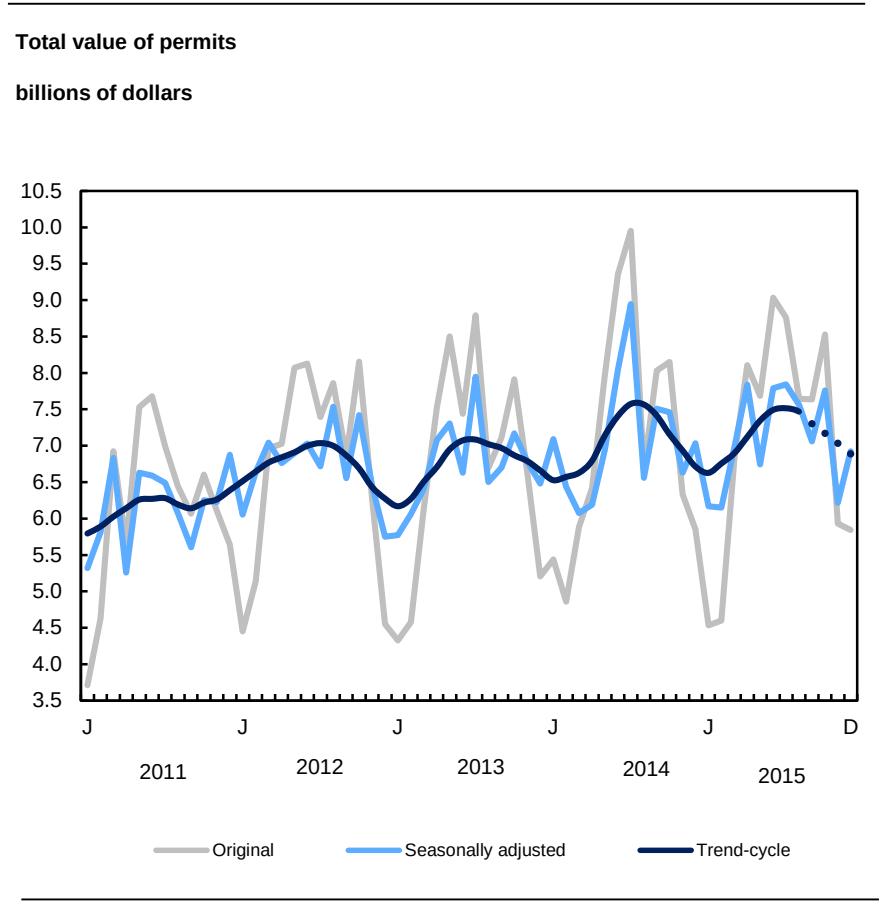
- Identifiable Seasonality approach led to the following results:

Sector	Permit Type	Seasonally Adjusted Series (n)	Seasonally Adjusted Series (%)	Contribution of Seasonally Adjusted Series' to Sector Total
Non-Residential	Commercial	8	36.4%	65.4%
	Institutional	2	9.1%	17.5%
	Industrial	6	27.3%	58.0%
Residential	Multiple	14	63.6%	44.4%
	Single	21	95.5%	99.98%

Identifiable Seasonality Approach - Results

- No residual seasonality in component series (by design)

- Residual Seasonality in Total Value of Permits
  - “Residual seasonality present in the last 3 years at the 5 percent level”
  - Particularly obvious in trend-cycle



Approach 1 – Aggregate cross-sectionally

- Adjust total (or sub-total) directly to address residual seasonality
  - Need additional step to reconcile components to totals
- Issues:
  - Reconciliation available only after system transition
  - Loss of coherence between components and totals
  - Deviations from strict seasonal pattern persist at aggregate level

Activity Sector	Province	Type of Area	2000-01	2000-02	2000-03	2000-04	…	2016-08
Non-Residential - Commercial	Newfoundland	CMA	x	x	x	x	…	x
		Other	x	x	x	x	…	x
	Prince Edward Island	Total	x	x	x	x	…	x
…	…	…	…	…	…	…	…	…
Residential - Singles	British Columbia	Other	x	x	x	x	…	x

Approach 2 – Aggregate across time

- Adjust quarterly aggregates for components
  - Quarterly pattern is more stable than monthly pattern
  - Additional step to benchmark adjusted monthly to quarterly values
- Issues:
  - Benchmarking available only after system transition
  - Monthly spikes still present
  - Revisions introduced when quarter is completed

Activity Sector	Province	Type of Area	2000-01	2000-02	2000-03	2000-04	…	2016-08
Non-Residential - Commercial	Newfoundland	CMA	x	x	x	x	…	x
		Other	x	x	x	x	…	x
	Prince Edward Island	Total	x	x	x	x	…	x
…	…	…	…	…	…	…	…	…
Residential - Singles	British Columbia	Other	x	x	x	x	…	x

Approach 3 – Combine smoothing with seasonal adjustment

- Adjust components that are not strictly seasonal
  - Allow less stability in the seasonal pattern
  - Adjustments would generally be small but could create false signals
  - Consider adjustment of borderline series as a smoothing
    - Increase outlier and extreme value tolerances (inconsistent spikes contribute)
    - Shorten length of seasonal filters

Activity Sector	Province	Type of Area	2000-01	2000-02	2000-03	2000-04	…	2016-08
Non-Residential - Commercial	Newfoundland	CMA	x	x	x	x	…	x
		Other	x	x	x	x	…	x
	Prince Edward Island	Total	x	x	x	x	…	x
…	…	…	…	…	…	…	…	…
Residential - Singles	British Columbia	Other	x	x	x	x	…	x

Approach 3 – Combine smoothing with seasonal adjustment

- Seasonal Adjustment and Smoothing
  - Series that are not strictly seasonal could still be adjusted (smoothed)
  - Target: adjust series representing a minimum of 95% of activity within sector
    - i) Traditional approach where target already met
    - ii) If not, adjust (smooth) seasonal series and largest until 95% of activity is represented

Default parameters (starting point)
- Critical value for RegARIMA outlier detection = 5
- Sigma limits for extreme = 2,4
- Seasonal Filter = S3X3

Approach 3 – Combine smoothing with seasonal adjustment

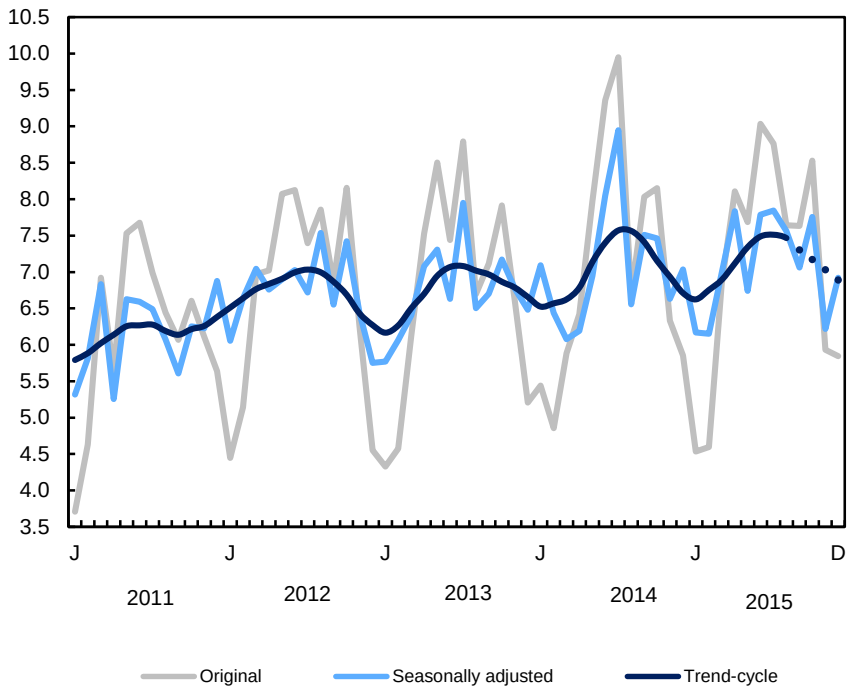
- Combined approach led to the following results:

Sector	Permit Type	Seasonally Adjusted Series (n)	Seasonally Adjusted Series (%)	Contribution of Seasonally Adjusted Series' to Sector Total	
Non-Residential	Commercial	14	63.6%	96.4%	Was 65.4%
	Institutional	12	54.5%	95.1%	Was 17.5%
	Industrial	12	54.5%	95.8%	Was 58.0%
Residential	Multiple	17	77.3%	99.2%	Was 44.4%
	Single	21	95.5%	99.98%	

Before and After

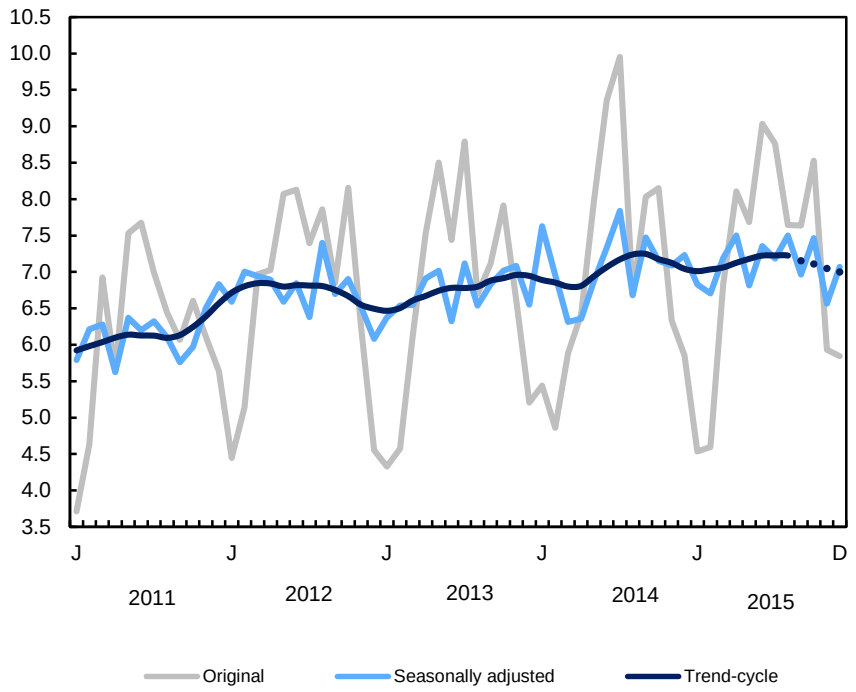
Total value of permits

billions of dollars



Total value of permits

billions of dollars



Summary of Combined Approach

- Less strict definition of seasonal pattern for borderline, large series
  - Allows peaks to occur in different months
  - Increase in the number of series that are adjusted
  - Includes unusual observations into estimation of seasonal pattern
- Seasonally adjusted and trend-cycle series are less irregular (smoother).
- Less residual seasonality in seasonally adjusted and trend-cycle estimates for aggregated series
- Increased potential for revisions in historical values of seasonally adjusted and trend-cycle estimates

  Higher outlier tolerances -> less robust
  Shorter seasonal filters -> more impact of individual months

Future Work

- Apply as a quality check for other projects
  - Highlighted power of trend-cycle to detect certain types of residual seasonality
  - Examine trend-cycle estimates for residual seasonality
- Could it be useful in other applications?
  - Use smoothing approach under similar conditions (volatile series with borderline seasonality)
- Update system and re-evaluate options with added flexibility (reconciliation)
- Develop diagnostics to identify residual seasonality, and approaches to address it

Thank you!

- For more information, please contact:
- Pour plus d'information, veuillez contacter :

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