IF YOU BUILD IT, THEY WILL COME? A DYNAMIC ANALYSIS OF THE FACTORS AFFECTING THE TRANSIT RIDERSHIP IN THE NEW YORK CITY REGION

City College of the City University of New York
January 2010

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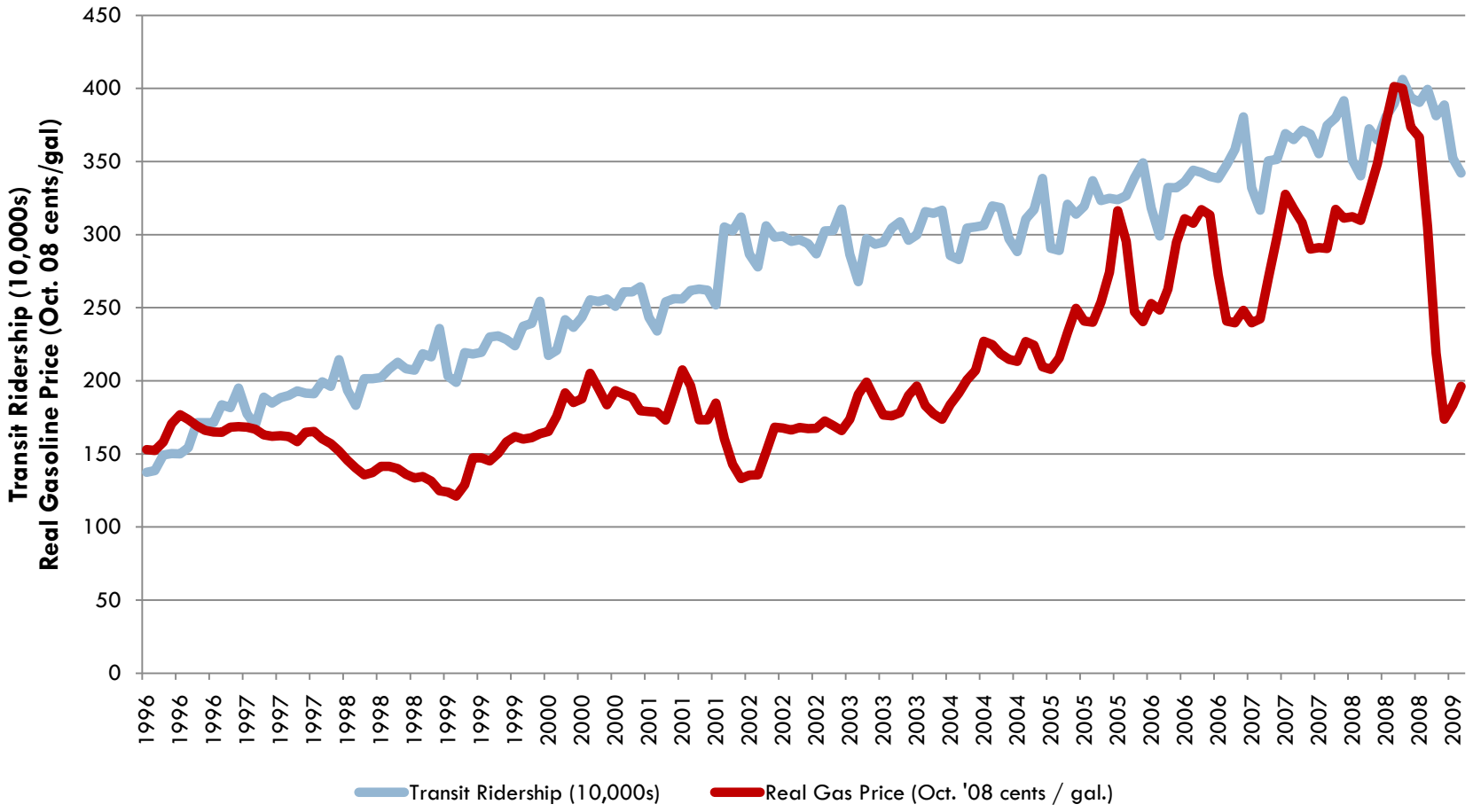
Presentation Outline

- Introduction
- Factors Affecting Transit Ridership
- Variables and Data Description
- Modeling Methodology
- Model Results
- Conclusions
- Questions

Introduction – Recent Trends



Introduction - Contributions

- Questions This Study Will Answer:
  - What are the underlying causes of transit ridership, particularly what is the causal relationship between transit supply and transit demand?
  - What are the short and long term effects of gasoline price on transit ridership?

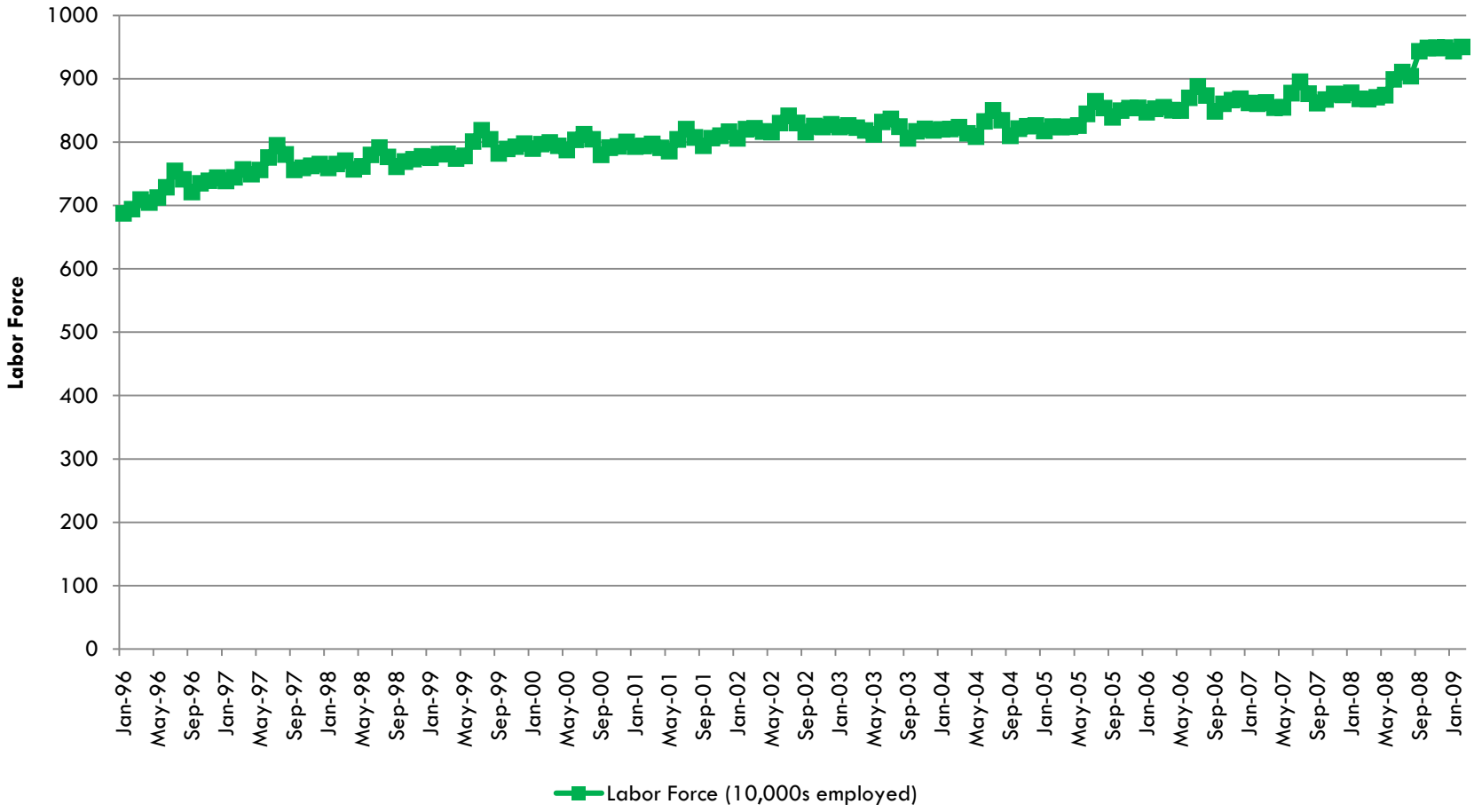
Internal Factors Affecting Transit Ridership

- Transit Service Supplied
- Transit Fare

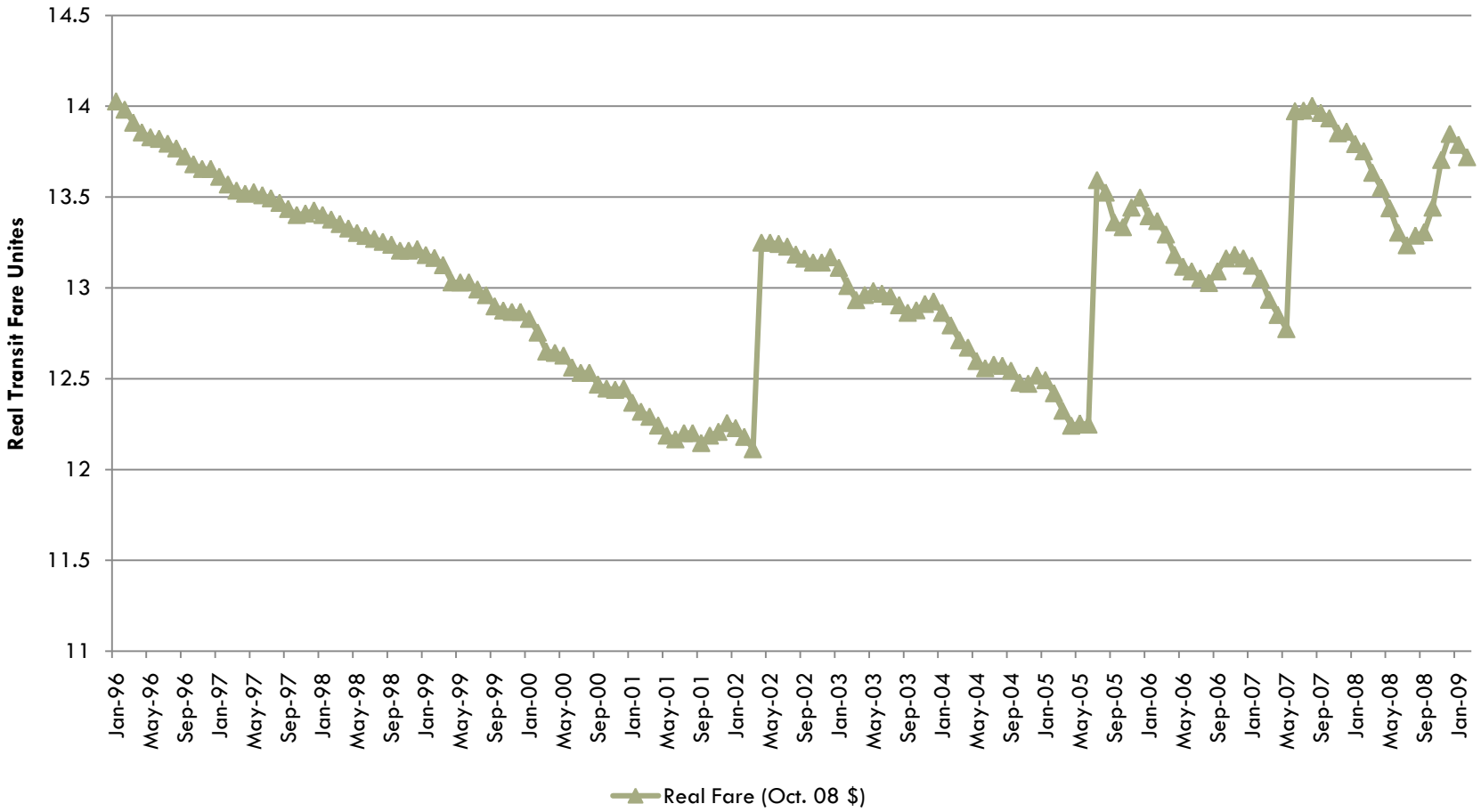
External Factors Affecting Transit Ridership

- Population and Employment
- Gasoline Price

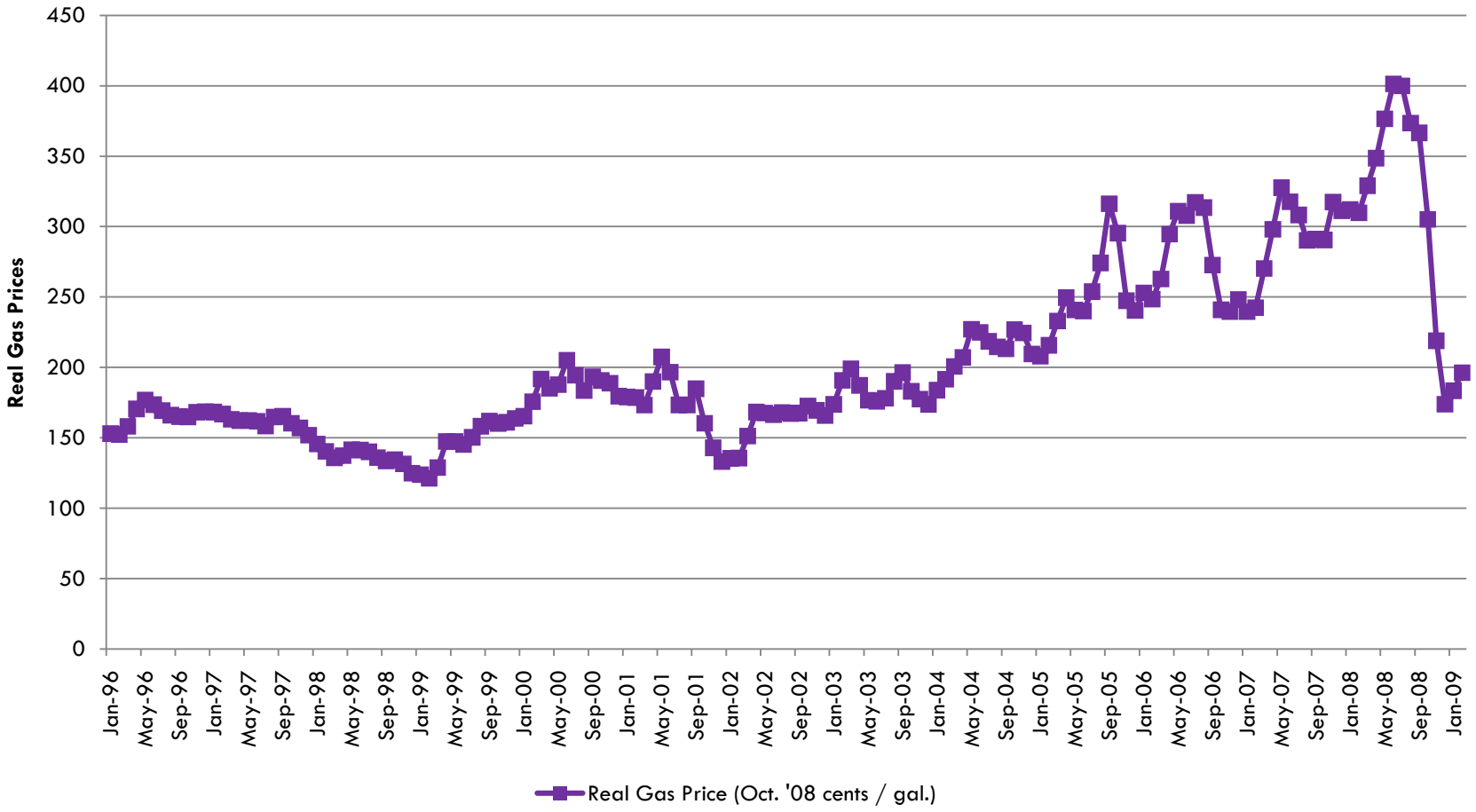
Population and Employment



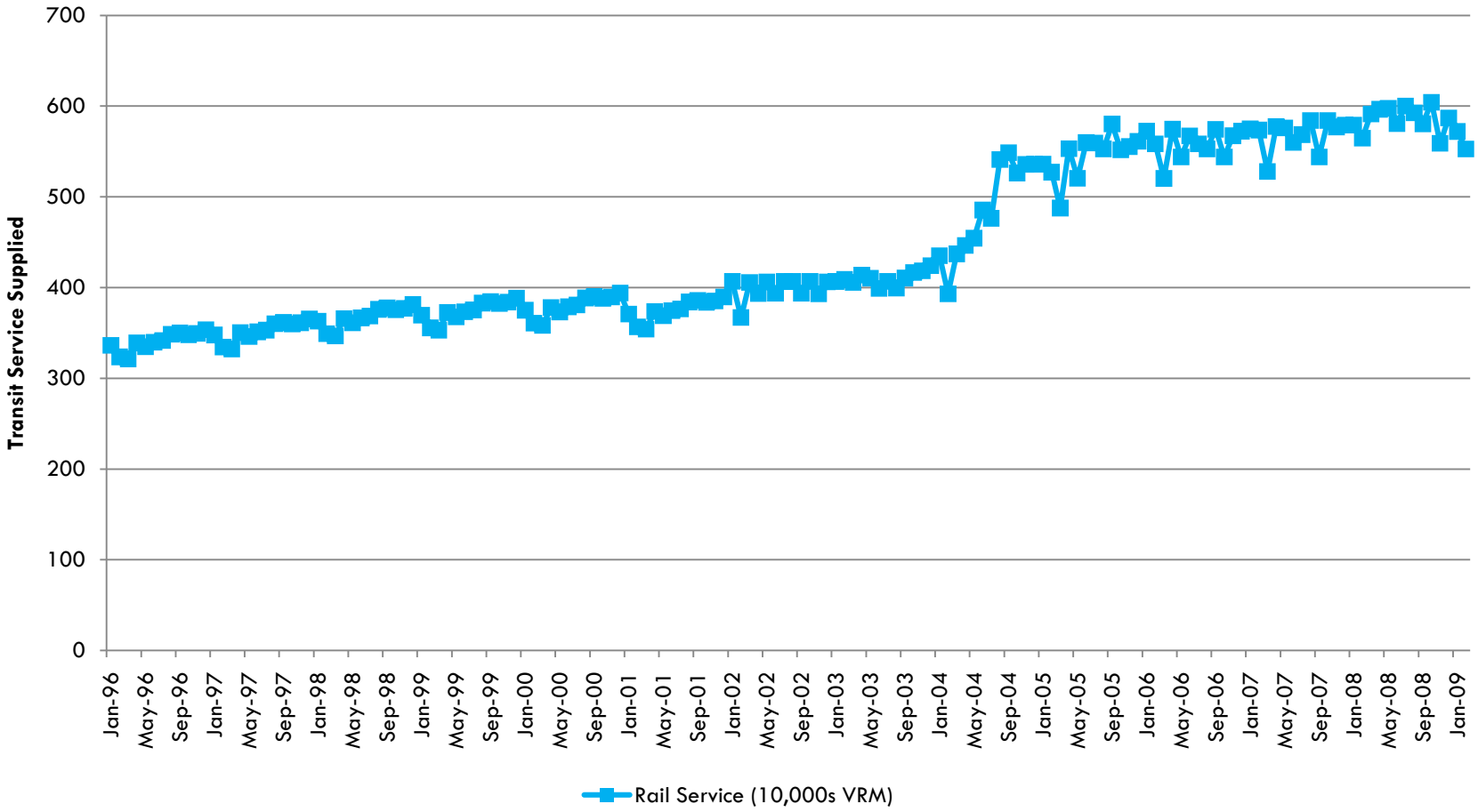
Real Transit Fare



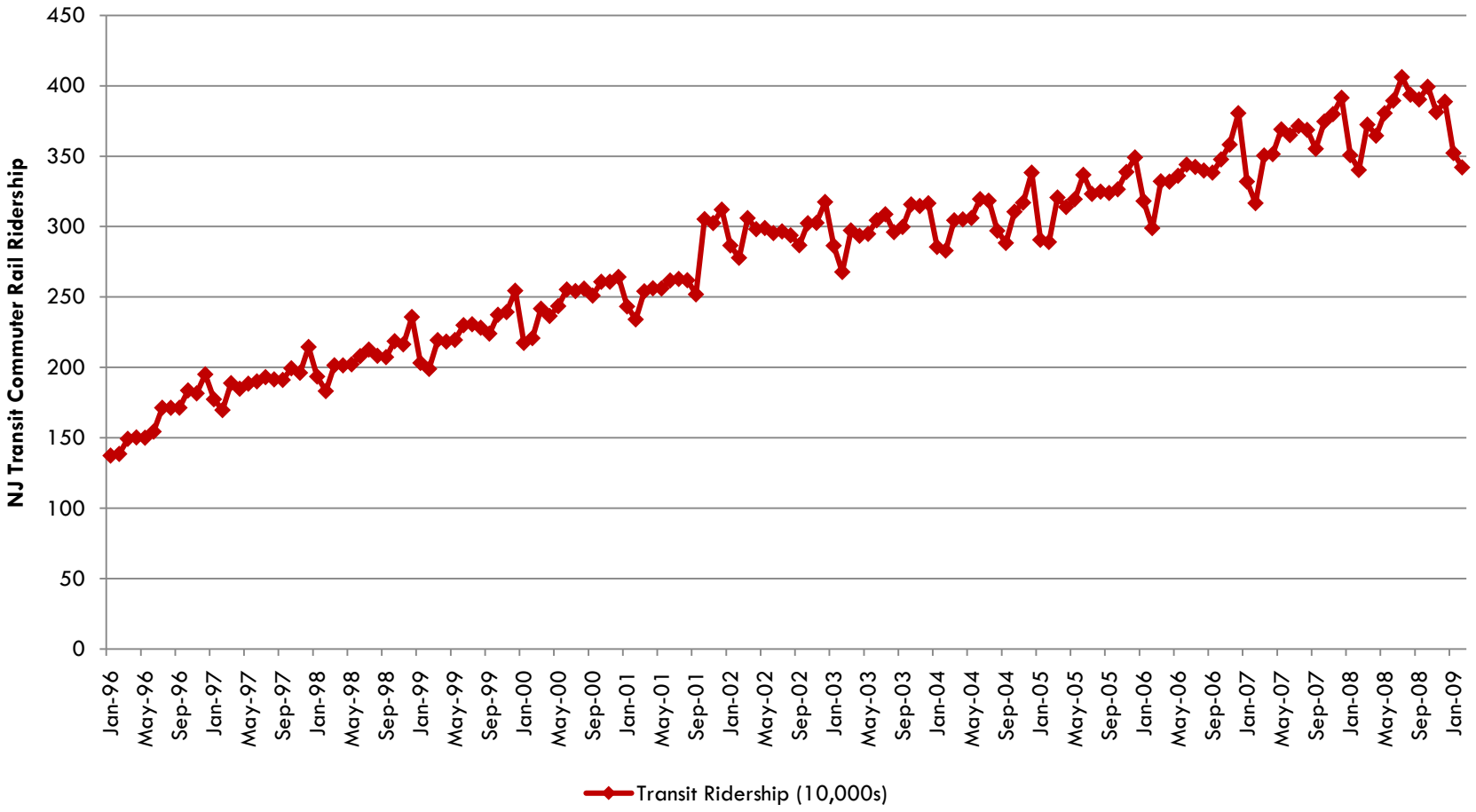
Real Gas Prices



Rail Service (Transit Supply)



Transit Ridership (Transit Demand)

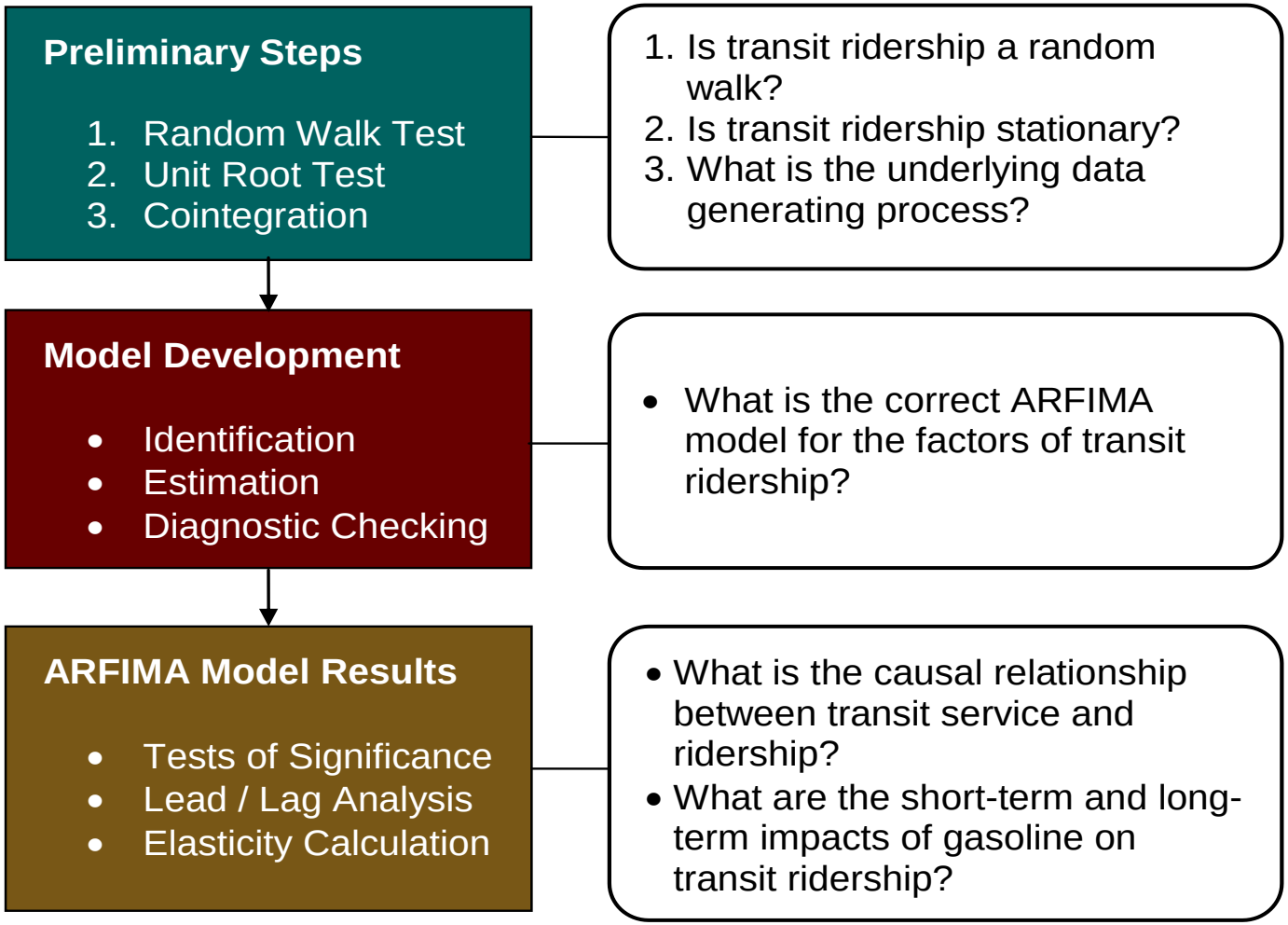


Introduction - Type of Analysis

- Cross Sectional Analysis

- Time Series Analysis

Modeling Methodology



Preliminary Steps

- Test for Random Walk
- Ordinary Least Square (OLS) Model
  - Transit Ridership = Previous Month + Constant
- Fails Test – Transit Ridership is not a Random Walk

Preliminary Steps

- Unit Root Test
  - Test for Stationarity

- No Unit Root Found, Implies Non-Stationary

Preliminary Steps

- Co-integration Test
  - Understand Underlying Data Generating Process
- Transit Service and Labor Force are Co-Integrated
- Transit Fare and Gasoline Prices are not Co-Integrated

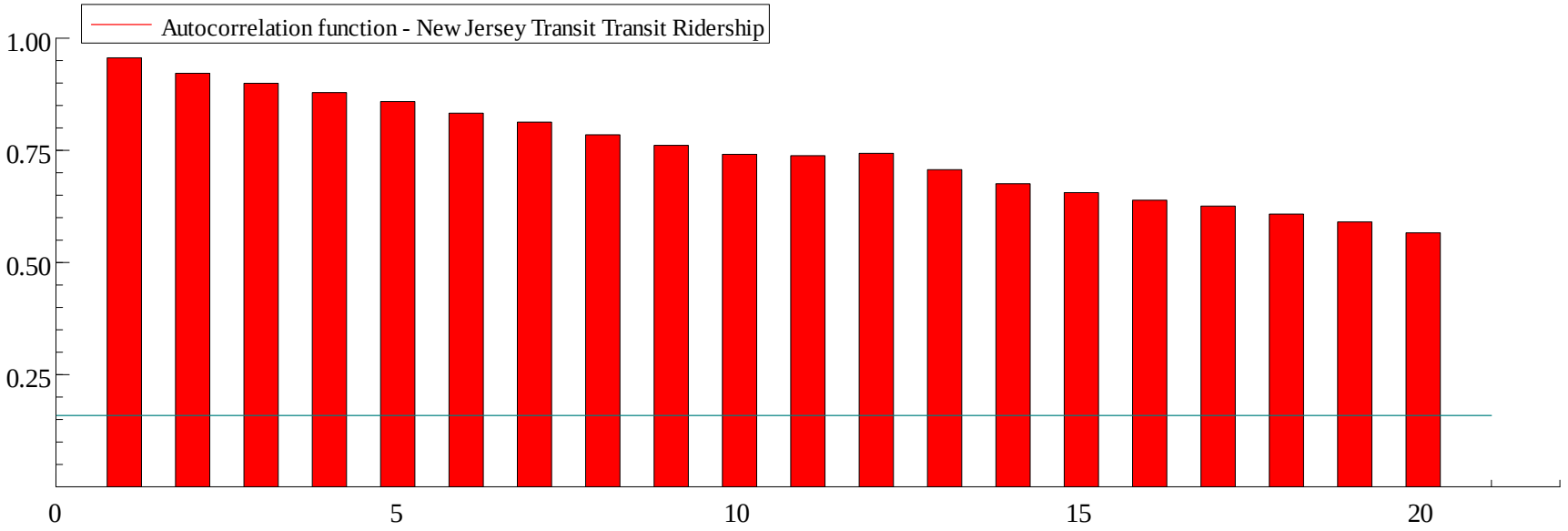
Model Development – ARFIMA Models

- Auto-Regressive Fractionally Integrated Moving Average Model
  - AR(p) – Auto-Regressive
  - d – Fractional Integration Parameter
  - MA(q) – Moving Averages

Model Development

- Box and Jenkins Method
  - Identification (AR(p) and MA(q))
    - Visual Inspection
  - Estimation (d and variable coefficients)
  - Diagnostic Checking (residuals)

Correlogram



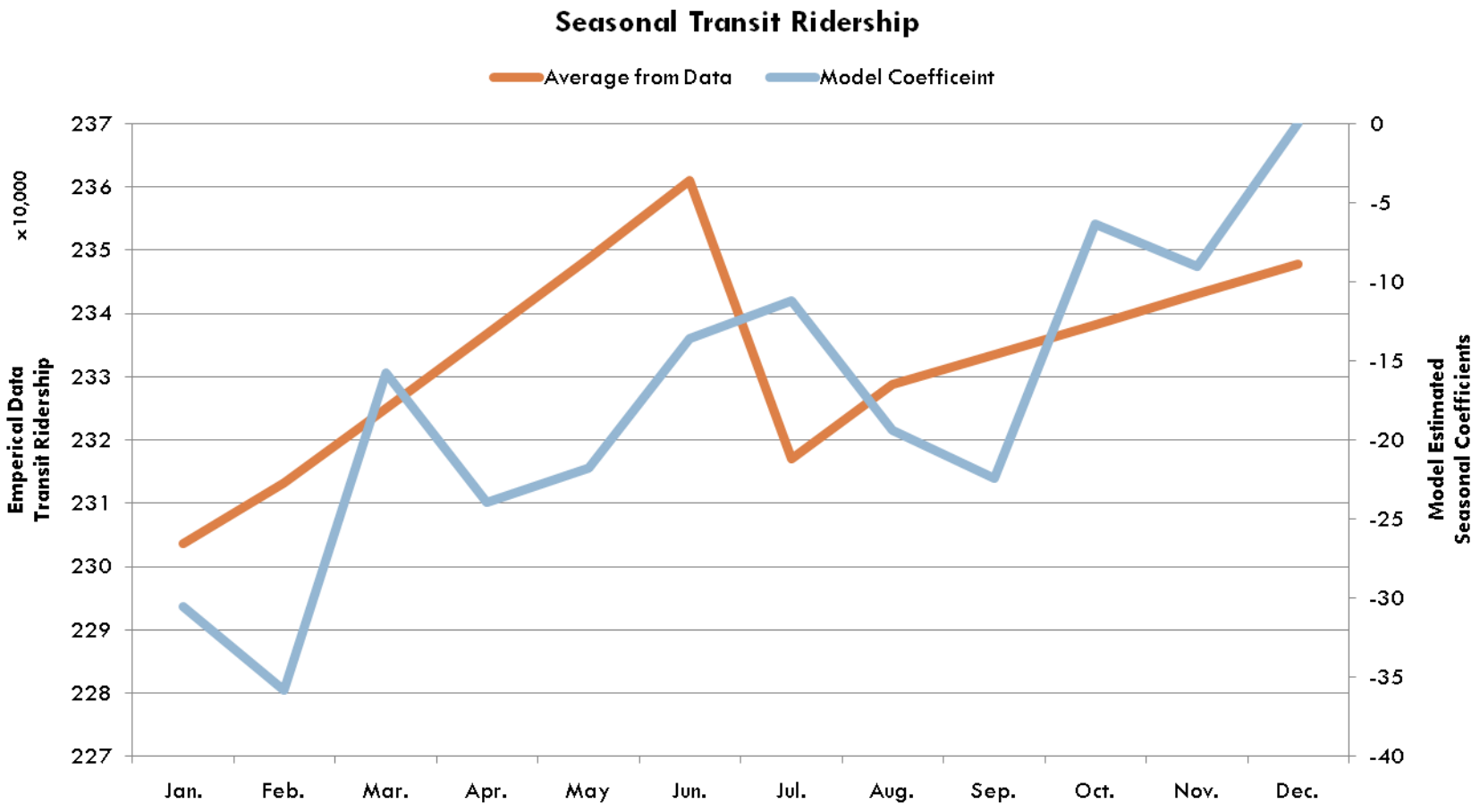
Model Results - Seasonality

	Coefficient	Std.Error	t-value	Probability
Constant and Fractional integration Parameter				
Constant	196.61	99.38	1.9	0.05
d parameter	0.48	0.03	14.7	0.00
Ridership at t-1				
AR 1	0.55	0.13	4.1	0.00
Log-likelihood: -664.2				
Seasonality				
Seasonal (Jan.)	-30.52	2.38	-12.8	0.00
Seasonal (Feb.)	-35.79	3.86	-9.29	0.00
Seasonal (March)	-15.78	4.16	-3.79	0.00
Seasonal (April)	-23.93	4.50	-5.32	0.00
Seasonal (May)	-21.78	4.90	-4.45	0.00
Seasonal (June)	-13.60	5.27	-2.58	0.01
Seasonal (July)	-11.20	5.06	-2.21	0.03
Seasonal (Aug.)	-19.37	4.70	-4.12	0.00
Seasonal (Sept.)	-22.41	4.73	-4.74	0.00
Seasonal (Oct.)	-6.38	4.23	-1.51	0.13
Seasonal (Nov.)	-9.06	2.45	-3.69	0.00
Log-likelihood: -539.9				

Model Results – Independent Factors

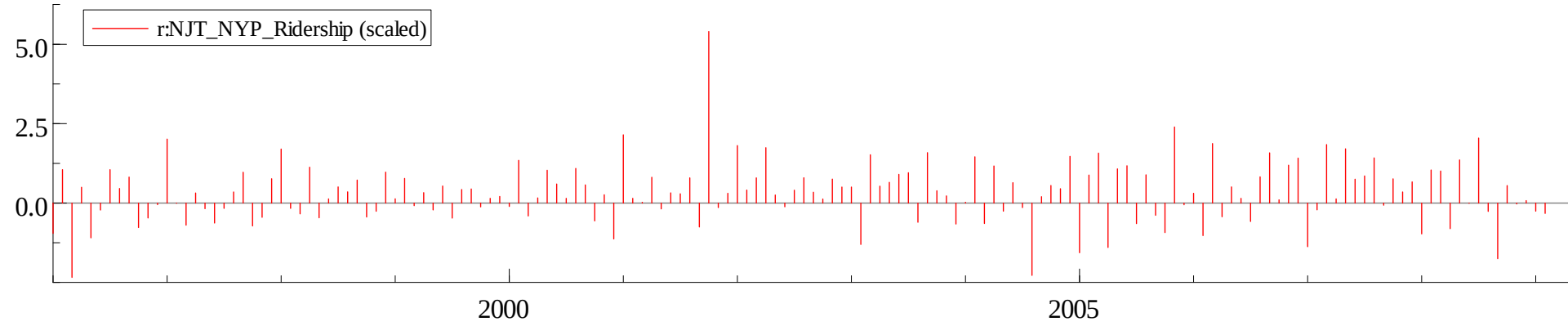
	Coefficient	Std.Error	t-value	Probability
Independent Factors				
Real Gas Price (cents/gal.)	0.14	0.05	3.02	0.00
Real Gas Price (t-13)	0.13	0.06	2.24	0.03
Transit Fare (Oct 08 dollars)	-8.55	3.47	-2.46	0.02
Transit Fare (t-10)	-8.52	3.50	-2.44	0.02
Labor Force (t-5) (100,000s of Employed people in workforce)	0.02	0.01	2.97	0.00
Service Level (10,000s of VRM)	0.08	0.03	2.19	0.03
Service Level (t-4)	0.09	0.04	2.53	0.01
Log-likelihood: -528.3				

Model Results - Seasonality



Model Results

- Residual Analysis
  - Portmanteau Statistic = 21.0 (Significant at 95%)



Model Results – Time-Series Attribute

- Lead / Lag Relationships

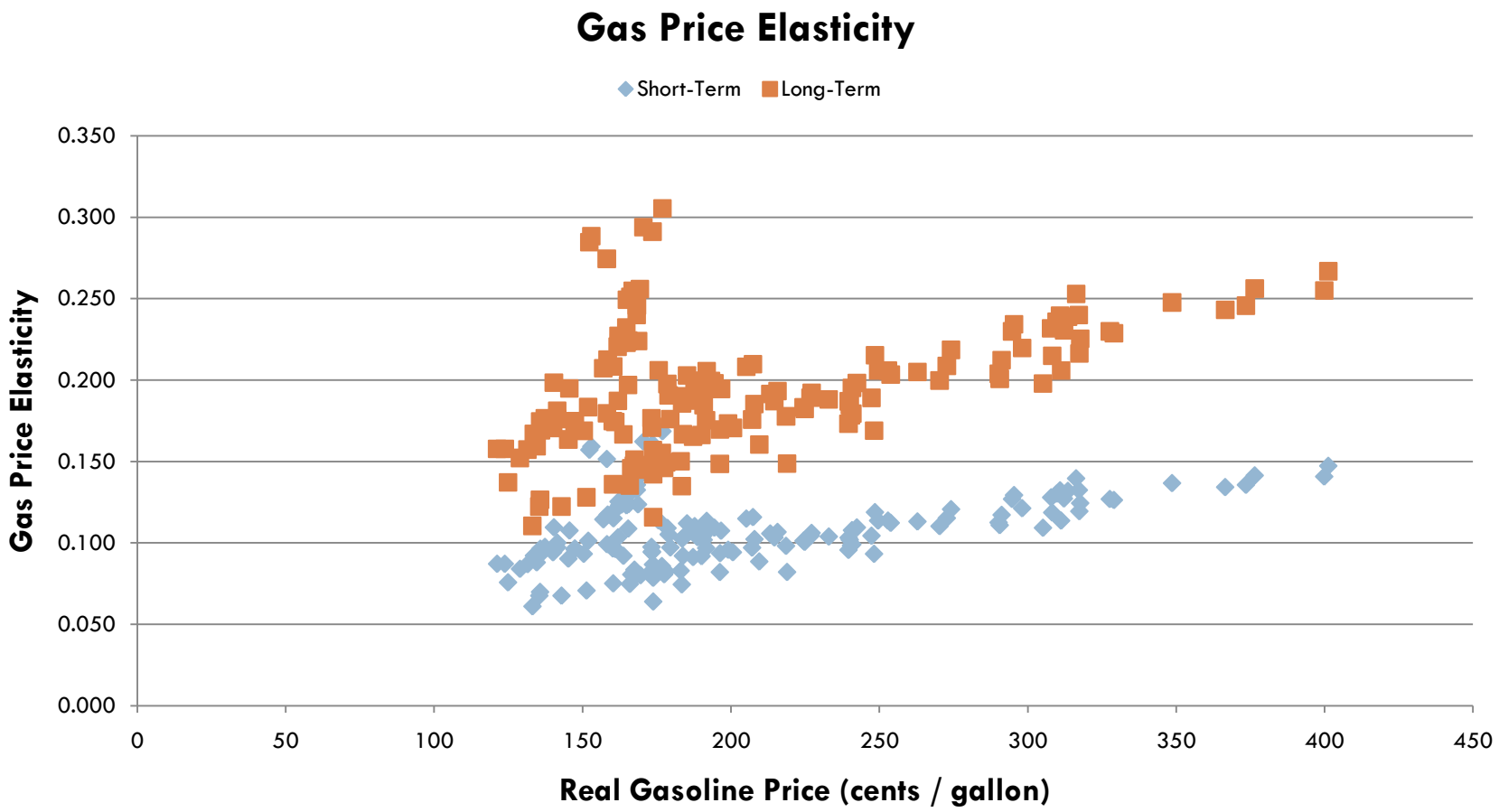
	Immediate Impact	Lag Impacts (months)
Gas Prices	Yes	13
Service Level	Yes	4
Fare	Yes	10
Labor Force	No	5

Model Results – Time-Series Attributes

- Short-Term and Long-Term Elasticities

	Short-Term	Long-Term
Gas Prices	0.11	0.19
Service Level	0.13	0.27
Fare	-0.40	-0.80
Labor Force	0.00	0.59

Model Results – Gas Price Elasticity



Conclusions

- Transit Demand Follows Transit Supply
- Gasoline Prices Influences Transit Ridership
- Short-Term and Long-Term Elasticities
- Transferable Methodology
- Future Research

Questions

Acknowledgements

- Prof. Chen, Thesis Advisor
- Prof. McKnight and Prof. Paaswell, Review Committee
- Mr. Tillotson, Mr. Marchwinski, NJ Transit
- Mr. Lutin, Newark College of Engineering
- Mr. Mosseri, Mr. Gazillo, URS Corporation

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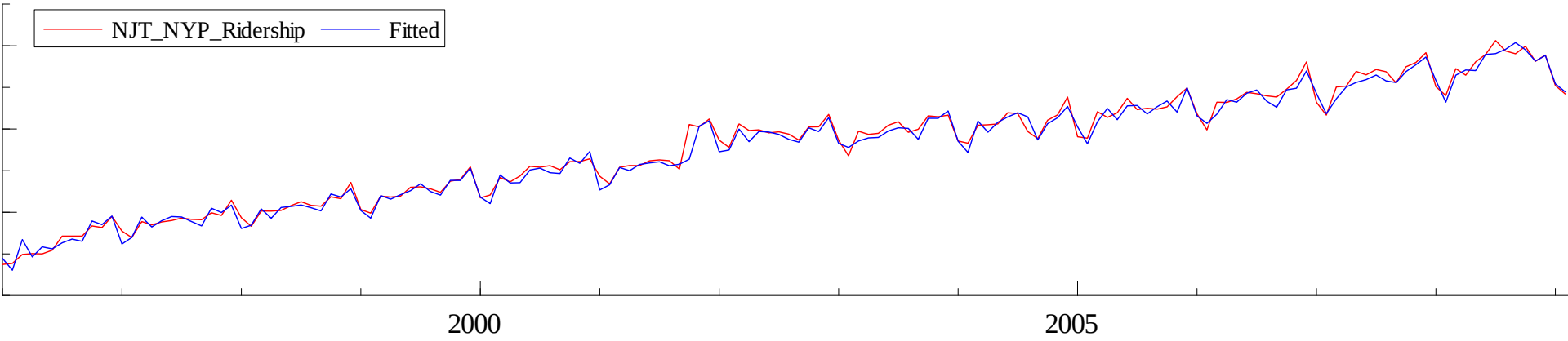
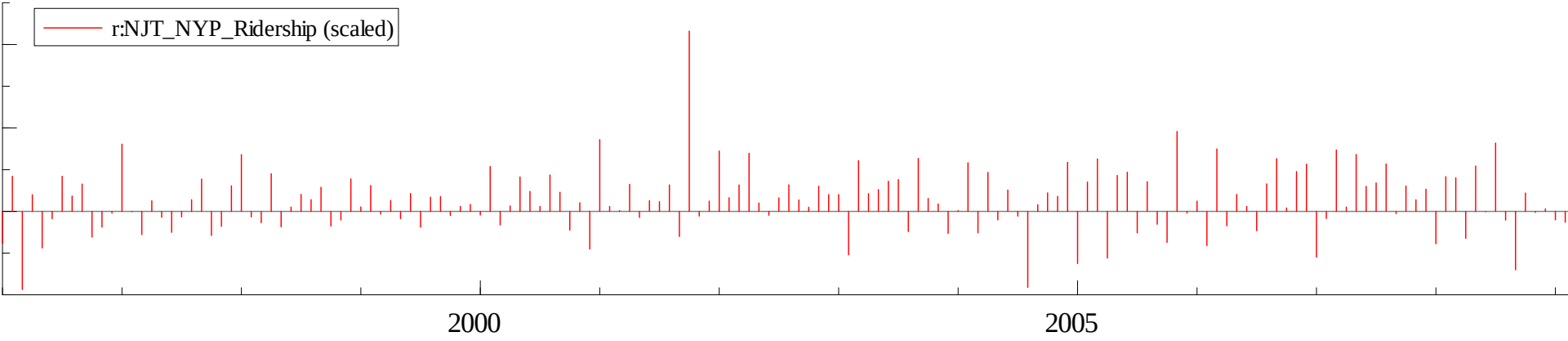
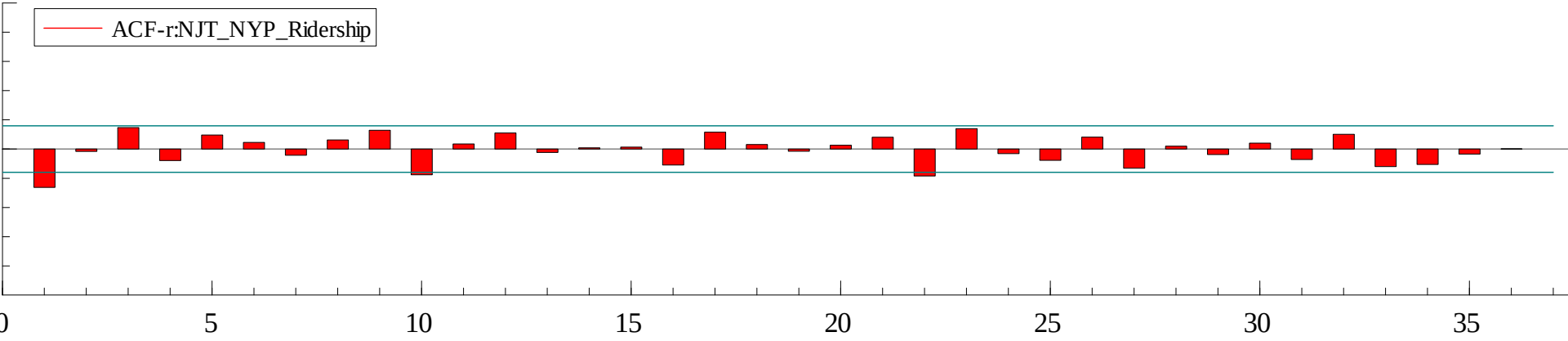

NJT_NYP_Ridership
Fitted
2000
2005


r:NJT_NYP_Ridership (scaled)
2000
2005


ACF-r:NJT_NYP_Ridership
0
5
10
15
20
25
30
35