Regression-Based Mixed Frequency Granger Causality Tests

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1. Motivation Testing for Granger causality with mixed frequency data often involves many parametric restrictions relative to sample size, especially when there is a large wedge between sampling frequencies (e.g. weekly and quarterly data). In such a case the trilogy test statistics may not be well approximated by their asymptotic distribution. A bootstrap method can be employed to improve empirical size, but this generally results in a loss of power. This paper presents simple and remarkably powerful Granger causality tests applicable to any mixed frequency sampling data setting.

2. Methodology Our tests are based on a simple dimension reduction technique for regression models. The procedure involves multiple parsimonious regression models where each model regresses a low frequency variable onto only one individual lag or lead of a high frequency variable. The lag or lead slope parameter is necessarily zero under the null hypothesis of non-causality. Our test is then based on a max test statistic that selects the largest squared estimator among all parsimonious regression models. Parsimony ensures sharper estimates and hence improved power in small samples. Inference requires simple simulation procedures because the test statistic has a non-standard limit distribution.

3. Main Results We show via Monte Carlo simulations that our max test achieves higher empirical power than existing tests for multiple causal patterns (Table 1). An empirical application examines Granger causality between weekly interest rate spread and quarterly economic growth in the United States. Our test yields an intuitive result that the interest rate spread causes economic growth until about the year 2000, after which causality vanishes, while existing tests yield mixed results.

Table 1: Rejection Frequencies of Mixed Frequency Granger Causality Tests

	Decaying C.		Lagged C.		Sporadic C.	
	Max	Wald	Max	Wald	Max	Wald
Small sample (40 quarters)	0.272	0.163	0.576	0.255	0.402	0.260
Medium sample (80 quarters)	0.642	0.480	0.931	0.731	0.803	0.740

The null hypothesis is non-causality from a high frequency variable to a low frequency variable. The ratio of sampling frequencies is set to be 12, approximately a week vs. quarter mixture. "Max" signifies the max test proposed by this paper, while "Wald" signifies the classical Wald test. We consider three causal patterns called the *decaying* causality, *lagged* causality, and *sporadic* causality. For each causal pattern and sample size (40 or 80 quarters), the max test achieves higher empirical power than the Wald test.