

# Non-Smooth Integrability Theory

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November 12, 2016

## Abstract

This paper studies a reverse calculation method for consumer's preference from demand function that is not necessarily differentiable. Compared with the classical theory, the feature of this study is to avoid the use of the Slutsky matrix. Instead, we assume that the solution of the partial differential equation corresponding with the Shephard's lemma has a concave solution. If the demand function is continuously differentiable, then this assumption is equivalent to the negative semi-definiteness and symmetry of the Slutsky matrix. Further, we demonstrate that our result is applicable for a demand function with quasi-linear preference by showing an example.

**Keywords:** demand function, integrability, income-Lipschitzian, expenditure function, Shephard's lemma.

**JEL Classification Numbers:** D11.

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