Paper or Plastic? The Effect of Time on Check and Debit Card Use at Grocery Stores

Elizabeth Klee*
Board of Governors of the Federal Reserve System

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Economists have long recognized that time costs of money can be significant and potentially affect the type of media of exchange used (Baumol [1952], Tobin [1956], Whitesell [1992], Santomero [1974], Santomero and Seater [1996]). Banks and retailers recognize these costs as well, and market transponder devices to pay for tolls, food and gas as a way to minimize the time spent at checkout.[1] But although there is theoretical research and anecdotal evidence that suggest time is an important element in determining the use of media of exchange, there is little empirical work documenting the magnitude of this effect. Perhaps this is due to a perceived lack of data (Hancock and Humphrey [1998]). Most of the data used previously to study payment behavior are based on surveys, either of sellers (ten Raa and Shestaloval [2002] or buyers (Avery et. al [1987], Boeschoten [1992], Kennickell and Kwast [1997], Stavins [2001], Mester [2003], Hayashi and Klee [2003]). These studies show that payment choices depend heavily on consumer income, age and demographic characteristics.

To overcome weaknesses from survey data, this paper uses scanner data from grocery store transactions to examine time costs associated with media of exchange. Grocery store scanner data has been used extensively in other contexts, for example, in estimating elasticities of demand for consumer products (Chevalier, Rossi and Kashyap [2003]) and in constructing price indexes for goods (Feenstra and Shapiro [2003]). Scanner data is an

*Board of Governors of the Federal Reserve System, Mail Stop 75, 20th and C Streets NW, Washington, DC 20551. The views are those of the author and not necessarily those of the Board of Governors, other members of its staff, or the Federal Reserve System.

[1]See "Contactless Pay Shaping Up as Smart Alternative", *American Banker*, March 15, 2004. While the underlying payment instrument is generally a credit card, the transponder device changes the implementation and speeds the exchange.

ideal medium for examining time costs associated with media of exchange as well. First, these data represent actual market exchanges, are very accurate, and are available at a very high frequency. Second, grocery store retailers spend much time and effort in minimizing the length of time for checkout transactions, partly driven by the industry's relatively low margins – the average after-tax net profit as a percent of total sales was approximately 1 percent in fiscal year 2003.[2] And third, everyone eats, everyone eats often, and everyone goes grocery shopping. Because groceries are perishable, consumers shop often, and thus this type of exchange is arguably one of the more frequent that a typical consumer makes. In fact, food purchases from grocery stores and other retail outlets represented 6.2 percent of disposable personal income in 2001.[3]

However, the scanner data have a major weakness – they are completely anonymous. The data contain no information about the buyer. This is problematic, for while factors such as availability of payment instruments, the effect on the consumer's overall financial portfolio, and the demographics of the consumer likely affect payment choices, there is no information on these factors. Moreover, it is likely that the expected length of time for the transaction affects choices, and thus, the length of time of a transaction is endogenously determined with the choice of payment instrument. But because the data are anonymous, there is no way to survey the consumer directly as to whether time is a significant factor in choosing a payment instrument.

The analysis takes steps to overcome these weaknesses. First, the analysis focuses on check and debit card transactions only, as both of these payment instruments have the same effect on a consumer's financial portfolio. Second, the analysis assumes that people shop locally for groceries, and uses census tract information to proxy for consumer income, age and demographic characteristics. And finally, the econometric procedure controls for the endogeneity of the expectations of the length of time of the transaction.

Within this structure, the results indicate that after controlling for the number of items bought, the number of coupons used and the day of the week, check transactions are, on average, predicted to be approximately 40 seconds longer than debit card transactions. Moreover, payment choices are correlated with the demographics of the local market. Furthermore, tests for enodgeneity show that consumers choose debit cards over checks

[2]See Food Marketing Institute, *Annual Financial Review*, December 2003.

[3]Figure includes purchases with food stamps and WIC vouchers and food produced and consumed on farms. Source is Economic Research Service, US Department of Agriculture.

in part because they expect debit card transactions to be faster than check transactions. Interestingly, the results suggest that debit card users are, on an absolute basis, more time sensitive than check users. Thus, the choice of payment instrument depends critically on time costs for media of exchange, and in particular, these sensitivities vary by the demographics of the local market.

Overall, the results in this paper support the theoretical literature on media of exchange and the empirical literature using survey data. Time factors significantly determine use of media of exchange, and sensitivity to these time factors depend on the income, age and demographic characteristics of the local market.