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ARE ATM/POS DATA RELEVANT WHEN NOWCASTING PRIVATE CONSUMPTION?

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November 2009

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Are ATM/POS data relevant when nowcasting private consumption?

Paulo Soares Esteves*

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Policymakers need timely and reliable information on the current state of the economy as macroeconomic forecasts and policy decisions are strongly affected by the quality and completeness of this assessment. Therefore, forecasters are always in search of new indicators that are related with the macroeconomic variable of interest and available earlier. This paper proposes the use of the ATM/POS data as an indicator to estimate private consumption. An application for Portugal is presented as a case study, where the out of sample performance of this indicator is evaluated against some benchmark naïve models and other alternative bridge models. The results clearly support the use of this information to nowcast non durables private consumption.

Keywords: Macroeconomic nowcasts, private consumption, ATM, POS.
JEL codes: E01, E27, C53

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1. Introduction

Timely and reliable information on the current state of the economy is crucial for both forecasters and policymakers. The quarterly national accounts releases are key looked-for information, but which are disclosed with a significant delay.[1]

Therefore, when nowcasting or producing short-term forecasts, one of the most important issues is to find indicators related with the targeted variable but that are available much earlier. The construction of such a link between the information included in one or few key indicators and the final variable to measure explains why these models are called "bridge models". They are widespread used as evidenced by some recent examples. For instance, Baffigi et. al. (2004) is an often referenced application for the euro area, while Kitchen and Monaco (2003) describe the approach adopted at the US Treasury Department to construct "real time" estimates for quarterly GDP.[2] More recently, this type of approach was extended to a large number of series, using a statistical framework that summarizes all the information in a few number of common factors that are then bridged into the variable to estimate – a recent application on real time forecasts for the US economy is given by Gianonne et. al (2008). This paper follows the more traditional and restricted approach, which is suited to investigate the explanatory power of a specific indicator.

When thinking of private consumption, the Automated Teller Machine (ATM) and Point of Sale (POS) data seems to fulfil two necessary requirements to emerge as a covariate indicator for private consumption. Firstly, cash withdrawals and card payments are truly associated with private consumption, being a measure of the same phenomenon. Secondly, this information is available very rapidly, typically just a couple of days after the end of the month. The use of this type of information was for the first time suggested and explored by Galbraith and Tkacz (2007), which presented some evidence that debit card data can lower consensus forecasts errors and are correlated with GDP revisions for the Canadian economy. Nevertheless, in general, this information is not taken into consideration by the institutions that usually evaluate the short-term economic fluctuations, in particular Central Banks and National Statistics Institutes. This probably reflects the less relevance of this information in the past, prior to the strong increase of the role of the ATM/POS services since the 90s.

The main objective of this article is to investigate the use of this information to nowcast private consumption, presenting an application for the Portuguese economy as a case study. The paper is organized as follows. Section 2 presents the database on ATM/POS withdrawals and payments for

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[1] Following the current Eurostat procedures, the flash estimate for GDP in the European Union countries is disclosed within 45 days of the end of the reference quarter, while the first complete set of quarterly national accounts is disclosed 30 days latter. The Bureau of Economic Analysis (BEA) presents the first number for the US GDP one month after the end of the quarter, while the first preliminary estimate is presented one month later.

[2] Concerning the Portuguese economy, two applications were recently published. Duarte and Cardoso (2007) and Ramos Maria and Serra (2008) present applications for exports and investment, respectively.

Portugal. The aim is to provide an overall overview of this type of database. Section 3 presents a bridge model to estimate private consumption. The results of this model are compared with those of two naïve models (carry-over and autoregressive) and with some alternative bridge models based on other indicators that are frequently used to forecast private consumption. Finally, section 4 displays the main conclusions.

2. The database

The monthly database used in this paper was built using the information provided by the Banco de Portugal Payment Systems Department, covering a sample period starting in January 1998 to June 2009 and encompassing the ATM/POS cash withdrawals and payments made by local residents.
Figure 1 presents the nominal data, both in monthly levels and in month-on-month rates. A notable feature that emerges from the chart is the strong seasonal pattern, characterized by a huge increase at the Christmas season (December) and in the months of the summer holidays (July and August).
Figure 2 presents the structure of this dataset by type of transaction. From a very rich database, three main aggregates are considered: (i) the ATM cash withdrawals of residents both in the national territory and in foreign countries; (ii) the card payments of residents also in the national territory and abroad, covering both debt and credit cards; (iii) the electronic payments of services, including the telecommunications card charges.

Figure 1 – ATM/POS data

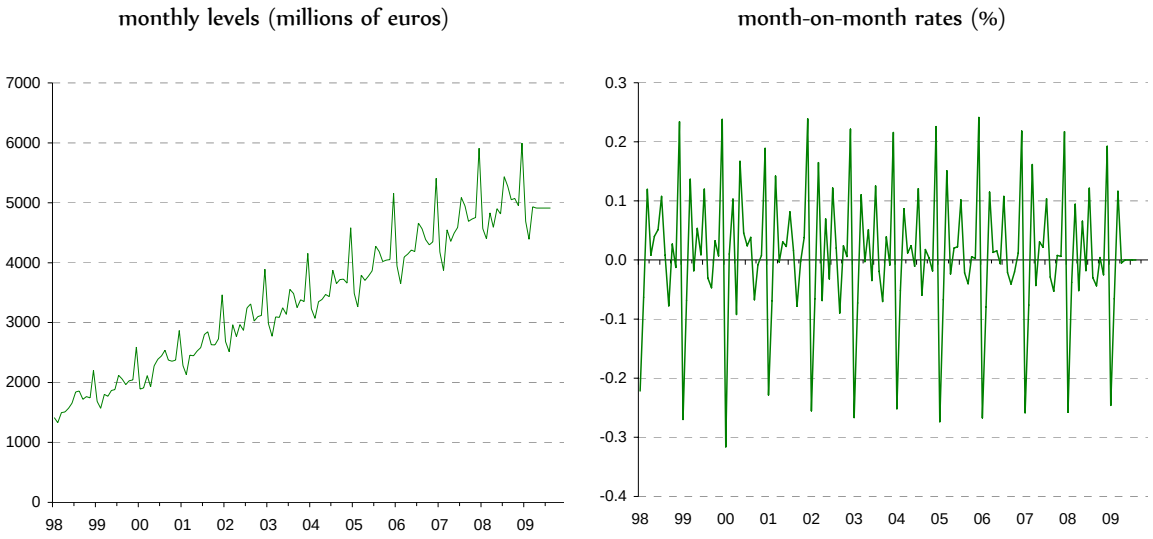


Figure 2 – ATM/POS dataset structure
monthly figures %

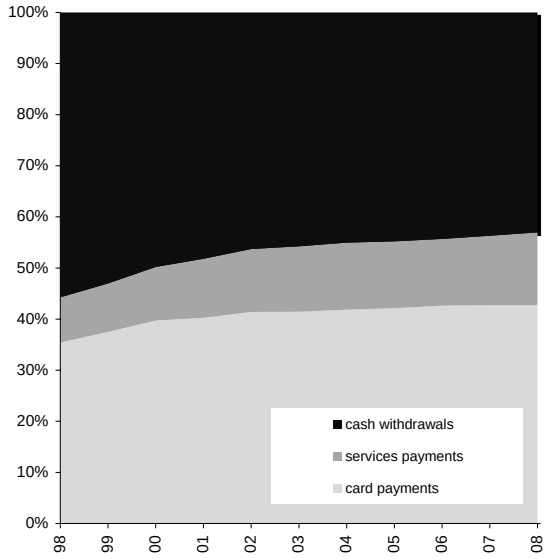
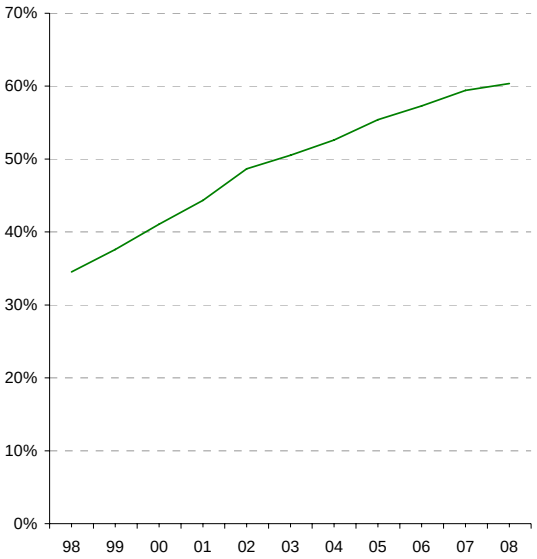


Figure 3 – ATM/POS data weight on nondurables consumption
annual figures %



The results evidence a reduction of the importance of cash withdrawals on total transactions, relatively to card and services payments. Presently, cash withdrawals and card payments dominate the transactions (both slightly above 40%), while the payments of services reaches a share of nearly 20%.

Figure 3 aims to illustrate the dimension of this dataset. Its share in terms of total nondurable consumption has been rising ever since 1998, although at a slow pace, reaching a level close to 60 per cent in 2009.

3. A race between indicators

This section evaluates the usefulness of this ATM/POS data to nowcast private consumption. This exercise is carried-out as a case study, making use of the available data for the Portuguese economy presented in the previous section.

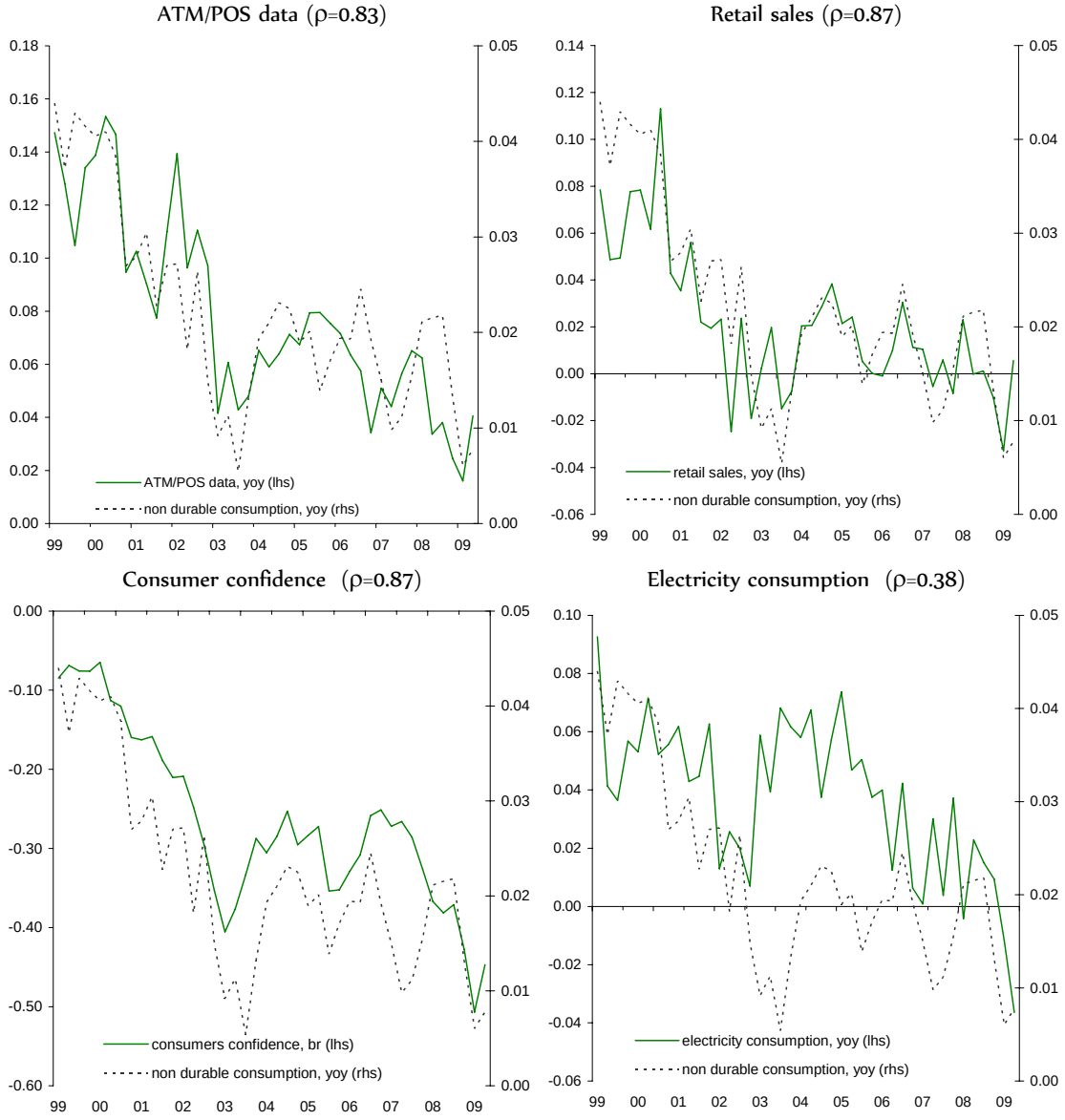
The targeted aggregate chosen to be forecasted is private consumption of non durable goods and services, which corresponds to roughly 90 per cent of the overall private consumption in the Portuguese economy. The decision of excluding durable goods is justified on two grounds.

Firstly, there are very direct, reliable and timely indicators that typically allow to measure quite accurately consumption of durables goods – the main example are cars sales that are available at the end of each month and which are directly used to measure durable consumption. Secondly, the importance of electronic payments must be more relevant when explaining non durables consumption. The expenditures on durable goods is typically less associated with the use of

electronic money, being more connected with the use of financing schemes owing the larger amounts usually involved in these transactions..[3]

Besides the ATM/POS data, the retail trade sales; the consumer confidence indicator level and the consumption of electricity are selected as the other competing indicators. Figure 4 presents these indicators vis-à-vis the nondurable consumption, as well the respective correlation coefficients.

Figure 4 – Competing indicators vs nondurable private consumption(*)



(*) all quantitative series are measured in real terms. The ATM/POS data was deflated with the Consumer Price Index (CPI).

[3] This option of excluding durables consumption is also validated by the available database. Considering the sample period and using quarterly figures measured in year-on-year rates - in order to overcome the seasonality issue -, the simple correlation coefficient between ATM/POS data and non durables consumption is 83 per cent. This correlation decreases to 65 per cent when computed with the overall consumption.

Concerning the comparability of the results, it should be mentioned that the race is not completely fair, favouring the retail sales indicator, which contrarily to the other indicators is not available at the end of the month. The confidence indicator covers the first two weeks being released at the end of month, while the ATM/POS data and the consumption of electricity are available few days after the end of the month. In contrast, the retail trade is only available at the end of the following month. The results do not take into account these differences.

Finally, the available electricity consumption data cover both households and firms. In the future, a possible breakdown by type of consumption – not available at the moment - may be interesting, changing the assessment on the use of this indicator.

3.1 Rules of the race

The general equation to nowcast private consumption on non durable goods and services is assumed to be the following:

$$\Delta^4 C_t = c_0 + \sum_{i=1}^{4} \alpha_{t-i} \Delta^4 C_{t-i} + \beta_t \Delta^4 I_t \qquad (1)$$

The year-on-year rate of change in consumption ($\Delta^4 C$) is explained by its lagged values and by the contemporaneous evolution of the chosen indicator ($\Delta^4 I$), after its transformation from monthly to quarterly frequency.

After the estimation of the model considering the ATM/POS data as the relevant indicator, an out-of-sample exercise is implemented. The results are compared with those from other alternative models: (i) two naïve models [random-walk assumption and an AR(4) model that corresponds to dropping the indicator from the equation above]; (ii) and the models using the alternative indicators to mimic private consumption.

Additionally, forecasts combination is also assessed. The several alternative single equations projections are aggregated, following the procedure presented in Diebold (1988). Thereafter, one indicator at a time is excluded from the pool in order to estimate the gain associated with its inclusion as a relevant indicator.

3.2 Final scores

All the models are evaluated to forecast the yoy rate of non durables private consumption or alternatively to foresee the evolution of those rates (acceleration/deceleration). This corresponds to a standard practical technique called "constant adjustment", which corresponds to adding a

constant to the model in order to assure that it fits exactly the last observable figure for the endogenous variable.

Two periods were considered to evaluate the out-of-sample performance of the several models: [2005q1:2009q2] and [2007q1:2009q2]. The current exercise should be considered as a pseudo real time analysis, not accounting for the usual uncertainty surrounding data revisions. Thus, the magnitude of the reported Root Mean Square Error (RMSE) should be interpreted carefully.[4]

The results are presented in Table 1. The first general result is that, in general, all the models considered seems to perform better when used to foreseen the first difference of the yoy rate of private consumption.

Other noticeable outcome is that the use of statistical indicators provides usually superior results

Table 1 – Forecasting performance evaluation
Root Mean Square Error – one step ahead out-of-sample forecast

out of sample period: 2005q1/2009q2 (18 observations)

	Single equation forecasts			Aggregation of forecasts	
	yoy	Δyoy		yoy	Δyoy
Carry-over	0.45				
AR(4)	0.53	0.51	Total	0.40	0.31
Retail trade	0.36	0.33	excl. Retail trade	0.43	0.30
Consumers confidence	0.51	0.42	Consumers confidence	0.32	0.32
Electricity consumption	0.54	0.57	Electricity consumption	0.40	0.33
ATM/POS data	0.35	0.34	ATM/POS data	0.43	0.34

out of sample period: 2007q1/2009q2 (10 observations)

	Single equation forecasts			Aggregation of forecasts	
	yoy	Δyoy		yoy	Δyoy
Carry-over	0.50				
AR(4)	0.64	0.57	Total	0.40	
Retail trade	0.40	0.34	excl. Retail trade	0.55	0.37
Consumers confidence	0.62	0.50	Consumers confidence	0.36	0.33
Electricity consumption	0.62	0.64	Electricity consumption	0.47	0.34
ATM/POS data	0.37	0.33	ATM/POS data	0.52	0.40

(1) The forecasts aggregation follows the procedure presented in Diebold (1988). Y is the aggregated forecast from the q individual forecasts Y_j ,

$Y = \sum_{j=1}^{q} w_j^* Y_j$ where the optimal weights w_j^* are obtained from the following vector w *

$w^* = \frac{1}{i_{(q,1)}^T \left(\frac{1}{n}\Omega^T\Omega\right)^{-1} i_{(q,1)}} \left(\frac{1}{n}\Omega^T\Omega\right)^{-1} i_{(q,1)}$, $i_{(q,1)}$ represents a vectors of ones and Ω is the covariance matrix between the error of the several procedures.

in terms of RMSE against the naïve models. The exception is the electricity consumption that in the several experiences underperforms the use of the naïve approaches. Comparing the results obtained with this single indicator approach, the ATM/POS data outperforms versus the other alternative indicators, followed closely by the use of the retail trade sales. On average, the gains – measured by the reduction in the RMSE - are close to 40 per cent when considering the naïve approaches and the models using the electricity consumption and the confidence indicator.[5] The results are close to the ones obtained with the model using retail trade statistics, which is typically the most frequently used indicator.

Concerning the aggregation of forecasts, the results suggest that the combination of several indicators may be preferable than to rely exclusively on one indicator. In the longer out-of-sample period, there are several combinations of indicators that outperform the approach based on one only indicator. In the shorter out of sample period, this result is not so general, and the use of the ATM/POS or retail sales single equations outperforms the aggregation of all indicators and is relatively equivalent to the aggregation that excludes electricity consumption or consumers confidence.

Comparing the usefulness of each indicator, the performance of combining several indicators increases clearly when the ATM/POS data or the retail trade sales is included in the set of indicators.

4. Concluding remarks

This paper claims the use of electronic payments databases as an instrument to nowcast private consumption, in particular non durable consumption, given that this information is related with private consumption and is timely available – typically just a couple of days after the end of the month. The possible relevance of this data was already explored in Galbraith and Tkacz (2007), which presented some evidence that debit card data can lower consensus forecasts errors and are correlated with GDP revisions for the Canadian economy. Nevertheless, its use does not seem to have captured the attention of the institutions that usually evaluate short-term economic fluctuations, in particular Central Banks and National Statistics Institutes. This may reflect its minor relevance in the past, before the strong increase of the role of the ATM/POS services that started in the 90s.

[4] See Cunningham and Jeffery (2007) for a recent survey about the importance of the data uncertainty in the UK and for a discussion into how best to deal with it.

[5] It could be argued to account for more lags when using the consumer confidence indicator given its leading properties for consumption. In fact, the inclusion of those additional lags allows to reduce the RMSE of this model, in particular in the most recent period, but without changing the relative performance across the several indicators.

The paper presents an application for the Portuguese economy as a case study, making use of the ATM/POS database available at Banco de Portugal. The use of this indicator is compared with some naïve models and with the use of other indicators that are frequently pointed out as reliable for forecasting private consumption, as retail trade sales, consumers' confidence or electricity consumption. Overall, the results sustain that the use of associated indicators may outperform the projections of the naïve models (carry-over and AR), and that the combinations of several indicators might be superior to the approaches relying exclusively on one indicator.

Concerning the comparison between the alternative indicators combinations, the ATM/POS and retail trade data outperforms clearly the other indicators. When comparing the out-of sample forecasting errors across the models using only one indicator, the smaller RMSE is registered in the ATM/POS and retail trade models. Moreover, the increasing performance of using several indicators simultaneously is decisively obtained when these two indicators are included in the set of explaining variables. Thus, the use of ATM/POS data compares with the results of using the retail trade index – probably the most frequently used indicator -, but with an advantage of becoming available earlier.

Overall, the results favouring the use of this data as an additional indicator are relatively robust, occurring in both the out-of-sample periods considered, independently of the models specifications being used to forecast the rate of growth of private consumption or its acceleration. The small number of observations underlying the current results is a caveat, which justifies special caution concerning their interpretation and strongly advises for future analyses regarding their stability. Nevertheless, the results raise a question: why should not one explore this data to estimate consumption?

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