

Money talks – Nowcasting real economic activity with payment systems data

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Abstract

Payment systems play a central role in the functioning of modern market economies, by enabling the transfer of money and financial instruments between economic agents in a safe and efficient way. In this context, researchers have devoted a great deal of attention to the assessment of the spillover effects that the development of payment systems could induce in an economy and on the demand for currency. More recently, the usage given to the data generated by these systems have been considerably broadened, to encompass issues as, *inter alia*, the assessment of financial integration and nowcasting private consumption. In this paper, we explore possible uses of payment systems data in the specification of coincident and/or leading indicators for key macroeconomic aggregates – such as the gross domestic product and private consumption of households. Given the strong connection between the phenomena underlying these data and the above-mentioned macroeconomic variables, we highlight the comparative advantages of this information in relation to competing indicators, which is based on its inherent quality, competitive costs and high frequency. In addition, we present the payment systems data available in Portugal, with particular emphasis on Automated Teller Machine and Point of Sale driven data, and describe how the current institutional environment and the recent enhancements in the reported information have gained further importance and relevance in meeting *Banco de Portugal*'s main goals.

Keywords: GDP forecasting; private consumption forecasting; nowcasting; leading indicators

JEL codes: E42; E27

1. Introduction

Good evidence-based policy making demands that decision makers are provided with quality and timely inputs that are able to shed light on the relevant realities and fundament the different alternatives under scrutiny. Although this might seem as a simple and rather naïve premise, the problem is even more complex when one thinks of economic policy making, since there is also the challenge to select and analyze timely information that allows a proper understanding on what is going on in the economy and where it is heading to. In such demanding context, researchers have continuously been debating the pertinence of different inputs to meet this purpose, which, in view of the data gaps unveiled by the recent great financial crisis, have become increasingly more important.

In the same vein, the paper seeks to contribute to this discussion by reflecting on the appropriateness of using payment systems data as leading and coincident indicators for key macroeconomic variables, through a meta-analysis of different contributions on this subject. To this extent, we review the nature and the traditional applications given for this type of data and highlight the recent propositions denoting the growing interest for the information generated through these systems. Drawing up on the work of Esteves (2009) and Garcia (2011), we illustrate how the data stemming from the Portuguese retail payment systems have been proving to be particularly useful in nowcasting the Gross Domestic Product (GDP) and the consumption of non-durable goods and services, both of which are key macroeconomic variables to take into account in many economic and financial decisions.

2. The data – what’s in it and where can it be found?

Before any investigation or discussion on the uses of payment systems data, it is of utmost importance to firstly clarify what is the nature and content of the referred information and where it can be found.

According to the Bank of International Settlements (BIS) (2012, pp. 8), a payment system “*is a set of instruments, procedures, and rules for the transfer of funds between or among participants*” which are “[...] *generally categorised as either a retail payment system or a large-value payment system*”. In this sense, a retail payment system is a “*funds transfer system*” which is operated either by the private or the public sector that deals with large volumes of low-value payments processed through a variety of forms: “*cheques, credit transfers, direct debits, and card payment transactions*”. By contrast, a large-value payment system is also a funds transfer system, but processes “*large-value and high-priority payments*” and is operated by central banks.

Naturally, the data generated by either types of payment systems is very diverse and, as discussed below, can arguably be used for several different purpose. Therefore, their applications must always be framed in light of the attachment to the reality under study. Notwithstanding, although these definitions and principles are quite clear and provide an overall idea of the phenomena being registered, they do not immediately convey *per se* an impression on what kind of information a researcher can extract from these systems. Indeed, in order to truly foster a fruitful discussion on the uses of payment systems data in the specification of coincident and/or leading indicators for key macroeconomic aggregates, it is also very important to identify what sources are available and clarify what their content is.

The information on payment systems is publicly available, both from a statistical and descriptive standpoint, from a variety of national and international sources, for either type of the referred payment systems. From the purely international perspective, the Bank of International Settlements (BIS) is one of the more relevant providers of payment systems statistics. It publishes yearly a report compiled by the Committee on Payments and Market Infrastructures (CPMI), known as the *Red Book*, which contains a set of very detailed statistics on payment, clearing and settlement systems in the CPMI countries¹. Among others, this report includes a set of statistics on the institutions offering payment services to non-banks (*e.g.* number of banks, number of accounts in banks, value of accounts in credit unions), a group

¹ Australia, Belgium, Brazil, Canada, China, Euro area, France, Germany, Hong Kong SAR, India, Italy, Japan, Korea, Mexico, Netherlands, Russia, Saudi Arabia, Singapore, South Africa, Sweden Switzerland, Turkey, United Kingdom and United States

of statistics on the functions of the payment cards and their accepting devices (*e.g.* number of cards with cash, debit, credit or e-money functions, total number of cards, number of Automated Teller Machine (ATM) terminals, number of Point of Sale (POS) terminals) and a very comprehensive set of indicators on the use of different payment instruments and terminals, which include, for example, the number of transactions per type of payment instrument/terminal.

In the same vein, but within the European context, the contributes provided by the European Central Bank (ECB) are also a reference worth highlighting, given their comprehensiveness and detail. Indeed, over the last three decades, the publication of the four editions of the *Blue Book*² – a very detailed descriptive report of the progress in the main payment systems in the euro area and non euro area countries – have supplied a crucial element of analysis of the evolution of the phenomena linked to the payment systems of several countries, namely the developments of their institutional framework, the preference for different payment methods, the growth of the interbank exchange and settlement systems and of the securities settlement systems.³ Besides this, the ECB is also an important player in the field of the dissemination of statistics on payment systems *per se*, by making available on its Statistical Data Warehouse (SDW) a very complete report containing country tables – for the euro area and non euro area countries – on issues deeply related to payment systems. These include, *inter alia*, the number of institutions offering payment services, the number of payment and terminal transactions involving non-monetary financial institutions, the value of transactions per type of payment service and the relative importance of different payment services, among several others.⁴

That being said, it is clear that the information on payment systems disseminated internationally is very rich and comprehensive, thus fostering an array of different uses which are critical for policy makers and enabling the international comparability of this phenomena. In the case of Portugal, the data available nationally are also of great utility for policy makers and researchers, given its very high degree of detail and timely publication. Indeed, the payments system in Portugal benefits from the stability conferred by its institutional environment, since, as Lima (2013) argues, there is only one large company involved in processing payment cards data and, pursuant to the regulatory and oversight powers conferred by the *Banco de Portugal's* Organic Law,⁵ the remaining payments institutions report to the *Banco de Portugal* (hereinafter referred to as the Bank) information deeply related to the payments system on a monthly basis. Given this very rich input, the Bank publishes, through its statistical dissemination tool,⁶ several statistics on payment systems covering its many dimensions: from the aggregate interbank operations processed in Portugal (either via clearing or in gross), to the different number of users and volumes involved in each of the payment instruments available in Portugal – cheques, credit transfers, direct debits, bills of exchange and the Portuguese ATM and POS network. In this domain, the Bank also publishes several indicators of the overall settlement system transactions and presents them by type of system, number of operations and value.

Against this background, through which we have explored thoroughly what is the content of payment systems data and provided key references on where it can be found, it is now important to understand what were the focus of earlier studies on payment systems, in order to evaluate the possibility of incorporating their contributes towards the fulfillment of this paper's purpose.

² First edition: 1992; Second Edition: 1996; Third edition: 2001; Fourth edition: 2007.

³ For more information on this publication, please consult <https://www.ecb.europa.eu/paym/intro/book/html/index.en.html>

⁴ For further information, please consult <http://sdw.ecb.europa.eu/reports.do?node=100000760>

⁵ For further clarification, please consult article 14 of Banco de Portugal's Organic Law through <https://www.bportugal.pt/sites/default/files/anexos/documentos-relacionados/leiorganica-en.pdf>

⁶ [https://www.bportugal.pt/EstatisticasWeb/\(S\(gmtvwtittgj1lb45g2fumw45\)\)/SeriesCronologicas.aspx](https://www.bportugal.pt/EstatisticasWeb/(S(gmtvwtittgj1lb45g2fumw45))/SeriesCronologicas.aspx)

3. Insights on the earlier uses of payment systems data

Nowadays, payment systems data are used as a tool to monitor the developments in the retail/large-value payment systems of a country, but also as an important input on the study of very different phenomena, spanning from the assessment of financial integration to the nowcasting of key economic variables. However, this was not always the paradigm. Indeed, as Jonker (2005) describes, up until the 1980s, the academics focused primarily on payments behavior and on how these could help in explaining the demand for currency, following up the insights developed by Baumol (1952) and Tobin (1956) on the optimal amount of cash, which later became known as the Baumol-Tobin model.

In this sense, Jonker (2005) provides a valuable literature review, from which the picture emerging is that the use of electronic payment cards (debit and e-purse) is negatively related with age and positively related with the educational level of consumers. Furthermore, women seem to use more different payment instruments than men. Cash is regarded as a universally accepted, but relatively unsafe mean of payment, whereas the debit card is considered to be modern, easy to use and practical. This evidence is consistent with the findings of *Banco de Portugal* (2007)'s report on the benefits and costs of different retail payment instruments: "*The survey focusing on consumers produces findings in line with studies in other countries (the U.S., Belgium and the Netherlands) to the effect that the use of electronic payment instruments (payment cards) is directly related to income and education and inversely to age*"⁷.

However, as Schreft (2006) describes, it was not until the mid-1990s that important research bodies, such as the Fed, "*really started encouraging payments research*", in response to a series of innovations in payments methods, as, for example, the introduction of new electronic payment instruments. This has led to a growing interest in payments information and it set the foundations for a stream of more recent studies on the choice between different payment instruments, as, for example, Van Hove *et al.* (2005) and Hyytinen and Takalo (2004)'s input on the relationship between the consumer's characteristics (*e.g.* age, gender, education) and their preferences for different payment methods.

More recently, the uses given to these data have been considerably broadened. Indeed, by resorting to payments information such as the demographic/geographic ATM penetration across countries, the total number of active cards, ATMs and POSs and the relative uses of the different payment methods, Matos and D'Aguiar (2009) have shown how payments data can be used to assess the dynamics of monetary and financial services. They found that the recent boom in retail financial services registered in Portugal is deeply connected to the proliferation and development of Multibanco, a network shared by all banks operating in Portugal that fully integrates ATM and POS terminals and that enables a large set of innovative services, such as the inter-bank transfer of money or the payment of utilities.

In the same vein, Lima (2013) has also investigated the possible uses of payments data for the improvement of monetary and financial analysis. The author showed that, apart from the purposes discussed above, data on the number and value of operations done through Portuguese ATMs and POSs (with cards issued abroad) and on the operations performed abroad by cards issued by Portuguese entities, are also used as a very important component of the compilation process of the travel account – an important part of the Portuguese balance of payments.

The contributions put forward by the previous researchers have highlighted not only how relevant payments system data are, but also how different its uses can be. Indeed, as Schreft (2006) describes, the times when payments data were discussed only within restricted specialized groups, with very limited scopes of discussion, are now over. It is now clear that "*payment decisions have macroeconomic implications*" (Schreft, 2006, pp.2) and must therefore be studied accordingly, in order to meet a handful of different purposes. In this context, one of the main potential uses of payment systems data, which seems to be untapped, consists in using this information as coincident/leading indicators for the economic activity. In the next section, we discuss this possibility and demonstrate how the inherent

⁷ Banco de Portugal (2007, pp.18)

quality, competitive costs and high frequency make up compelling arguments for the consideration of these data for these purposes.

4. Nowcasting real economic activity with payment systems data

One of the key inputs from Schreft (2006)'s description of the growing interest in payment systems data is the recognition of the macroeconomic implications that payment decisions convey. Under this premise, one might engage in the investigation of how these implications help in better understanding the economic reality and its foreseeable behavior.

To this extent, Esteves (2009) presents one interesting contribution on the use of payments data as input to nowcast a key economic variable: the consumption of non-durable goods and services. The author argues that ATM and POS data fill two key requirements to be used for this purpose: (i) it is "truly associated" with the reality it seeks to portray and (ii) the frequency with which it is available, "typically just a couple of days after the end of the month", is highly beneficial for nowcasting purposes. In this sense, Esteves (2009) elected to use ATM/POS cash withdrawals and payments made by local residents to nowcast the consumption of non-durable goods and service.

In order to evaluate the comparative performance of payments system data, the author selected a set competing indicators, which included the retail trade sales, the consumer confidence indicator level and the consumption of electricity, and compared the co-movement of each of these 4 time-series with the actual consumption of non-durables.

Table 1 – Pearson's correlation coefficient between the consumption of non-durables and payment systems data and its competing indicators in Esteves (2009)

Pearson's Correlation Coefficient	
	Consumption of non-durables
Retail trade	0.87
Consumer confidence	0.87
Electricity consumption	0.38
ATM/POS data	0.83

Although there are some methodological differences between the different indicators that are not taken into account,⁸ the comparison of the correlation coefficient between the consumption of non-durables and each of the four competing indicators, depicted in Table 1, clearly shows the relevance and pertinence of using ATM/POS data in nowcasting the consumption of non-durables, as it is observed a very high degree of association between the ATM/POS and non-durable consumption curves. Despite of the fact that this comparison already provides an early insight on the pertinence of using ATM/POS information for the referred purposes, Esteves (2009) investigated deeper the comparison of these indicators, by defining a general equation⁹ to nowcast the consumption of non-durable goods and services, which included the different competing indicators. In this process, the author compared the root mean square error (RMSE) for the one step ahead out-of-sample forecasts of this model, for the specifications including each of these indicators and two additional naïve models – random-walk and auto-regressive of order 4 (AR(4)).

⁸ Especially the availability of the information.

⁹ The equation used by Esteves (2009) to nowcast private consumption of non durable goods and services is:

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

Where $\Delta^4 C_t$ is the year-on-year rate of change in the consumption of non durables and $\Delta^4 I_t$ is the "contemporaneous evolution of the chosen indicator, after its transformation from monthly to quarterly frequency." (Esteves, 2009, pp. 6).

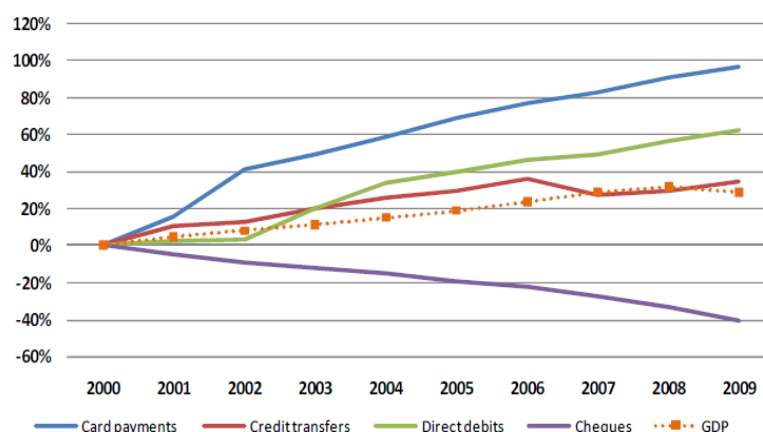
Table 2- Forecasting performance evaluation: Root mean square error in Esteves (2009)

Out of sample period: 2005q1 to 2009q2			Out of sample period: 2007q1 to 2009q2		
	Single equation forecasts			Single equation forecasts	
	Yoy	Δ yoy		Yoy	Δ yoy
Random-walk	0.45		Random-walk	0.50	
AR(4)	0.53	0.51	AR(4)	0.64	0.54
Retail trade	0.36	0.33	Retail trade	0.40	0.34
Consumer confidence	0.51	0.42	Consumer confidence	0.62	0.50
Electricity consumption	0.54	0.57	Electricity consumption	0.62	0.64
ATM/POS data	0.35	0.34	ATM/POS data	0.37	0.33

The results of this procedure, shown in Table 2, clearly showed that ATM/POS data performs significantly better than its competing indicators in the out-of-sample forecasting of the consumption of non-durables. Indeed, Esteves (2009) reports that “*On average, the gains [of using ATM/POS data] – measured by the reduction in the RMSE – are close to 40 per cent*” and that these results show that the performance of the retail trade information – the most frequently used source for the envisaged purposes – is very close to the ones obtained by the ATM/POS information. However, it must be also noted that, as the author emphasis, payments information are available much faster than its competing indicators, which further attests the validity of using this information to nowcast economic activity from both the quality and availability of the forecasts point-of-view.

In the same vein as Esteves (2009), but in a broader scope, Garcia (2011) investigated the role of payment system statistics on the evaluation of economic activity. To demonstrate the usefulness of this information for that purpose, the author started by describing the cashless payments landscape in Europe at the time. In Figure 1, one can observe precisely the high co-movement between the GDP growth rate and the credit transfers growth rate – which can be an interesting feature to explore when considering how to nowcast GDP – and the explosive evolution of the use of card payments and direct debits, which were already noted by Matos and D’Aguiar (2009) for the Portuguese economy. Under this background, the author stresses how relatively important cashless payments have become over the past decade, by comparing, for the European Union (EU) countries, the declining trend in ATM withdrawals per card to the rising trend of the number of payments per card, which further builds the case for the increasing importance of the cashless payments instruments in economic transactions and for the need to consider payments data when monitoring the economic activity.

Figure 1 – Number of transactions with cashless payment instruments within the monetary union countries (cumulative growth rates) in Garcia (2011)



In this sense, after carefully describing how the Portuguese institutional environment fosters the reporting and analysis of payments information (as Lima (2013) reports) and the cashless payments dynamics in Portugal, Garcia (2011) shows how Portuguese payment systems data can be used as a first indicator of macroeconomic trends, especially as a crisis performance indicator and as a tool for short term macroeconomic monitoring. To demonstrate the pertinence of using payments data as a crisis performance indicator, Garcia (2011) resorted to three key metrics: the value of customer operations settled through TARGET2-PT, the cheques returned for insufficient funds in the account (as a % of presented cheques) and the number of direct debit R-transactions¹⁰ (as a % of direct debit instructions).

Figure 2 - Value of customer operations settled through TARGET2-PT and GDP in Portugal (growth rates) in Garcia (2011)

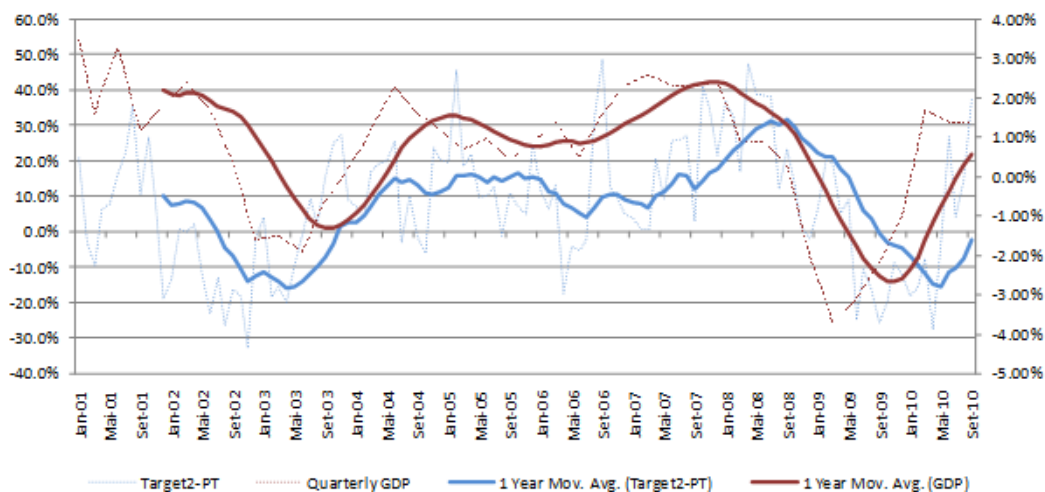
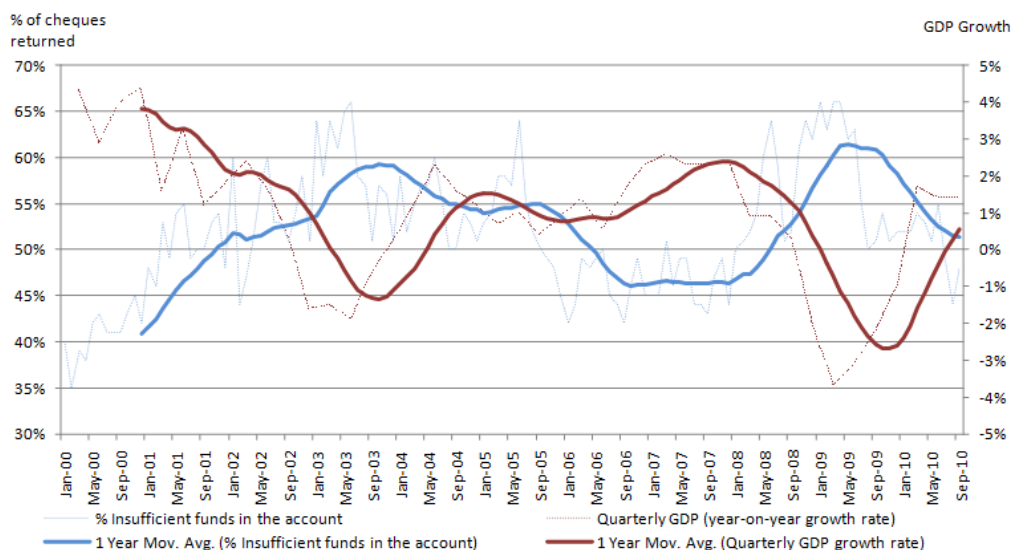
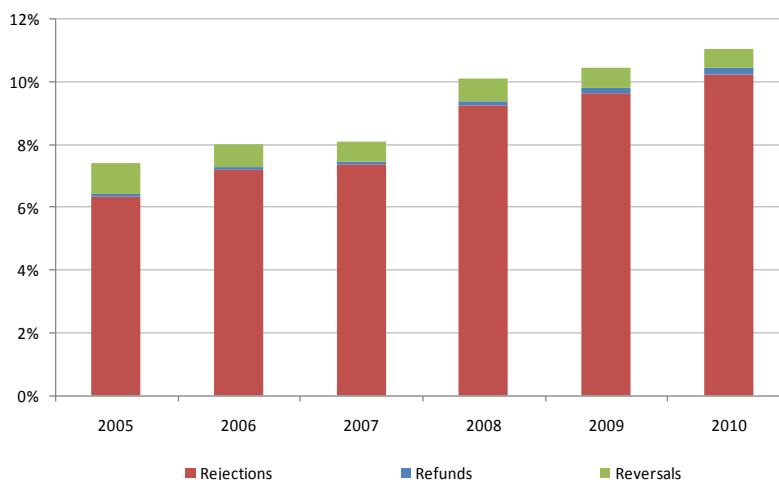


Figure 3 - Cheques returned for insufficient funds in the account (as a % of presented cheques) and GDP growth in Portugal in Garcia (2011)



¹⁰ Direct debit R-transactions are the direct debit transactions which are rejected.

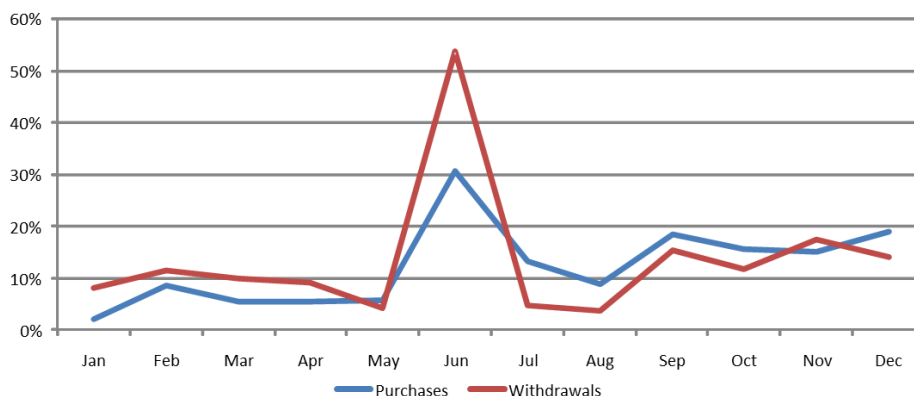
Figure 4 - Number of direct debit R-transactions (as % of direct debit instructions) in Portugal in Garcia (2011)



When analyzing figures 2, 3 and 4, one can validate the exercise ran by Garcia (2011) both from a pro-cyclical and counter-cyclical point-of-view. If one considers figure 6, it is clear that the 1 year-moving average of the operations settled through TARGET2-PT and the same period moving average for the GDP fluctuate in a pro-cyclical fashion, thus evidencing a high degree of positive association between the two phenomena. Conversely, when one considers figures 7 and 8, one can verify that the 1 year moving average of the cheques returned and the same period moving average for the GDP move in a clear counter-cyclical fashion. The same relation is also found when considering the number of direct debit R-transactions, which have increased sharply in the period of the great financial crises. In this sense, Garcia (2011) argues that the benefit of using this data for this purpose is not only the quality of the forecasts obtained, which are evident through the figures analyzed, but also the possibility to assess more timely the performance of the economy– which is invaluable for economic policy makers.

Apart from the demonstration of the usefulness of payments information as a tool for performance evaluation, Garcia (2011) also showed, through a very simple example, how the same information can be used for short term macroeconomic monitoring. Taking as reference the year of 2004 in Portugal, the author resorted to the information on withdrawals and purchases made in Portugal with cards issued abroad to demonstrate the impact that the European football championship (which took place in Portugal in June of 2004) had on the hosting country’s economy.

Figure 5 – International withdrawals and purchases in Portugal in 2004 (month-on-month growth rates) in Garcia (2011)



The analysis of the month-on-month growth rates of this data allow to quickly perceive the positive effect that the event induced in the local economy and presents a first quality *proxy* for the measurement

of this phenomena, something which would take considerably more time to do with alternative information (as, for example, the competing indicators used in Esteves (2009)).

Bearing in mind the insights provided on the uses of payment systems data as a first indicator of macroeconomic trends, Garcia (2011) concludes by noting that this information is “*almost not used by institutions that evaluate short-term economic fluctuations.*” and by signaling the need to start using it more often, under the argument of the growing importance of cashless electronic payment instruments, the relative quality of the nowcasts obtained and the timeliness and reliability with which this information is available for policy makers.

5. Conclusions

Payment systems data, *i.e.* the information stemming from the retail/large-value payment systems which enable the transfer of funds between/among participants, are nowadays being discussed and regarded as a crucial element for good evidence-based policy making. However, this was not always the case, as up until the beginning of the 21st century the academics and researchers focused primarily on what payment systems data could reveal about the degree of financial integration of a country or help in the modelling of the demand for currency.

The growing interest on the phenomena that payments information could unveil was then triggered by a series of innovations in different payments methods, which have significantly broadened not only the content and the research interest on this topic but also the uses of this information. This is crystallized on the fact that data on payments and withdrawals with cards issued by foreign and national entities have recently been given a whole new purpose, as a crucial element in the compilation of the travel account of the Portuguese balance of payments. In this paper, we have not only discussed where one can find the most relevant sources of payments data – both from the international and the national (Portugal) perspectives – but also described their contents and conventional uses.

The insights provided in this research show that payments data are an essential tool to meet one of the most critical aspects of economic decision making: the monitoring and assessment of real economic activity. This is warranted due to three essential features of the data under scrutiny: its comparative quality, high frequency and relative low cost.

Indeed, this paper has shown how payments data can beat indicators conventionally used to forecast key macroeconomic variables, such as the consumption of non-durable goods and services or gross domestic product. Esteves (2009) even reported that, in the case of the out-of-sample forecasting of the consumption of non-durable goods and services, payment systems data produced forecasts that were, on average, 40% better than its competing indicators. In the same vein, Garcia (2011) further validated the quality of this information as an input for the evaluation of economic activity, by demonstrating how large pro-cyclical and/or counter-cyclical relationships with GDP can be drawn with this data, thus providing a tool to better understand and monitor the economic reality.

This research has also clearly depicted how the high frequency and the low cost associated to this data benefits policy making. By being *nearly* costless and available typically just a few days after the phenomena occur – which effectively enables a much faster evaluation and reaction to economic events – it is clear that this is a combination of features than arguably any indicator can match.

Therefore, in light of the research path undergone, it seems crystal-clear that payment decisions have macroeconomic implications that provide a very inexpensive, fast and quality input onto the economic reality. It is now up to researchers everywhere to listen wisely to what money has to say about the economy.

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